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Original article

The health of Saudi older adults; results from the Saudi National Survey for Elderly Health (SNSEH) 2006–2015☆

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ABSTRACT

Objectives: To Describe the Saudi older adult (SOA) characteristics and Introduce the Saudi National Survey for Elderly Health (SNSEH).
Methods: The SNSEH, a population-based nationally-representative survey, was used. Subjects were included in 2006–2007, using random-cluster sampling utilizing probability proportional to size approach, and followed-up to determine their vital status until June 2015. In the analyses, survey weights were incorporated. Parametric, non-parametric and logistic regression were used. Cox-proportional hazard regression was used to determine gender effects on mortality.
Results: We included 2,946 SOA. The mean age was 70.1(SD = 0.3). Around, 70% were illiterate. Almost 50% had monthly income of 2500 (2007-Saudi-Riyals). The most reported diseases were hypertension, diabetes and joints pain. The most reported medications were over the counter, antidiabetics and antihypertensive. The nine-years age-adjusted death hazard was 42% higher in SOA males.
Conclusion: This is an introductory paper for a series of papers that describe SOA health. These efforts will help in guiding the development of a national healthcare model for SOA, evidence-based health policies and public intervention programs that address SOA health-related issues.

1. Introduction

The unprecedented improvement in human longevity is one of the most remarkable events of the 20th century. Therefore, population aging, with all of its consequences, is evident in most parts of the world, including countries in the Eastern Mediterranean Region (World Health Organization, 2002). For instance, the United Nations and World Health Organization (WHO) estimate the global population of those over the age of 60 will be 1.2 billion by 2025 and will reach 2 billion by 2050 which represents 22% of the population (World Helath Organization, 2002; Bloom et al., 2010). Of this group, 80% will be based in developing countries where 4% are expected to be above 80 years old (World Health Organization, 2002; Bloom et al., 2010).

Saudi Arabia demographic trends are changing. The kingdom follows the global increase in aging population. This is mainly due to an increase in life expectancy, high birth rates in the last four decades, and a recent decline in the fertility rate. The life expectancy has improved from 64.4 years in the 1980s to 74.3 years in the 2000s (World Bank, 2014). Between 1980 and 2000, Saudi experienced a population expansion due to a high birth rate, national development and improvement in maternal and child health (World Bank, 2014). As a result, elderly population of those aged 60 and above is projected to increase from 3% in 2010 to 9.5% and 18.4% in 2035 and 2050, respectively (United Nations, 2012).

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☆ The results of this work can be used to guide evidence-based practices that deliver services and interventions that respond to the needs and preferences of older adults. This project is aimed at empowering and enhancing the health and quality of life of older adults in Saudi Arabia.

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With meager resources including qualified human capital and a poor aging understanding, Saudi Arabia faces many challenges in caring for Saudi Older Adults (SOA). Furthermore, population aging in developing countries is accelerating in a fast rhythm in contrary to industrialized countries where it is a gradual process following steady socioeconomic growth over several decades and generations. Such a fact is associated with dramatic changes in family structure and roles, as well as in labor patterns and migration. Therefore, it is expected that most civil society institutions will be overwhelmed by the social, economic, and health needs of this ever-increasing population segment. Consequently, policy makers have to put in more effort to achieve the worldwide aim of successful aging (World Health Organization, 2002).

From a health perspective, the geriatric population has specific characteristics, unique health issues, and social conditions that affect them directly. The impact of these conditions can be different than on other age groups since their responses and abilities to cope with illness or alteration in the environment are limited. These changes can dramatically impact their quality of life. Furthermore, with advancing age, chronic disease rate and Multiple Chronic Conditions escalate sharply and have huge burdens on the individuals, health systems, and society (Anderson, 2010; Yach et al., 2004). Moreover, as a vulnerable group, they have to deal with the worst outcomes and health complications (Yach et al., 2004; Brown et al., 2004; Raphael et al., 2003; Roglic et al., 2005).

In Saudi Arabia, one of the main challenges in advancing the elderly health is the huge gap in the scientific literature about their characteristics, health status, and needs. This information is central in developing evidence-based national health policies and public intervention programs. Consequently, such a gap has created the need for a national health survey that explores the aforementioned needs in Saudi elderly which led to the development of the Saudi National Survey for Elderly Health (SNSEH). Therefore, this study has two main objectives: first, to introduce the methodological design used in the SNSEH. Second, to describe the characteristics of the Saudi geriatric population using the SNSEH. The results of this study serve as a seed for geriatric research. Following papers will focus on addressing the gap as the SNSEH is currently the main national representative source regarding this population in Saudi Arabia.

2. Methodology

2.1. The survey

The SNSEH is a nationwide, representative, population-based survey of SOA 60 years of age or older. This dataset is the most recent, and the largest source of health-associated information related to the aging population in Saudi Arabia. The survey was conducted in order to guide a national healthcare model development for older adults. In addition, it was done to enlighten decision makers in the process of developing evidence-based health policies and public intervention programs taking into consideration the Saudi community customs and culture.

In order to meet the aforementioned aims, the survey focused on: (1) describing the health status and the most common health problems; (2) evaluating healthcare services available and provided; and (3) measuring health services utilization among SOA. The survey was conducted from June 2006 to June 2007, and the data became available in 2010. However, this data has received very limited analysis.

2.2. Study sample and weight calculations

At the time of the study, the total Saudi elderly population was estimated to be 859,421 which was 5.2% of the total Saudi citizen population. The study population was sampled based on two inclusion criteria: (1) age 60 or older; and (2) Saudi citizen. The sample size was calculated for a complex survey for point estimate using chronic conditions proportion or disability among the elderly of 10%, 95% significance level, a degree of precision of 0.02, a Design Effect of 2.5, and a response rate assumption of 80%; the final sample size was 2704 persons (Almanaa et al., 2010). Considering the interclass correlation equals 0.05, the cluster size was computed to be 31 elderly. Using systematic random sampling and applying Probability Proportional to Size (PPS) sampling, 88 clusters were selected. The list of the whole population provided by the Central Department of Statistics and Information at the Ministry of Economics and Planning accompanied with the catchment area of primary health care centers (PHCCs) were used to create the cluster frame. Lastly, for subjects' selection, a cluster map was used to select a random street and random household that satisfied the inclusion criteria for the interviews. The selected subjects were contacted for two household visits in order to conduct personal interviews and perform physical examinations and investigations. Proxies were mainly used when physical or intellectual impairments prevented the subject from directly answering the interviewer. Nevertheless, proxies were not used if the questionnaire assists the mental or physical patient status such as depression scale and cognitive abilities.

The utilization of the PPS sampling approach eliminates the need to adjust for the complex design sampling (the base weight) in weight calculation. However, non-response, over sampling, and post-sampling stratification according to the census data were incorporated in calculating a standardized survey weight.

2.3. Variables and measures collected in the SNSEH

During the household visits, surveyors recorded information on individual's socio-demographic status, physical health perceptions, illnesses, heath conditions and their effects on functioning, smoking history, nutrition, Activities of Daily Living (ADL), cognitive and mental screening questions, a geriatric depression scale, sleep apnea scale, alternative medicines consumption, caregiver strains, utilization of preventive services and periodic health evaluations, health services utilizations, and general physical clinical examinations. Additionally, investigations such as fasting blood sample, X-rays, and electrocardiography (ECGs) were performed at the PHCCs unless the subject was not able to visit the PHCC; in this case only the blood sample was collected.

Data were collected using a structured interview technique and validated questionnaire items. Structured data forms were also used for obtaining the clinical history, physical examination, and clinical investigation information. During the questionnaire development, the research team considered previous validated surveys pertaining to older adults such as the Survey of Health, Aging and Retirement in Europe (SHARE), the Questionnaire on Health and Long Term Care for the Elderly and the Questionnaire of Community Care for Elderly People in the Eastern Mediterranean Countries.

The questionnaire underwent several steps of modification based on expert review, researchers and field supervisors' suggestions, with feedback incorporation from a pilot study. Trained research teams carried out the interviews and data collection and each team included a primary health care doctor. In each region, the deputy director of the regional health affairs supervised the research team with direct support from the investigators.

2.4. Ethical issues

The included subjects were provided an informed consent. Personal data were collected such as, national identification number,

medical record number, and contact information. These variables are kept in a secure system. Only selected investigators had access to this information. In addition, subjects' personal identifiers were removed from the data before data sharing. The survey project was approved and funded by the Saudi Ministry of Health (MOH). Furthermore, the research and ethical committee at the MOH oversighted all aspects related to human subject protection. The institutional review board at Imam Muhammad Bin Saud Islamic University exempted the study from full IRB review (IRB number: HAPO-01-R-011).

2.5. Survival follow-up

In 2015, to follow up the cohort longitudinally, a survey was sent to the National Vital Information Center at the Ministry of the Interior to gather further information regarding the subjects. The mortality information was recorded for the subjects until June 2015. Consequently, survival time was calculated from recruitment time until date of death. Subjects who did not die by the end of June 2015 were censored.

2.6. Statistical analyses

The cohort was described using frequencies and percentages for categorical variables and means and standard deviations for continuous variables. In addition, bi-variable analyses were done using chi-square, Fisher's test or simple logistic regression for categorical variables and *t*-test for continuous variables. Lastly, Cox's proportional hazards model was applied to the population using age and gender as explanatory variables for survival. All analyses were adjusted by the standardized survey weight. Statistical analyses were done using STATA 14 MP (StataCorp, 2015).

3. Results

The SNSEH included 2946 SOA. While 91% of the subjects answered the survey directly, 4.7% used a proxy such as a caregiver in providing their responses. Only 0.5% provided their answers in both approaches while 3.7% were not reported. There was no significant difference between gender in using proxy persons (P = .32).

Males constituted almost 60% of the unweighted sample. The mean age was 70.1 with a standard deviation (SD) of 0.3. The mean age for the females was 69.33 (SD = 0.4) while mean age for the males was 70.98 (SD = 0.3) P < .001. Subjects were distributed in the five geographic regions as follows: central 23.65%, western 30.76%, eastern 13.76%, southern 25.01% and northern 6.83%. While 79% were living in urban regions only 20% were located in rural areas with 1% undocumented. With regards to education level, approximately 70% of the subjects were illiterate followed by subjects who have finished elementary grade (21.66%). Subjects who finished intermediate or high school were 6.4% while 2.1% had completed university degrees. Monogamy was the most prevalent marital status (57.19%) followed by being widowed (22.98%). In addition, approximately 13% of the subjects reported to marry more than one wife.

Around 53.5% have reported an income less than SR2500, 22.7% SR2,500-SR4,999, 13.5% SR5,000-SR9,999 and 5.6% greater than SR10,000. The main source of income for approximately 41% of subjects was government pension, followed by first degree descendent (27%), self-support (18.4%), other relatives (2.7%), other sources (5%) such as organizational charities and 6% were unknown. When subjects where asked whether their income covers their needs, there was a proportional relationship between answering "very well" and the income. In contrast, an inverse relationship existed between answering "poorly" or "Sufficient" and the income (Fig. 1). Compared to those with income less than SR2500, SOA who had an income between SR5000-7499 were 3.04 times more likely to state that their income covers their needs [95% confidence interval (CI): 2.15, 4.29]. The same trend was seen with SOA who had income SR7500-9999 as well as income greater than SR10,000.

With regards to working status of the subjects at the time of the interview, only 11.53% were working, 53.31% not working, 32.89% housewives, 2.21% retired and 1.8% missing. The nature of jobs commitment differs among the 11.53% of working SOA. For instance, 5.8% of the subjects were on a long-term contract while 1.4% were on short term contract. The remaining 4.33% were self-employed, volunteers or on non-contract jobs. Among all subjects, less than 1% had more than one job.

While self-support was strongly associated with lower odds of being not working (unadjusted OR = 0.2; 95% CI: 0.16–0.26), income sources such as governmental pensions (unadjusted OR = 1.4; 95% CI: 1.11–1.7), children (unadjusted OR = 3.1; 95% CI: 2.24–4.38) or relative sponsorship (unadjusted OR = 3.6; 95% CI: 1.13–11.5) were all associated with higher odds of not working.

Most of the subjects were living in modernized-type of residence with majority living in small houses (39.28%) followed by large houses (27.60%).

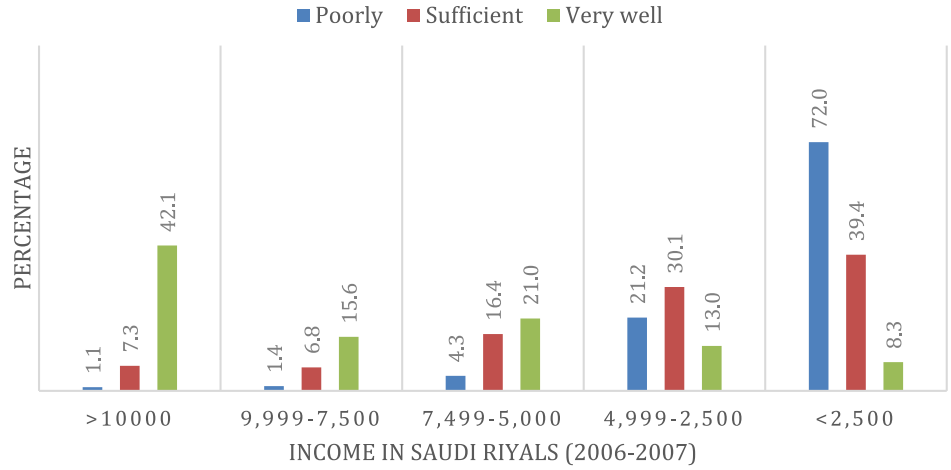

Fig. 1. The Association between Subjects' income and whether it is enough to cover their needs (N = 2946).

Table 1
Demographic and socioeconomic characteristics of Participant in the SNSEH (n = 2946) [a]

Variables	Female n (%)	Male n (%)	Total n (%)[b]	χ^2, P-value
	1461 (49.58)[c]	1485 (50.42)[c]	2946 (100)	
Age (years)				**<.001**
60–65	633.8 (43.39)	459.2 (30.91)	1093 (37.1)	
66–70	290.8 (19.91)	366.4 (24.67)	657.2 (22.31)	
71–75	205.3 (14.06)	278.8 (18.77)	484.1 (16.43)	
76–80	151.1 (10.34)	178.3 (12)	329.4 (11.18)	
81–85	76.3 (5.221)	101.7 (6.849)	178 (6.042)	
86–90	41.0 (2.805)	58.3 (3.927)	99.3 (3.371)	
>90	36.7 (2.515)	32.0 (2.153)	68.7 (2.332)	
Missing	25.7 (1.756)	10.7 (0.719)	36.3 (1.233)	
Education level				**<.001**
Illiterate	1280 (87.61)	760 (51.15)	2039 (69.23)	
Less than 8 years	146 (10.02)	492 (33.11)	638 (21.66)	
Intermediate or High	20 (1.4)	168 (11.34)	189 (6.41)	
University or higher	6 (0.4)	57 (3.83)	63 (2.13)	
Missing	8 (0.58)	9 (0.57)	17 (0.57)	
Average monthly income (Saudi Riyal)				**<.001**
>10,000	61 (4.176)	103.5 (6.967)	164.5 (5.583)	
9999–7500	28.51 (1.952)	90.37 (6.084)	118.9 (4.035)	
7499–5000	84.56 (5.789)	194.4 (13.09)	278.9 (9.469)	
4999–2500	242.7 (16.62)	427.3 (28.76)	670 (22.74)	
<2500	928 (63.54)	646.6 (43.53)	1575 (53.45)	
Missing	115.8 (7.927)	23.35 (1.572)	139.1 (4.723)	
Marital				**<.001**
Monogamy	670.2 (45.88)	1015 (68.31)	1685 (57.19)	
Polygamy	53.19 (3.64)	332 (22.35)	385.2 (13.07)	
Widow	615 (42.11)	62.12 (4.18)	677.1 (22.98)	
Single	48.12 (3.29)	58.46 (3.94)	106.6 (3.62)	
Separated	68.03 (4.66)	17.51 (1.18)	85.54 (2.90)	
Missing	6.033 (0.41)	0.6816 (0.05)	6.714 (0.23)	
Location				**.9626**
Urban	1153 (78.96)	1167 (78.53)	2320 (78.9)	
Rural	288 (19.7)	301 (20.29)	589 (20)	
Missing	20 (1)	18 (1)	37 (1)	
Regions				**.8311**
Central	327 (22.39)	369.7 (24.88)	696.7 (23.65)	
Western	446.6 (30.58)	459.5 (30.94)	906.1 (30.76)	
Eastern	214.2 (14.66)	191.2 (12.87)	405.4 (13.76)	
Southern	373.6 (25.58)	363.1 (24.44)	736.7 (25.01)	
Northern	99.19 (6.791)	101.9 (6.863)	201.1 (6.827)	
Past Occupation				**<.001**
Skilled	2.64 (0.18)	44.33 (2.98)	46.97 (1.59)	
Intermediate	13.17 (0.9)	106.6 (7.18)	119.8 (4.07)	
Semi-skilled	14.9 (1.02)	210.4 (14.16)	225.2 (7.65)	
Labor	59.9 (4.08)	504.7 (33.98)	564.3 (19.15)	
Military	5.7 (0.39)	326.5 (21.98)	332.2 (11.28)	
Housewives	856.8 (58.66)	9.47 (0.64)	866.3 (29.4)	
Retired with pension	5.74 (0.39)	50.13 (3.38)	55.88 (1.9)	
Not working	262.6 (17.98)	90.34 (6.08)	352.9 (11.98)	
Other	8.52 (0.58)	103.4 (6.96)	111.9 (3.8)	
Missing	231 (15.82)	39.52 (2.66)	270.5 (9.18)	
Current working status				**<.001**
Working	32.7 (2.24)	306.8 (20.66)	339.6 (11.53)	
Not Working	456.8 (31.27)	1114 (74.97)	1570 (53.31)	
Retired	2.2 (0.1513)	63.1 (4.246)	65.3 (2.216)	
Housewives	968.9 (66.34)	0 (0)	968.9 (32.89)	
Missing	0 (0)	1.8 (0.124)	1.8 (0.0625)	
Housing				**.012**
Villa/Palace	383.5 (26.26)	429.7 (28.93)	813.1 (27.6)	
Small Villa	543.9 (37.24)	613.3 (41.29)	1157 (39.28)	
Flat	398.8 (27.3)	325.4 (21.91)	724.1 (24.58)	
Wooden	28.75 (1.968)	12.49 (0.8409)	41.24 (1.4)	
Mud	36.93 (2.529)	60.53 (4.075)	97.46 (3.308)	
Other	25.28 (1.731)	16.02 (1.078)	41.29 (1.402)	
Missing	43.47 (2.977)	28.03 (1.887)	71.51 (2.427)	

[a] The frequencies and percentages throughout the table are adjusted for survey weights (survey design, non-response and post-stratifications).
[b] Column percentage.
[c] Row percentage.

Across all educational levels, elderly females were less educated than elderly males. For instance, the level of illiteracy was 87.6% among females compared to 51.2% in males. Similarly, only 10% of females completed elementary school compared 33% of the males. Overall, there were no statistically significant differences in geographic locations and site of residence (urban vs. rural) by gender (Table 1).

When the subjects were asked to list five medical conditions they were suffering from, the majority reported diabetes mellitus (DM) 32%, hypertension (29.7%) and joints disorders (25%), digestive disorders (9.4%) and endocrine and metabolic disorders (7.8%). While in most disease conditions there were no statistical significance in prevalence between males and females, certain differences were noticed between the two genders. For instance, the prevalence of reported hypertension was significantly higher among the females (32.2%) compared to the males (27.1%; P = .023). This pattern was seen in joints disorders (Males vs. Females: 22% vs. 32%; P = .007), gastrointestinal diseases (Males vs. Females: 8.0% vs. 10%; P = .034), and endocrine and metabolic disorders (Males vs. Females: 6.5% vs. 9.2%; P < .001). Fig. 2 shows the distribution of the common disorders reported by both genders.

Regarding medications utilization, the most prevalent reported medication used among SOA was paracetamol (67%) followed by non-steroidal anti-inflammatory drugs (50%), joint pain drugs (50%), multivitamins and minerals (48%), antidiabetics (47%), antihypertensive (42%) and aspirin (31%). In general, there were no difference between males and females in terms of medications utilization. Nonetheless, the prevalence of paracetamol was significantly higher among the females compared to males (Females vs. Males: 71% vs. 64%; p = .008). Similar trend was found with joint pain medications (Females vs. Males: 53% vs. 47%; p = .014), antihypertensives (Females vs. Males: 47% vs. 38%, p = .001), heartburn drugs (Females vs. Males: 31% vs. 25%; p = .012), osteoporosis drugs (Females vs. Males: 8% vs. 2%; p = <.001) and anxiolytics (Females vs. Males: 2% vs. 0%; p = .005). Table 2 shows the prevalence of the medication reported by SOA stratified by gender.

Out of the whole cohort, mortality information was obtained for 2080 subjects who were followed up. Out of these subjects, 613 (29.4%) died between mid-2006 and mid-2015. The mean age at death was 78.6 (95% CI: 77.49–79.72). There was a strong evidence that being male was associated with increased hazard of death compared to females (Hazard Ratio (HR) = 1.42 (p < .001; 95% CI: 1.18–1.69)) controlling for age. In addition, each additional year of age was associated with 6% increase in the hazard of death (HR 1.06 (p < .001; 95%CI: 1.06–1.07)). Fig. 3 shows the plot of cox's proportional hazards model that compares the survival by genders after controlling for age.

4. Discussion

This study is the first of series that describes the geriatric population in Saudi Arabia. The SNSEH included 2946 SOA. Almost 60% of the participants were less than 70 years old. In contrast to what observed in surveys conducted in other countries where females constituted higher percentage of the samples, in this survey males constituted 60% of all subjects (Thanakwang, 2009; Hennessy et al., 2015; Ajmera et al., 2013). This can be explained by the culture nature in Saudi Arabia were old females do not usually interact with foreigners especially in the presence of male relatives. This observation should be taken into account when designing future surveys by oversampling female population.

In this cohort, males were significantly older than females. This result was consistent with the Saudi national census in 2010 (Central Department of Statistics and Information Department, 2011). However, the magnitude of difference in age most likely does not have any practical implication. The vast majority of SOA lived in urban areas (78.74%) which is very comparable to the percentage of urbanization reported in the Saudi national census 2010 and the "World Urbanization Prospects 2014 report" (Central Department of Statistics and Information Department, 2011; UNPD, 2014).

Because formal education in Saudi Arabia started late for most of the geriatric generation, illiteracy was particularly high among females. Illiteracy and consequent health illiteracy have been associated with poor health outcomes (World Health Organization, 2010; Health WCoSDo, 2008). In addition, since approximately 50% of SOA have an income of less than SR2500, the combination of low income and illiteracy mandates the importance of creating programs to lower the financial burden and contain easy to follow instructions to improve overall health.

Based on simple logistic regression all income levels greater than SR5000 were associated with statistically significant improve-

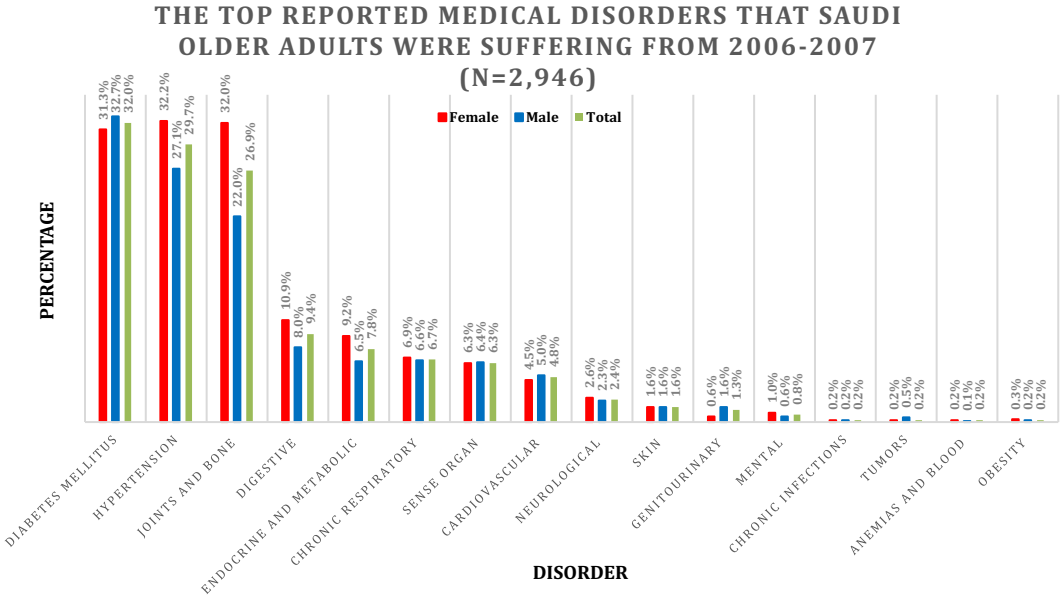

Fig. 2. The top reported medical disorders that Saudi older adults were suffering from between 2006 and 2007 (N = 2946).

Table 2
Prevalence of main medications utilization among Saudi older adults 60 years or older (N = 2946).[a]

Medications categories	Female (n) %	Male (n) %	Total (n) %	P-value
Paracetamol	1037 (71)	951 (64)	1988 (67)	.008
Joint pain medications	780 (53)	695 (47)	1475 (50)	.014
NSAIDs	751 (51)	719 (48)	1469 (50)	.336
DM medications	683 (47)	701 (47)	1384 (47)	.862
Multivitamins & minerals	695 (49)	732 (48)	1426 (47)	.104
Anti-hypertensive medications	686 (47)	566 (38)	1252 (42)	<.001
Aspirin	454 (31)	474 (32)	928 (31)	.737
Acid suppressants and antacids	457 (31)	377 (25)	833 (28)	.012
Anti-hyperlipidemia	275 (19)	233 (16)	507 (17)	.108
Eye medications	239 (16)	247 (17)	486 (16)	.897
Laxatives	230 (16)	249 (17)	480 (16)	.611
Asthma medications	138 (9)	126 (8)	264 (9)	.421
Iron	157 (11)	103 (7)	259 (9)	.072
Congestive heart failure medications	107 (7)	115 (8)	222 (8)	.79
ENT medications	98 (7)	122 (8)	219 (7)	.363
Coronary artery disease & other heart medication	86 (6)	98 (7)	184 (6)	.523
Osteoporosis: hormonal and other medications	112 (8)	34 (2)	146 (5)	<.001
Antidepressants	78 (5)	61 (4)	140 (5)	.498
Benzodiazepines	59 (4)	60 (4)	119 (4)	.975
Chronic lung medications	43 (3)	43 (3)	86 (3)	.999
Sleep disorders medications	24 (2)	21 (1)	45 (2)	.558
Anxiolytics	23 (2)	6 (0)	30 (1)	.005

DM: Diabetes Mellitus, NSAIDs: Nonsteroidal anti-inflammatory Drug, ENT: ear, nose and throat.
[a] The frequencies and percentages throughout the table are adjusted for survey weights (survey design, non-response and post-stratifications).

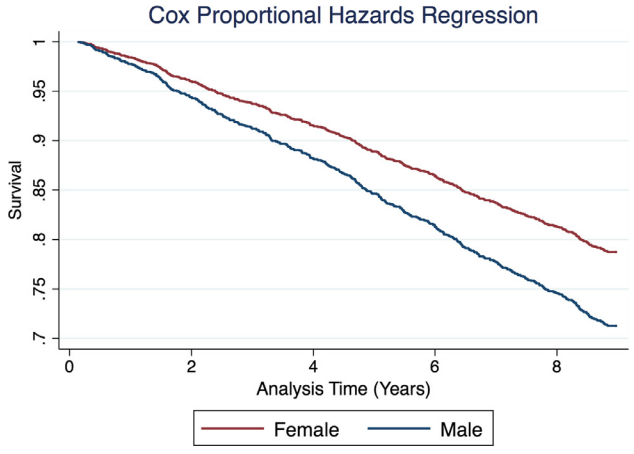

Fig. 3. Plot for Cox's proportional hazards model compares the survival by genders after controlling for age (N = 2069).

ments in the level of satisfaction. Further studies should explore the minimum sufficient income needed for SOA, including special needs groups, which will have an implication on the national social benefit programs.

In this study, the prevalence of self-reported DM was approximately 32% which is higher than the reported adults' DM prevalence (16.7%) by the international diabetes federation (IDF) in 2006 as well as 2015 report (17%) (International Diabetes Federation, 2015; International Diabetes Federation, 2006). However, since the IDF reports included ages 20–79, it is most likely that DM prevalence was diluted by the inclusion of younger subjects. When the use of anti-diabetics was accounted for, the prevalence of DM increased to 47%. The latter percentage is consistent with the estimated DM prevalence by Al-Rubeaan and colleagues between 2007 and 2009, who reported a prevalence of 45–50% and Al-Modeer in 2013 reported 57.3% (Al-Rubeaan et al., 2015; Al-Modeer et al., 2013).

Almost 30% of SOA subjects suffered from hypertension, which is associated with increased mortality and morbidity. For instance, in 2008, the WHO reported that approximately 400 individuals/100,000 annually died from cardiovascular related diseases in Saudi Arabia (Organization WH, 2013). When antihypertensive medications were accounted for in estimating the prevalence of hypertension, the prevalence increased to 42%. This was very similar to the calculated prevalence among SOA aged 65 or older that was reported in the Saudi health information survey in 2013 (El Bcheraoui et al., 2014).

As the majority of the SOA population are relatively young, this provides an excellent opportunity to intervene in order to overcome the long-term consequences. Several studies discussed successful aging as a function of preventing disability and diseases, active engagement with life, as well as high cognitive and physical functions (Anton et al., 2015; Harmell et al., 2014; Rowe and Kahn, 1997). Therefore, the emphasis should be on empowering and enabling this segment to access and receive a comprehensive care in an efficient and timely approach. Furthermore, public policy efforts should focus on developing innovative approaches that ensure their active engagement in the society.

Many countries have developed such programs to assist successful aging (Harmell et al., 2014; Petrescu-Prahova et al., 2015; Caprara et al., 2015; Ahn et al., 2015). In Saudi Arabia, since 2006, critical activities, policies, and programs were also introduced to promote the health of SOA. These started with conducting the SNSEH which was followed by signing the Riyadh declaration "Care for Older Adults" by the Gulf Cooperation Council countries in 2009. This declaration was formulated after extensive workshops where government sectors and non-government stakeholders such as community and charitable organizations as well as the Saudi human right commission were involved. The declaration focused on developing national strategies for improving older adult health guided by data and based on evidence, updating all national policies addressing health of older adults, participating in international efforts regarding older adults' rights, enhancing the integration between the government sectors, and stimulating social and community sectors regarding issues related to older adults (Khoja and AlSofiani, 2015). Therefore, developing policies, programs and interventions based on this declaration is essential as the demographic

composition is changing in a way that will produce a positive trend in the Saudi Aging Index, defined as "number of persons 60 years old or over per hundred persons under age 15" (Economic UNDo, 2002). This index will increase from 6 in 1980–1995 and 9 in 2000–2005 to above 160 in the 2050s (Fig. 4).

In addition, as part of the national health strategy 2010–2015, the MOH launched a campaign of creating age-friendly PHCCs throughout Saudi Arabia by reviewing the infrastructure and the architectural designs to make them age-friendly. Furthermore, the general directorate at the MOH identified eleven common health conditions that PHCCs should manage and provide comprehensive services for older adults. Consequently, these eleven conditions became a part of the required geriatric services in the "Policy and Procedures for Primary Health Care Accreditation Standards' regulation document (The General Directorate of Health Centers Policies, 2014).

Furthermore, the MOH has created "The Home Care Program for Older Adults" to provide all medical services that can be offered at home without jeopardizing the quality of service. Such service has been proven to improve patients' satisfaction, reduce staff burnout, and reduce hospitalization rate for ambulatory care-sensitive conditions (Al-Modeer et al., 2013; Nelson et al., 2014). The services were provided by a team of physicians, nurses, social workers, and medical educators.

However, despite the MOH efforts, interdisciplinary work between the stakeholders including leaders of Saudi healthcare system, healthcare providers, researchers, public health specialists, policy developers and public health advocates, medical educators and educational institutes, Ministry of Labor and Social Development, Social Security and Retirement Agency as well as social and community organizations is needed to achieve the goal of successful active aging. The WHO Eastern Mediterranean Regional Office has proposed fourteen steps for modelling national policy for the Elderly (Organization WH, 2006). Such a framework should be referred to in developing policy and programs pertaining to SOA.

Therefore, in response to the special challenges and requirements of the aging population, all stakeholders should work together to develop informed national evidence-based policies, programs, and interventions for healthy aging in order to maintain SOA independent, autonomous and active as possible so they can contribute productively to the society. Efforts should also decrease the burden on the individuals, their families, the healthcare delivery system, and the whole society, which will assist in integrating the aging population and offer better social security and health care for them.

Medications utilization among SOA reflects the most common disorders among this population. For instance, as the prevalence of reported joint and bone diseases reached 27%, it is expected that 50% of SOA are using joint pain drugs. This is because many SOA may not have been officially diagnosed with joint pain disorders but, nevertheless, are taking NSAIDs, paracetamol, opioids or disease-modifying antirheumatic drugs for joint pain control.

Vital status information was available for 71% of the whole population. This in itself may reduce the generalizability of the results due to loss of follow-up. Nevertheless, the results are still the best available evidence about SOA over nine years of follow up. The life expectancy in this cohort was 78.6 (95% CI: 77.49–79.72) which is higher than the reported life expectancy by World Bank (1960). Such difference is most likely attributed to the stable nature of this cohort compared to the whole Saudi society including younger ages who frequently die due automobile crash; the leading cause of death among younger ages ((IHME). IFHMAE, 2016). Therefore, age-specific life expectancy can be better than the overall life expectancy when it comes to improving such metrics nationwide.

In Saudi Arabia the age adjusted hazard of death was 42% higher in males compared to females which has been similar to what has be reported in the U.S. as well as Europe (Kochanek, 2016; Explained ES, 2016).

This study has multiple strengths: first, it is based on nationally representative data that was designed to assess the health status of the SOA population in Saudi Arabia. Second, despite that the data was collected in between 2006 and 2007, it was demonstrated throughout the paper that the results are still representative to the current SOA population since all recent literature were comparable to the survey findings. Third, the survey included questions and instruments that have been used and validated in other studies in different settings. Therefore, the results can be generalized to the SOA population and allow for regional and global comparisons. Fourth, the fact that missing information was very few increases the validity of presented results. Lastly, the follow up with the enrolled subjects to ascertain their vital status creates an opportunity to examine the effects of social determinants of health on mortality among SOA in future analyses.

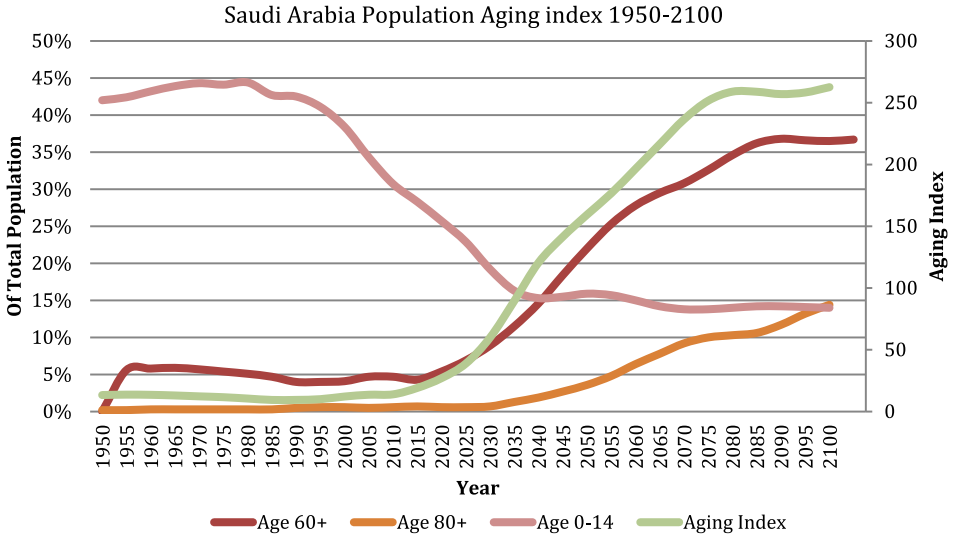

Fig. 4. Saudi Arabia population aging index and the proportion of extreme age groups, 1950–2100 based on a medium fertility rate assumption.(4).

This work inherits the limitations that characterize survey-based studies. For example, most of the variables were self-reported. The issue of self-reporting and self-rated measures is an area of discussion, especially when it involves older adults with limited cognitive ability. In addition, there are biases contributed by the sensitivity and specificity of instruments used in assessing some conditions.

In conclusion, the SNSEH is the most recent and nationally representative sample for geriatric population in Saudi Arabia. Therefore, more efforts should be exerted to utilize the survey in order to understand the characteristics and the social determinants of health for this population which support the development of evidence based public health policy and interventions. By the end of this decade, Saudi Arabia is likely to have developed an effective system to provide care for their older people and to prepare the younger generation to enter old age in good health and fitness.

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Appendix A. Study sampling and sample size calculation

The sample size was calculated for a complex survey for points estimate using: proportion of chronic condition and disability among SOA as 10%, level of significance of 95%, and a degree of precision of 0.02. The calculated sample was 865 for simple random sampling design. The formula (Lemeshow and Robinson, 1985) used to calculate the sample size is:

$$N = Z^{\wedge}2 * P(1 - P)/D^{\wedge}2$$

where N: Required sample size, Z: 1.96 at 95% level of significant, P: Proportion of chronic condition or disability among population, D: degree of precision.

Using cluster sampling and applying Probability proportional to size (PPS) sampling with design effect of 2.5, and assuming a response rate of 80%, the yielded final sample size was 2704 persons. (Almanaa et al., 2010) Considering the interclass correlation equals to 0.05 and using formula 2, the size of the cluster composed of 31 subjects. (Ukoumunne et al., 1998) Therefore, the total number of cluster was 88 clusters. The clusters were selected from the list of the population provided by the Ministry of Health and Central Department of Statistics and Information at Ministry of Economics and Planning in KSA. The catchment area of primary health care center (PHCC) was used as a cluster for individuals sampling frame. Cluster map was used to select a random street and random household. Through revision of family records in the PHCCs, households satisfied this inclusion criterion were included for interview.

The survey-standardized weight for subjects was calculated and adjusted for oversampling; non-response and post stratification based on the census data. This survey weight will be used in the data analysis and presentations.

$$DEFF = 1 + c + (n - 1)$$

where DEFF: Design effect, c: interclass correlation and n: the cluster size.

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