Trends of Cause and Sex-Specific Mortality, and Its Impact on the Life Expectancy among Qatari Population

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Abstract-The study aimed to assess the changes in the cause and sex-specific mortality and the life expectancy in Qatar from 1996-2010. Method: the electronic database, from the tertiary healthcare providers at the Hamad Medical Corporation (HMC), and vital health statistics from Supreme Council of Health in Qatar was utilized to assess the impact of cause and sex-specific mortality on life expectancy at birth. Correlation between life expectancy at birth to causes such as cardiovascular diseases (CVD), traffic accidents, malignant neoplasm, endocrine diseases and congenital abnormalities was measured, so as to compare the potential gains from the elimination of these causes. Result: in Qatar, considering the time period of 1996-2010, the gain in life expectancy at birth was 3.6 years for men and 2.3 years for women. Overall, all cause mortality rate was 176.7 per 100,000 during 1996-2010. The mortality related to circulatory system ranked first, with mean annual mortality rate of 38.7 per 100,000, followed by road traffic accidents (27.18). Among males, mean annual mortality due to traffic accidents and circulatory systems declined from 1996 to 2010. Among females, mean mortality rate due to neoplasm mildly increased from 20.0/100,000 in 1996 to 24.8/100,000 in 2010, and that due to prenatal conditions among females declined from 12.0/100,000 in 1996, to 6.9/100,000 in 2010. Among both males and females, the mean mortality for circulatory system declined during 1996 to 2010. Overall, except for road traffic accidents (r=-0.130, p=0.494), ill-defined conditions (r=-0.235, p= 0.212), and endocrine disease (r=-0.135, p=0.476) all other leading causes of mortality showed significant negative correlation with life expectancy at birth. Conclusion: increases in life expectancy in Qatar were mostly achieved by reductions in all causes mortality, and especially from reductions in mortality from the circulatory and endocrine system diseases, and prenatal and congenital deaths. The present study provided useful information which can help the policy makers in more effective allocation of resources for public health programs in Qatar.

Keywords- Diseases; Mortality; Causes; Incidence; Life Expectancy

I. INTRODUCTION

Health policy-makers and managers often face the challenge of setting disease prevention and control priorities, and also for responding to it with appropriate strategies. Preferably, these decisions should be based on summary measures of population health [1, 2]. These summary measures are intended to guide debates on future health priorities, and they provide a way of monitoring and evaluating the healthcare services and any beneficial changes in the population health [2].

The mortality rates have been used historically to compare health status across populations. These mortality rates are usually dominated by the underlying disease processes of the elderly, and do not fully account for the burden of premature mortality [3]. Life expectancy is a superior summary measure of mortality and more intuitive than mortality rates. The change over time serves as an indicator for social and economical developments within a population and is therefore a useful instrument for public health communication [4-7].

Trends in life expectancy and mortality of a population, thus provide important information for setting future health priorities, and can be beneficial when designing public health strategies. As changes in life expectancy are only composite measures of changes in mortality rates, it is more useful to present de-compositional life expectancy in terms of age, gender and disease groups, and correlate the life expectancy with these subgroups for better explanation. This method is commonly used in the demographic literature to explore differences in life expectancy between groups or within time intervals [4-8].

In this context, this study provides a detailed overview of the sex and cause specific mortality and the life expectancy in the Qatari population from 1996 to 2010. It also analyzes the effect of contribution of sex and cause specific mortality on the change of life expectancy. As analyzing data between distant points in time, may miss important trends in mortality occurring within smaller time periods therefore, this study estimated not only the cumulative but also the annual contributions of sex and

disease-specific mortality rates to the change in life expectancy between 1996 and 2010.

II. SUBJECTS AND METHODS

This is a retrospective, descriptive population based study. The population in Qatar was estimated to be 438,065 in the year 1996 and 1.7 million in the year 2010 and has a unique distribution of population according to gender and ethnicity [9]. Approximately 30% of the total population is nationals [9] and majority of the total population (>70%) are males, and more than 90% of population lives in urban settings [10]. The higher male to female ratio is because of expatriate population (laborers) who are predominantly males. In Qatar, family or spouse visa is only allowed for a specific category of expatriates who are either professionals or earning certain amount of money per month. Thus, most of the expatriates (predominantly males) are living as bachelors in Qatar.

The study was conducted on the databases for the period of 1996-2010, from Hamad medical corporation, supreme council of Health, and Qatar statistics authority.

For the Tertiary healthcare providers, the data from "Medical records from the tertiary care hospitals" at the Hamad Medical Corporation (HMC) were used. HMC is the governing body for the tertiary healthcare hospitals in Qatar and caters for about 90% population of Qatar. The medical records databases at these hospitals [11], consists of patients' records coded according to the International Classification of Diseases, 10th Revision [12]. This includes information on socio-demographic variables such as age, sex, ethnicity, nationality, etc. Also, the diseases and injuries are included into broad groups based on ICD-10, for instance communicable diseases and maternal, perinatal and nutritional disorders and congenital problems; and also chronic non-communicable diseases including circulatory diseases, endocrine diseases and nervous systems, etc. For Injuries, details on variables as time of injury, place of fall, the type of injury, the region of the body injured and the severity of injury, etc. are also recorded. In addition, the diseases and conditions which cannot be assigned to any of the above are grouped into "ill-defined conditions". The data provided by this database are well suited for epidemiologic purposes and are representative of the population of Qatar. Data on the number of deaths by sex, age and specific causes were obtained from the mentioned databases.

In addition to medical records, the data from the Supreme Council of Health in Qatar (catering for primary and secondary health care facilities) were also utilized. The Vital Health Statistics from the "Supreme Council for Health registry" and Statistics Authority in Qatar [13] also provided mid yearly populations for each year of study, and in addition individuals residing and dying in Qatar were considered in our analyses.

Death records are based on death certificates completed shortly after the time of death and are coded according to the International Classification of Diseases, 10th Revision [12].

The above mentioned data sources were used as they offered different dimensions of data for our study. The medical records from HMC provided data from tertiary care for the mortality by cause. Data from "Supreme Council of Health" provide information from primary and secondary health care, and the vital health statistics from the "statistics authority Qatar" provides gender and age wise mid yearly population. These Vital health statistics are updated and published on yearly basis by the Supreme Council of Health and Statistics Authority in Qatar [9]. These account for the population of Qatari nationals, as well as the updated yearly population of the immigrants in the country. The latest census for the Qatar was also carried out by Qatar statistics authority in year 2010 [9].

III. ANALYSIS

Data were analyzed using SPSS Version 19.0. Year wise life expectancy at birth for total population and both males and females from 1996-2010 as maintained by statistics authority Qatar was obtained. Cause specific mortality rate per 100,000 population was calculated for total population and both males and females. Difference in mortality rate between males and females was measured through two sided independent samples t test. Correlation between cause specific mortality rate in each year and life expectancy at birth during that year was assessed through Pearson correlation coefficients. The level $p<0.05$ was considered as the cut-off value for significance.

IV. RESULTS

Table 1 depicts the life expectancy at birth among males and females in the state of Qatar during 1996-2010. Overall, life expectancy has increased from 75 years in 1996 to 78.2 years in 2010. Among females it increased by a value of 2.3 years from 75.4 in 1996 to 77.7 yrs in 2010, and among males it increased by 3.6 years from 75 yrs to 78.6 years in 2010. Life expectancy was slightly more among females as compare to males during 1996 to 2005, but the trend changed and after 2006 with males having slightly more life expectancy than females.

TABLE I LIFE EXPECTANCY AT BIRTH AMONG MALES AND FEMALES IN THE STATE OF
QATAR POPULATION DURING THE YEAR 1996 -2010

Year	Male	Female	Female-male difference	Overall
1996	75.0	75.4	0.4	75.0
1997	74.0	75.9	1.9	74.7
1998	73.7	74.9	1.2	74.2
1999	74.2	75.4	1.2	74.7
2000	74.3	73.8	-0.5	74.4
2001	74.3	74.8	0.5	74.4
2002	74.4	74.7	0.3	74.6
2003	74.4	74.7	0.3	74.6
2004	76.8	76.5	-0.3	76.7
2005	75.3	75.8	0.5	75.5
2006	75.9	75.7	-0.2	75.8
2007	77.8	77.9	0.1	77.8
2008	78.1	77.4	-0.7	77.8
2009	78.3	77.6	-0.7	77.9
2010	78.6	77.7	-0.9	78.2

Table 2 shows mean annual mortality rates per 100,000 population ranked by cause of death among Qatari population during 1996-2010. Overall "all cause mortality rate" was 176.73 per 100,000 populations with no significant difference between males and females during 1996-2010. Mortality related to circulatory system ranked first with a mean annual mortality rate of 38.77 per 100,000, followed by road traffic accidents (27.18). Mortality related to nervous system ranked last in the table with mean annual mortality rate of 3.45 per 100,000. Mortality related to road traffic accidents, and ill defined conditions were significantly higher among males as compared to females ($p<0.001$) while mortality related to neoplasm ($p<0.001$), endocrine disease ($p=0.001$), congenital abnormalities ($p<0.001$), prenatal conditions ($p=0.031$), and nervous system ($p=0.003$) were significantly higher among females as compare to males.

TABLE II MEAN ANNUAL RATES OF MORTALITY RANKED BY CAUSES OF DEATH AMONG MALES AND FEMALES IN
THE QATAR POPULATION 1996 – 2010

Cause of Death	Mean annual mortality rate per 100 000 population				
	Over all	Male	Female	Female –male difference	P-value
Circulatory system	38.77	38.98	38.55	-0.43	0.923
Traffic Accidents	27.18	43.19	11.17	-32.02	<0.001
Ill-defined Conditions	29.62	39.96	19.29	-20.67	<0.001
Neoplasm	19.70	15.50	23.89	8.39	<0.001
Endocrine disease	13.03	10.07	16.00	5.92	0.001
Congenital Abnormalities	8.60	5.67	11.53	5.86	<0.001
Prenatal Condition	8.66	7.60	9.71	2.11	.031
Respiratory system	7.76	6.37	9.15	2.78	.009
Genitourinary system	7.12	5.65	8.58	2.93	.031
Infectious and Parasitic	4.42	4.38	4.46	0.08	.872
Digestive system	4.28	4.49	4.07	-0.42	.630
Nervous System	3.45	2.56	4.34	1.78	.003
Other Causes	4.14	3.23	5.05	1.82	.127
All Causes	176.73	187.67	165.80	-21.87	.073

Table 3 presents correlations between life expectancy at birth and cause-specific mortality rates due to leading causes among males and females in Qatar during 1996-2010. Overall, except road traffic accidents (r=-0.130, p=0.494), ill-defined conditions (r=-0.235, p=0.212), and endocrine disease (r=-0.135, p=0.476), all other leading causes of mortality showed significant negative correlation with life expectancy at birth. Among males, mortality related to circulatory system, neoplasm, congenital abnormalities, respiratory system, genitourinary system, and nervous system showed significant negative correlation with life expectancy at birth. Also, among females mortality due to circulatory system, congenital anomalies, and digestive system were having significant negative correlation with life expectancy at birth.

TABLE III CORRELATIONS BETWEEN LIFE EXPECTANCY AT BIRTH AND CAUSE-SPECIFIC MORTALITY RATES DUE TO LEADING CAUSES OF DEATH, AMONG MALES AND FEMALES IN QATAR POPULATION 1996 – 2010

Cause of Death	Over all		Male		Female	
	r	P-value	r	P-value	r	P-value
Circulatory system	-.806	<0.001	-.875	<0.001	-0.696	0.004
Traffic Accidents	-.130	0.494	-.192	.493	0.008	0.977
Ill-defined Conditions	-.235	0.212	-.465	.081	-0.001	0.997
Neoplasm	-.386	0.035	-.845	<0.001	-0.331	0.228
Endocrine disease	-.135	0.476	-.496	.060	0.089	0.753
Congenital Abnormalities	-.436	0.016	-.807	<0.001	-0.595	0.019
Prenatal Condition	-.435	0.016	-.677	.006	-0.248	0.373
Respiratory system	-.510	0.004	-.799	<0.001	-0.322	0.242
Genitourinary system	-.460	0.011	-.629	.012	-0.484	0.067
Infectious and Parasitic	-.476	0.008	-.586	.022	-0.356	0.193
Digestive system	-.566	0.001	-.475	.073	-0.706	0.003
Nervous System	-.360	0.051	-.552	.033	-0.494	0.061
Other Causes	-.488	0.006	-.495	.061	-0.596	0.019
All Causes	-.864	<0.001	-.909	<0.001	-0.877	<0.001

r =Pearson Correlation coefficient

Table 4 shows year wise trend of cause specific mean annual mortality rate among males and females in Qatar during 1996 to 2010. Among males, mean annual mortality rate due to traffic accidents was 44.46/100,000 in 1996 with highest mortality rate of 76.10 during 2006. The trend was generally increasing from 1996 till 2006. A regular steep decline was observed in the mortality due to traffic accidents from 2007 onward to 2010. Annual mean mortality rate in 2010 due to traffic accident was 29.32/100,000, which was lowest since 1996. Among males, the mean annual mortality rate due to circulatory system was 49.83/100,000 in 1996. The trend was irregular from 1996-2001, generally increasing, but with occasional declines. After 2001 the trend shows a steady decline till 2004 when mortality was 30.37/100,000. After 2004 till 2010, the trend was again irregular, but overall declining. The mean annual mortality rate in males due to circulatory system was 23.38/100,000 in 2010.

TABLE IV MEAN ANNUAL RATES OF MORTALITY FROM THE LEADING CAUSES OF DEATH AMONG MALES AND FEMALES IN QATAR POPULATION 1996-2010

Year	Male			Female		
	Traffic Accidents	Circulatory system	Neoplasm	Endocrine disease	Prenatal Condition	Circulatory system
1996	44.46	49.83	20.01	10.86	12.01	45.73
1997	43.75	52.73	29.79	9.38	12.69	46.89
1998	44.73	57.67	27.15	7.45	11.71	34.07
1999	44.53	47.81	23.11	14.89	13.87	47.77
2000	29.18	40.58	33.26	15.88	8.44	50.13
2001	39.95	62.37	17.85	17.36	10.61	55.47
2002	40.85	44.07	27.8	14.61	5.18	43.82
2003	39.81	34.97	19.64	25.26	8.42	40.09
2004	49.62	30.37	23.87	17.90	9.15	39.78
2005	55.16	38.59	22.64	20.00	7.92	42.26
2006	76.19	33.09	25.09	18.64	8.60	49.47
2007	43.57	21.29	21.58	16.68	7.19	32.05
2008	34.74	26.26	17.92	18.20	6.54	27.87
2009	32.01	21.74	23.83	18.74	8.03	21.15
2010	29.32	23.38	24.83	14.08	6.92	21.72

Among females, mean mortality rate due to neoplasm mildly increased from 20.01/100,000 in 1996 to 24.83/100,000 in 2010. The highest mortality rate due to neoplasm among females was observed in year 2000 (33.26/100,000). For endocrine diseases in females, mortality rates increased from 10.86/100,000 in 1996 to 14.08/100,000 in 2010. The trend was irregularly increasing till 2003, when it started declining slowly. The highest mortality rate due to endocrine disease was 25.26/100,000 in year 2003. The mortality rate due to prenatal conditions among females was 12.01/100,000 during 1996, with a good decline since then to a value of 6.92/100,000 in 2010. The trend of mean annual mortality rates due to circulatory system diseases was

irregular between 1996 and 2006, however, after 2006 there was a consistent steep decline till 2010. The mean annual cause specific mortality rate due to circulatory system among females was lowest (21.72 per 100,000 population) in 2010 while on the other hand it was highest (55.5 per 100,000 population) during 2001.

Table 5 shows a 5 yearly trend for mean annual mortality rate from leading causes of deaths in Qatar from 1996 to 2010. Mortality rate due to neoplasm, respiratory system, prenatal condition, genitourinary system, and nervous system declined gradually during the three 5-yearly periods.

TABLE V MEAN ANNUAL RATES OF MORTALITY FROM THE LEADING CAUSES OF DEATH AMONG IN QATAR POPULATION 1995-2010

Cause of Death	Over all	Period		
		1996-2000	2001-2005	2006-2010
Circulatory system	46.67	64.92	45.76	25.02
Traffic Accidents	27.30	26.07	28.23	27.25
Ill-defined Conditions	23.30	12.90	26.84	32.32
Neoplasm	20.18	23.01	19.31	16.77
Endocrine disease	12.61	10.27	16.37	11.36
Congenital Abnormalities	8.66	11.83	8.42	5.46
Respiratory system	8.56	9.95	9.24	6.54
Prenatal Condition	7.94	10.80	7.07	5.30
Genitourinary system	6.90	10.35	6.77	3.94
Digestive system	4.52	5.56	3.71	4.00
Infectious and Parasitic	4.22	5.07	5.19	1.83
Nervous System	3.56	4.57	3.13	2.66
Other Causes	4.00	3.95	5.83	2.25
All Causes	178.43	199.64	185.86	144.70

Figure 1 shows trends of life expectancy at birth among males, females and total population between 1996 to 2010. While the life expectancy at birth among female population was higher than males in 1996, the gap started decreasing consistently till 2005 where the life expectancy became equal among both males and females. After 2005, the life expectancy of males population remained higher than females population. There was a significant positive correlation between life expectancy at birth and duration of time (r=0.79, p<0.01).
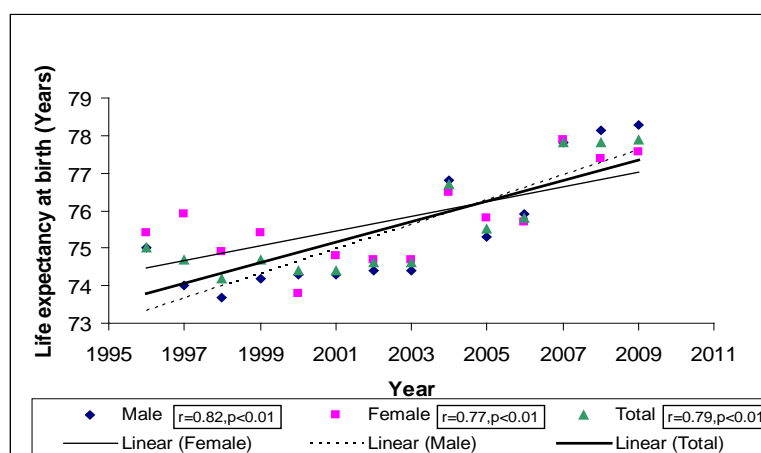

Fig. 1 Trends of life expectancy at birth among males and females in Qatar population 1996 -2010

V. DISCUSSION

The life expectancy at birth as a measure of mortality is a valid and important indicator of population's health status. In many countries there have been notable improvements in the health of populations and life expectancy in the last century [5, 6, 14].

This study shows improvements in the life expectancy in Qatar over the period 1996–2010, for both males and female populations. It also shows reductions in mortality from diseases as cardio vascular diseases, malignant neoplasm, endocrine diseases, prenatal conditions, respiratory diseases and infectious diseases. In Qatar, for the time period of 1996-2010, the gain in life expectancy at birth was 3.6 years for men and 2.3 years for women. This gain in the life expectancy is similar to that reported by other studies in Kuwait [15] and Italy [6]. A study in Germany also reported an improvement of 2.2 years for both the sexes per decade for the time period between 1962 and 2002 [5].

Overall for Qatari population, major contributors of mortality were circulatory system diseases, road traffic accidents, neoplasm, endocrine disease and ill defined conditions. For males the main contributors were circulatory system diseases and road traffic accidents. For females the circulatory system diseases, neoplasms and endocrine diseases were main contributors to mortality. The infectious diseases and prenatal conditions had smaller contributions. This is also supported by the fact that 55% of the disease burden in Qatar is attributable to non-communicable diseases [16]. Also the distribution of chronic diseases related risk factors among the general population is similar to that of developed nations; 12% of the population has diabetes, 30% is overweight, 20% is obese, 41% has high cholesterol, and 21% has the metabolic syndrome [17].

Considering the gender differences in the mortality rates, the mortality for the traffic accidents and the ill-defined conditions was significantly higher in males as compared to females in Qatar. On the other hand, the mortality from neoplasms, endocrine diseases, congenital abnormalities, genitourinary diseases, and prenatal conditions was significantly higher in females than in males. For gender differences in life expectancy, it was slightly more among females as compared to males during 1996 to 2005, but the trend changed after 2006 with males having slightly more life expectancy than females. The impressive reduction in mortality from the cardiovascular diseases, road traffic injuries and neoplasms in the males during the period is the main reason for this changing trend.

This pattern of the so-called epidemiological transition [18] which is depicted by the cause specific mortality in present study has also been reported from developed countries like Germany [5], Italy [6], Spain [8] and United States [2]. For instance a study from Singapore reported that three quarters of pre-mature mortality burden in Singapore was due to cardiovascular diseases, cancers and injuries [19]. Another study reported a contribution of 93% by non communicable diseases and accidents and injuries to the premature mortality in Spain [20].

The gender differences in the cause specific mortality highlighted in our study are different from those reported from Kuwait [15] and Italy [6]. The study in Kuwait found the cause specific mortality of most of the causes to be higher for males than the females [15], where as the study by Conti S et al found higher contribution for deaths due to traffic accidents in the females [6].

The largest contribution to increases in life expectancy in Qatar came from CVD, similar to findings from other European countries [6], in Japan [7, 21], and in the United States [8]. The strong and significant negative correlation between circulatory system diseases mortality and the life expectancy in current study is further strengthened by the fact that the life expectancy has gradually increased with a decline in the circulatory system mortality. The main gains in life expectancy for both genders were observed for time period 2006-2010, when concurrently there was major reduction in the CVD mortality for both males and females. Similar trends are reported from a study in Italy where 50% of the gain in life expectancy in men for decade 1985-1994 was due to reduction in CVD mortality [6].

The above findings also imply that further gains in life expectancy can be achieved in Qatar by reducing the circulatory systems mortality in coming years. While strengthening the health services in the primary, secondary and tertiary health level are important, public health strategies for the major risk modifications and prevention for the cardiovascular diseases are also needed. For instance life style changes including dietary and physical activity modifications for prevention of obesity, overweight and hyper-lipidemia, and prevention of tobacco use, etc. can further help in reducing burden of cardiovascular diseases in Qatar.

Despite enormous efforts to reduce mortality from cancer in industrialized countries, the success to date has been only moderate [4-8]. Nevertheless, substantial improvements in therapy and prognosis of several specific types of cancer (i.e. malignant neoplasms during childhood) have been made [22-23]. Overall, for the Qatari population from 1996-2010 there is a slow decline in the neoplasm related mortality. There is however significant difference in the mean neoplasm mortality rate between males and females, with mortality higher among the females [22].

For our study the mortality from the prenatal conditions in the female almost halved during the study period, and become 6.92 per 100,000 live births in 2010. Our finding is consistent with results from other countries that experienced improvement in life expectancy [21]. Mortality from pneumonia, infectious and parasitic diseases, congenital malformations, and nervous system diseases has also decreased from 1996-2010 in Qatar.

The mortality due to traffic accident in this study is an important contributor to overall mortality in Qatar, and particularly in males. The correlation coefficient between traffic accidents and life expectancy at birth during 1996-2010 was -0.19 for males and -0.13 for females, although statistically insignificant the negative correlations suggests that the elimination or even partial reduction of accidents as a cause of death would give an important gain in life expectancy among men [24]. Few accidents are due purely to chance; but many are preventable through information, education and measures like improved planning and design of the environment. As road accidents account for about two-thirds of the overall accident mortality in Qatar [24-27] and the number of cars has also increased substantially during the last 15 years [28], it seems reasonable to suggest that programmes to prevent fatal motor vehicle accidents should be given priority in economic planning [25-26]. Preventive actions should be aimed, specifically the introduction of safety elements (seat belts. helmets, child seats) and action

on alcohol abuse, mobile phone use while driving which are a significant contributory factor to road accidents, should be enhanced [25-27]. These preventive actions are quoted among the main goals of many Developed and Developing National Health Plans [29].

A limitation of our study had been the potential quality of the Data. An international study by Colin D. Mathers et al had assigned Qatar to the group of countries with the low quality national data [30]. The percentage of causes of death assigned to ill defined causes was >20% and was the reason for the low quality in that study. This has also been reflected in our results as the mortality rates from the "ill-defined conditions". But despite this observation on the quality of data, the coverage of data from the vital registration system from the study by Mathers et al was in acceptable range. In our study we have tried to capture the data from different sources of health care system so as to have greater representation of the population. The population of Qatar is highly urban (>90%) [10] and our data sources cater for most of the cases from the country. The unique nature of the country with high urbanization and immigrations rates has resulted in a dynamic population. Nevertheless, the Qatar yearly updates its population vital statistics and a regular census is conducted, with a most recent one being done in 2010 [9]. The presence of "ill defined conditions" has its implications and can have resulted in under or over representation of some of the mortality rates in this study. However the national disability adjusted life years (DALY) estimates provided by the World health organization for the Qatar also shows similar trends, with non-communicable diseases and injuries accounting for over 80% of DALYs for Qatar.

In the future, genetic research will play a major role in health sciences. However, overly enthusiastic expectations regarding the benefits of genetic research contain the risk that priorities are changed and research into environmental and social determinants and prevention of the non-communicable diseases are neglected [23]. The common chronic diseases are caused by a complex relationship of lifestyle (e.g. low physical activity, overweight, smoking, etc.), socioeconomic and genetic factors [23]. Epidemiological research has identified major risk factors for CVD and for several types of cancer. Many causes are known and potentially preventable by changes in life-style [23].

Future efforts to increase life expectancy in Qatar should aim at further improvements in therapeutic and preventive measures and the social environment. In conclusion, adoption of feasible measures of both primary and secondary prevention and improvement in medical treatments will make it possible to make improve life expectancy for the Qatari's population.

VI. KEY POINTS

Life expectancy in Qatar increased steadily between 1995 and 2010 by about 2.13 years per decade.

Despite the steady increase, the quantitative contributions of changes in age- and disease-specific mortality varied strongly over time.

In the State of Qatar, changes of the political and social and health systems led to an increase in life expectancy (3.2 years between 1996 and 2010).

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