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Burden of Neurodegenerative Diseases in the Eastern Mediterranean Region, 1990-2016:

Findings from the Global Burden of Disease 2016 Study

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ABSTRACT

BACKGROUND AND PURPOSE: The Eastern Mediterranean Region (EMR) is experiencing a demographic shift towards rapid ageing at a time of political unrest. We aimed to estimate the burden of neurodegenerative disorders, and its relationship with sociodemographic indicators (SDI) in the EMR countries from 1990 to 2016.

METHODS: Using data from the Global Burden of Disease (GBD) 2016 study, we calculated country-specific trends for prevalence, mortality, disability-adjusted life-years (DALYs), years of life lost (YLLs), and years lived with disability (YLDs) for Alzheimer's disease/other dementias and Parkinson's disease in the EMR during 1990-2016.

RESULTS: In EMR, age-standardized prevalence rate of Alzheimer's disease/other dementias and Parkinson's disease was estimated at 759.8 (642.9-899.9) and 87.1 (69.8-108.2) /100,000 in 2016, demonstrating 0.01% and 42.3% change from 1990, respectively. Neurodegenerative disorders contributed to 5.4% of total DALYs and 4.6% of total YLDs among the older EMR population aged 70 years or older in 2016. Age-standardized DALYs due to Parkinson's disease was strongly correlated with the SDI level (r=0.823, *p*-value<0.001). The YLD/DALY ratio of neurodegenerative diseases declined during this period in the low income EMR countries but not in high income ones.

CONCLUSIONS: Our findings demonstrated an increasing trend in the burden of dementias and Parkinson's disease in most EMR countries between 1990 and 2016. With aging of the EMR populations, countries should target the modifiable risk factors of neurodegenerative diseases to control their increasing burden.

Keywords:

Neurodegenerative Diseases, Parkinson's Disease, Alzheimer's Disease, Dementia, Global Burden of Diseases, Eastern Mediterranean Region (EMR)

INTRODUCTION

Alzheimer's disease, other dementias, and Parkinson's disease are the most common neurodegenerative disorders of elderly population. In 2015, approximately 46 million people were living with dementias and >6 million were suffering from Parkinson's disease, worldwide [1]. The debilitating nature of neurodegeneration has made it a leading cause of dependence and disability in the globe [2]. While deaths resulting from more commonly known non-communicable conditions such as stroke, heart disease, and several cancers have decreased, deaths from Alzheimer's and Parkinson's diseases have constantly increased during recent decade [3, 4].

The main risk factor for both Alzheimer's and Parkinson's diseases is increased age [5]. Because of a rapidly aging population, therefore, prevalence of neurodegeneration is predicted to nearly double every 20 years [6]. Between 2017 and 2050, the elderly population, defined as subjects 60 years of age and older, has been estimated to increase from 962.3 to 2080.5 million in the world, including 3.2-fold increase in Africa (from 68.7 to 225.8 million) and 2.3-fold increase in Asia (from 549.2 to 1273.2 million) [7]. Population transition in the Eastern Mediterranean Region (EMR) is also remarkable, and even with the unrest conflicts, all countries in the EMR observed an increase in life expectancy and many experience an immense demographic shift toward rapid ageing [8]. Recent census in Egypt[9] and Pakistan [10] showed a population growth rate above the expected estimations. In Saudi Arabia and UAE, 51% [11] and 34% [12] of the population is younger than the age of 25,

respectively. Iran's population, on the other hand, is rapidly aging and the proportion of those who age >60 years is projected to reach 30% by 2050 [13]. With such a rapid population growth and fast aging, EMR countries should be well prepared facing with even a larger burden of neurodegenerative disorders in near future, which will likely increase due to population ageing in the region. While there is a strong need for the health policymakers, epidemiologic data on the burden of dementias and Parkinson's disease in the EMR is scarce.

The Global Burden of Disease (GBD) 2016 Study is the most comprehensive epidemiologic and updated source of summary health metrics for 333 diseases and injuries of human including neurodegenerative disorders [14]. Using data from the GBD 2016 Study, we aimed to investigate trends in prevalence, years lived with disability (YLDs), disability-adjusted life-years (DALYs) and mortality rates for Alzheimer's disease and other dementias and Parkinson's disease in EMR countries from 1990 to 2016. Secondly, regarding the socioeconomic diversity of the EMR, we compared burden of neurodegenerative diseases between EMR countries with different income level.

MATERIALS AND METHODS

Eastern Mediterranean Region (EMR)

The World Health Organization (WHO) has grouped its member states into six regions based on geographical terms. The Eastern Mediterranean Region (EMR) region has more than 500 million inhabitants, representing a diverse group of 22 countries, as defined by WHO. Based on per capita gross national product (GNP), these countries were categorized into three groups: 1) low income; Afghanistan, Djibouti, Somalia, Yemen, 2) middle income; Egypt, Iran, Iraq, Jordan, Lebanon, Libya, Morocco, Pakistan, Palestine, Sudan, Syria, and Tunisia, and high income; Bahrain, Saudi Arabia, Kuwait, Oman, Qatar, United Arab Emirates (UAE) [15, 16].

We also calculated socio-demographic index (SDI), as a summary metric of income per capita, average years of schooling among people aged 15 years and older, and total fertility rate [17]. SDI values were scaled to a range of 0 to 1 (or 100%), with 0 indicating the worst and 1 representing the best status in each component in 2016 [14]. In EMR, SDI ranged from 0.27 in Somalia to 0.83 in Kuwait, compared to 0.19 in South Sudan and 0.94 in Luxembourg globally in 2016.

Global Burden of Disease (GBD) 2016 Study

The Global Burden of Disease (GBD) 2016 methodology has described previously [4, 14, 18-21]. Briefly, GBD Study uses meta-analytical approaches on a comprehensive epidemiological dataset to estimate causes of death, disease incidence, prevalence, exposure to risks, and injuries via pooling data, adjusting for biases, and incorporating covariates.

Case Definition and Input Data

Alzheimer's disease and other dementias

In GBD 2016, the Diagnostic and Statistical Manual of Mental Disorders (DSM) III, IV or V, or ICD case definitions were used as the reference to define Alzheimer's disease and other dementias. The relevant ICD-10 codes for dementia are F00, F01, F02, F03, G30, and G31, and the ICD-9 codes are 290, 291.2, 291.8, 294 and 331 [19]. GBD uses mortality data from vital registration systems, as well as prevalence data from surveys, and administrative data such as claims sources. In the GBD 2016, systematic review was updated covering January 2015 to October 2016, with the search terms to capture studies for all dementia, including its sub-types. The search yielded 1,208 initial hits and 27 were marked for extraction.

Parkinson's disease

The corresponding ICD-10 codes for Parkinson's disease are G20, G21, and G22. In GBD, Parkinson's disease is defined in the presence of at least two of the four primary symptoms: (1) tremors/trembling, (2) bradykinesia, (3) stiffness of limbs and torso, and (4) posture instability [19]. Like dementia, vital registration systems, surveys, and administrative data are used to extract input data for the burden of Parkinson's disease. For GBD 2016, the systematic review was updated covering January 2008 to October 2016, with the search terms set to capture studies for Parkinson's disease prevalence by Hoehn and Yahr stage, as the severity indicator. This search strategy resulted in 234 initial hits with 21 sources marked for extraction. Details of the systematic review approach and inclusion criteria have been previously described [19].

Modelling Strategy

GBD pools epidemiologic data by random-effects meta-analysis methods using Cause of Death Ensemble model (CODEm) and DisMod-MR 2.1, which is a Bayesian meta-regression tool to determine prevalence and incidence by cause and sequelae [22]. Further details on modelling strategy and optimization methods have been previously described [19].

Due to marked discrepancies between prevalence data and cause of death data, mortality and morbidity estimates were modelled jointly to achieve consistent estimates for dementia. We believe that parts of difference in mortality of dementia between different locations, is due to different behavior of individuals who are responsible for identifying causes of deaths. To correct this across time and locations, we modelled mortality due to dementia using prevalence data and estimates of excess mortality derived from specific countries that were most likely to code deaths to dementia relative to prevalence. We used a similar strategy for Parkinson's disease as well.

Calculation of Burden Indicators

Years lived with disability (YLD)

The YLD measures the burden of living with a disease or disability. In GBD, a parsimonious set of sequelae was defined for Alzheimer's disease and other dementias and Parkinson's disease that best described different aspects of their disabling consequences. Each non-fatal sequela was estimated separately [19].

Years of life lost (YLL)

The YLL provide a summary measure of premature mortality. In GBD, YLLs were calculated by multiplying the number of deaths, due to Alzheimer's disease and other dementias and Parkinson's disease in this report, at each age by the standard life expectancy at that age [4].

Disability-adjusted life year (DALY)

As a measure of overall disease burden, DALY represents the number of years lost due to ill-health, disability or early death. In GBD, DALYs for Alzheimer's disease and other dementias and Parkinson's disease were computed as the sum of YLLs and YLDs for each country, age, sex, and year with 95% uncertainty intervals (UIs) based on the 25^{th} and 975^{th} values of the ordered 1000 draws [14]. Since dementias and Parkinson's disease mostly affect elderly population, in addition to the all-age and age-standardized estimates, we also reported the burden for older ages. Furthermore, we also calculated YLD/DALY ratio, ranging between 0 and 1, as an indicator of health system efficiency to prevent death caused by neurodegenerative diseases and therefore decrease YLL (larger YLD/DALY ratio).

Statistical Analysis

We applied bivariate Pearson correlation to investigate the association between prevalence/burden of neurodegenerative diseases and socio-demographic index (SDI) using IBM SPSS Statistics software (version 23.0). A two-tailed p-value of <0.05 was considered as the threshold for a statistically significant association.

RESULTS

Prevalence

In 2016, the age-standardized prevalence rate of Alzheimer's disease and other dementias and Parkinson's disease in the EMR was estimated 759.8 (95% UI 642.9-899.9) and 87.1 (95% UI 69.8-108.2) /100000 people, respectively. Among the elderly population who aged 70 years or older, prevalence of Alzheimer's disease and other dementias was 8,265.7 (95% UI 6,798.4-9,991.7) /100000 people and Parkinson's disease was 787.5 (95% UI 607.4-1,006.0) /100,000 in EMR in 2016, a 6% and 48% increase from 1990. In both males and females, prevalence of dementias and Parkinson's disease dramatically increased by advancing age, reaching up to 15.4% (95% UI 12.5-18.9%) and 1.3% (95% UI 1.0-1.7%) among those aged 80 years or older, respectively (Figure 1).

Afghanistan (959.7, 95% UI 802.3-1142.1 /100,000), Tunisia (953.3, 95% UI 799.8-1137.1 /100,000), and Saudi Arabia (953.2, 95% UI 798.8-1135.9 /100,000) had the highest age-standardized prevalence rate of Alzheimer's disease and other dementias in 2016 (Table 1). By contrast, Pakistan (457.2, 95% UI 385.0-542.1 /100,000), Somalia (508.6, 95% UI 425.3-605.5 /100,000), and Djibouti (518.3, 95% UI 435.2-618.3 /100,000) had the lowest age-standardized prevalence rate of dementias. Egypt experienced the largest increase in the age-standardized prevalence rate of Alzheimer's disease and other dementias from 1990 to 2016. Except Somalia, Yemen, Iraq, and Qatar, all-age prevalence rate of dementias has been increased in most of the EMR countries during this period. Yet, age-standardized prevalence rates have been almost unchanged for dementias, which demonstrates that population ageing is the main driver for increase in all-age prevalence rates. Dementia was more prevalent in women with the largest age-standardized female/male ratio estimated for Somalia and Djibouti (1.41, Supplementary Figure 1-A). Among the elderly population in EMR (age >+70 years), prevalence rate of dementia has increased from 8.4% to 9.0% in women and from 7.0% to 7.5% in men during 1990 to 2016, which is constantly higher than the global estimates for men (Figure 2-A).

In 2016, Iran (125.3, 95% UI 101.4-156.0 /100,000) and Kuwait (107.2, 95% UI 85.4-133.3, /100,000) had the highest age-standardized prevalence rate of Parkinson's disease; whereas, Somalia (36.2, 95% UI 28.2-45.3 /100,000) and Djibouti (40.7, 95% UI 31.9-50.9 /100,000) had the lowest rates (Table 2). From 1990 to 2016, all-age prevalence of Parkinson's disease has increased in all EMR countries, and Oman experienced the largest increase in age-standardized prevalence rate (74.2%). Parkinson's disease was more prevalent in men in all EMR countries, with the lowest female/male ratio estimated for Somalia and Djibouti (0.64, Supplementary Figure 1-B). Among the elderly population who aged >+70 years, Parkinson's disease was less prevalent in the EMR countries compared to the globe in 1990. However, as shown in Figure 2-B, the prevalence in the EMR has increased faster during the last 26 years, and the difference with the global estimates seems to be narrowing in both men (from 0.6% to 0.9%) and women (from 0.4% to 0.6%) in 2016.

Disease Burden

In 2016, a total of 19.8 (95% UI 18.4-21.3) million DALYs were in the elderly population (>+70 year) of the EMR, of which 986,158.4 (95% UI 808,265.6-1,211,912.7) and 88,870.7 (95% UI 66,829.3-115,843.1) DALYs were due to dementias and Parkinson's disease, respectively. Neurodegenerative disorders contributed to 5.4% of total DALYs and 4.6% of total YLDs in the EMR among those aged 70 years or older in 2016. All-age and age-standardized DALY, YLD and death rates of dementias and Parkinson's disease in each EMR country are summarized in Table 1. Majority of the EMR countries experienced an increase in annual rate of change in all-age DALYs due to neurodegenerative disorders between 1990 and 2016. Nevertheless, after age standardization, the annual rate of change in DALY rates remained positive mostly for Parkinson's disease and not dementias (Supplementary Figure 2). Alzheimer's disease and other dementias caused the largest age-standardized DALY in Afghanistan (741.3, 95% UI

607.9-897.7 /100,000) and Libya (667.8, 95% UI 548.9-810.9 /100,000) (Table 1). From 1990 to 2016, Pakistan (+5.8%) and Lebanon (-12.5%) experienced the largest increase and decrease in the age-standardized DALY due to dementias. In most of the EMR countries, age-standardized death rate due to Alzheimer's disease and dementias was higher than the global estimates in 2016 (40.8, 95% UI 35.4-47.5 /100,000), with the highest one occurred in Afghanistan (60.6, 95% UI 49.9-75.6 /100,000).

In EMR, Parkinson's disease has produced more all-age and age-standardized DALYs in 2016 compared to 1990 (Table 2). Between the EMR countries, Iran (68.4, 95% UI 52.3-87.4 /100,000) and UAE (61.1, 95% UI 45.9-79.5 /100,000) had the largest DALY generated by Parkinson's disease in 2016. The largest increase in age-standardized DALY from 1990 to 2016, however, was observed in Oman (67.8%). Mortality rate due to Parkinson's disease has increased in all EMR countries during this 26-years period, with the highest tare estimated for Iran (4.7, 95% UI 3.5-6.2 /100,000).

Variations in Trends of Disease Burden by Income Level and SDI

As shown in Figure 3, the highest prevalence rate of dementia among population aged >70 years was seen in Tunisia, Lebanon and Saudi Arabia, all of which had an SDI >0.70, whereas, the lowest rates were observed in Pakistan (SDI=0.52), Somalia (SDI=0.27) and Djibouti (SDI=0.42). Overall, there is a moderate direct correlation (r=0.552, p-value=0.008) between the SDI level and prevalence rate of Alzheimer's disease and other dementias among the elderly population (70 years or older) in the EMR. However, no association was found between the age-standardized DALYs due to dementia and SDI (p-value=0.331). Both prevalence rate among the older population (r=0.881, p-value<0.001) and age-standardized DALY (r=0.823, p-value<0.001) caused by Parkinson's disease were strongly correlated with the SDI level (Figure 3).

Since the year 2000, middle-income and high-income EMR countries have experienced gradual increase in the age-standardized YLD/DALY ratio of neurodegenerative disorders, yet this ratio is consistency below global estimates (Figure 4). For both dementias and Parkinson's disease, the EMR countries with low-income level showed a declining trend in the YLD/DALY ratio during this 26-years period. In 2016, the highest and lowest age-standardized YLD/DALY ratios for dementias were estimated for Lebanon (23%) and Djibouti (17%), respectively. Similarly, for Parkinson's disease, the same countries ranked as the highest and lowest rations in 2016 (Lebanon: 23%, Djibouti: 16%).

DISCUSSION

This is the first study to provide estimates on the prevalence and burden of neurodegenerative disorders in the EMR countries during 1990-2016. Our findings indicated that in most EMR countries, all-age prevalence, YLDs, deaths and DALYs due to dementias and Parkinson's disease have increased. With the rapid aging of the population and its growth, countries need to address the risk factors and plan for managing these diseases as they will pose a huge financial and health professional demand in the coming years.

In line with the literature [23], prevalence of dementias in the region continued to increase exponentially with advancing age in both men and women, reaching up to >15% among the oldest old population aged >80 years. As a result, in the EMR where most countries are experiencing a rapid pace of aging and improving life expectancy [8], prevalence and burden of neurodegenerative disorders are rapidly increasing; nevertheless, exceptions are the countries that are confronting with deadly conflicts (e.g. wars, natural disasters) resulting in premature deaths, namely Somalia, Yemen, and Iraq.

Recently, it has been shown that the global burden of Parkinson's disease has more than doubled within the past 26 years [24]. Our findings, however, showed that the pace of increase in the prevalence of dementias and Parkinson's disease in the EMR is faster than the global trend, which further highlights the need to pay more attention to the burden of neurodegenerative disorders in the region. In contrast to dementias, both all-age and age-standardized prevalence rates of Parkinson's disease have been increased during 1990-2016 in the EMR. This is in line with the global trend for prevalence of Parkinson's disease showing that population aging is not the only underlying reason [24]. Longer disease duration and environmental factors could be other potential contributors, yet, further studies are needed.

Overall, we found a direct strong association between the prevalence of neurodegenerative disorders and SDI in the EMR. Both Alzheimer's disease and other dementias and Parkinson's disease were more prevalent in high-SDI countries. This may reflect poor recognition and documentation of neurodegenerative diseases in EMR countries with low SDI. The same trend was also observed for the burden caused by Parkinson's disease, where countries with higher SDI had significantly higher DALY generated by Parkinson's disease. Interestingly, following age standardization, DALY due to Alzheimer's disease and dementias did not correlate with SDI, and instead, the highest burden was estimated for Afghanistan, a country with low SDI.

The YLD/DALY ratio, as an efficiency indicator of the healthcare system, showed a declining trend for the burden of neurodegenerative disorders in low-income EMR countries. While parallel to the global trend, relative mortality and YLLs due to neurodegenerative disorders have been decreased in the middle- and high-income EMR countries since 2000, contribution of YLLs to the DALYs of dementias and Parkinson's disease have increased in the low-income countries. Nevertheless, the YLD/DALY ratio in the entire region is below the global average,

which warrants the need for improvement of the quality of care for neurodegenerative conditions in all EMR countries.

Policymakers of the health sectors in the EMR countries should target modifiable risk factors of neurodegeneration well in advance. Growing evidence has shown a clear direct association between midlife obesity [25, 26], diabetes [27], metabolic profile [28], multiple cardiovascular risk factors [29] and increased risk of late-life dementia. A recent meta-analysis revealed that a medium level of physical activity could lower the risk of developing Parkinson's disease later in life [30]. The associations between midlife metabolic/vascular risk factors and burden of neurodegenerative diseases later in life, might partly stemmed from vascular dementia and vascular parkinsonism (i.e. post-stroke). Nevertheless, recent literature supports the role of vascular risk factors in the pathogenesis of even the so-called idiopathic neurodegenerations (i.e. Alzheimer's disease) decades before any cognitive problem starts [31]. These results are of particular importance for the EMR countries.

Our recent estimates demonstrated that the prevalence of metabolic risk factors such as obesity has increased from 15.1% (95% UI 13.4–16.9) in 1980 to 20.7% (95% UI 18.8–22.8) in 2015 among the adult population in the EMR [32]. Also, burden of diabetes has increased from 1990 to 2015, with an age-standardized DALY rate being higher than all other WHO regions [33]. Healthcare policymakers in all EMR countries should tailor plans to reduce the burden of metabolic/vascular risk factors in the middle-aged population in order to diminish the prevalence and burden of neurodegeneration in future. A modelling meta-analysis recently concluded that a 10% current reduction in the burden of key risk exposures would lead to an 8.3% decrease in the prevalence of dementia in 2050 [34]. Another study estimated that 10-25% reduction in major midlife risk factors namely diabetes, hypertension, obesity, smoking, depression, low educational attainment, and physical inactivity could potentially prevent as many as 1.1-3.0 million Alzheimer's disease cases worldwide [35].

We acknowledge limitations of our study. First, dementias and Parkinson's disease are usually underestimated as the cause of death in most vital registries, particularly in low- and middle-income countries. In GBD 2016, however, we used a modelling strategy to estimate excess mortality caused by Alzheimer's disease and other dementias and Parkinson's disease, which was implied by prevalence and mortality rates in countries that were most willing to code deaths to neurodegenerative disorders in their vital registrations [1]. Second, estimates of cause-specific death rates in most of the EMR countries may rely on verbal autopsy data rather than physician-certified death records. Verbal autopsy instruments are unable to capture disorders such as dementias and Parkinson's disease [1]. Third, original epidemiologic data for the prevalence and mortality of neurodegenerative diseases are sparse for most of the EMR countries, therefore, estimates were driven by covariates in the statistical modeling. This, in fact, highlights the need for well-designed surveys on the epidemiology of dementias and Parkinson's disease in the region. Fourth, data on specific type of dementias and parkinsonism is not available in GBD. In fact, neurodegenerative disorders vary widely in pathology (e.g. vascular dementia, Alzheimer's disease, fronto-

temporal dementia, Lewy body dementia), which in turn result in various epidemiological features. This needs to be covered in future versions of GBD to improve the accuracy of estimates for the burden of different types of neurodegenerative disorders.

Our results demonstrated a high burden of neurodegenerative diseases in the EMR. This burden will increase as the population grow and ages. Currently, neurodegenerative disorders are under-recognized, undertreated, and undermanaged in the EMR, particularly in the low-income countries. EMR countries should benefit from the successful experience of developed high-income countries in controlling the burden of neurodegenerative disorders [36], by applying some of the innovative approaches. EMR countries should prioritize lowering the current and future burden of neurodegenerative diseases to reduce the strain of already limited financial resources and lack of health professionals.

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Authors Contribution

Name	Location	Role	Contribution
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Kia Vosoughi	Iran University of Medical Sciences, Iran	Author	Interpreted the data; revised the manuscript for intellectual content
Pouria Heydarpour	Tehran University of Medical Sciences, Iran	Author	Interpreted the data; revised the manuscript for intellectual content
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Conflicts of interest

The authors declare that they have no conflicts of interest at the time of submission.

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Table 1. All age and age-standardized rates of prevalence, DALYs, YLDs and deaths per 100,000 people for Alzheimer's and other dementias by country in the Eastern Mediterranean Region between 1990 and 2016

Location	All Age		Age-Standardized	
	1990	2016	1990	2016
Low-income Countries				
Afghanistan				
Prevalence	174.9 (146.6-208.3)	196.5 (164.4-232.9)	973.9 (817.5-1156.2)	959.7 (802.3-1142.1)
DALYs	121.6 (97.0-150.5)	145.7 (118.7-179.5)	705.6 (562.5-879.2)	741.3 (607.9-897.7)
YLDs	22.8 (16.1-30.7)	25.9 (18.2-34.5)	134.0 (94.4-177.3)	133.0 (93.6-176.3)
Deaths	7.2 (5.6-8.9)	8.7 (7.1-10.7)	56.6 (43.2-71.1)	60.6 (49.9-75.6)
Djibouti				
Prevalence	108.7 (91.2-129.5)	169.1 (142.1-200.8)	540.6 (455.8-643.6)	518.3 (435.2-618.3)
DALYs	80.6 (64.5-101.1)	136.7 (104.2-173.2)	428.7 (349.0-533.6)	442.8 (344.3-556.9)
YLDs	15.2 (10.5-20.3)	24.0 (16.6-32.0)	79.0 (54.8-105.1)	76.0 (52.3-101.7)
Deaths	5.3 (4.2-6.7)	10.1 (7.6-12.9)	38.8 (30.8-48.2)	41.3 (32.1-52.0)
Somalia				
Prevalence	140.6 (117.5-168.0)	124.7 (104.3-148.8)	536.6 (450.2-638.7)	508.6 (425.3-605.5)
DALYs	105.2 (83.9-131.8)	96.6 (76.9-122.2)	422.7 (339.4-527.5)	415.7 (334.3-522.7)
YLDs	19.6 (13.7-26.3)	17.5 (12.1-23.4)	78.0 (54.5-105.6)	74.3 (51.9-98.5)
Deaths	6.9 (5.4-8.8)	6.5 (5.2-8.3)	37.4 (29.5-46.9)	37.3 (29.9-46.5)
Yemen				
Prevalence	227.0 (190.8-268.6)	217.0 (183.5-257.0)	981.7 (827.9-1175.5)	937.3 (788.0-1116.6)
DALYs	142.6 (114.6-174.9)	145.0 (118.9-177.2)	634.9 (515.9-779.3)	653.2 (538.7-796.4)
YLDs	30.3 (21.4-40.3)	28.9 (20.3-38.2)	135.3 (95.9-178.4)	130.9 (91.7-172.5)
Deaths	9.0 (7.2-11.2)	9.0 (7.4-11.1)	49.7 (40.4-61.2)	52.6 (43.3-63.6)
Middle-income Countries				
Egypt				
Prevalence	335.2 (285.6-394.8)	387.6 (334.1-447.0)	810.8 (691.9-951.0)	818.0 (705.9-946.9)
DALYs	208.3 (174.4-246.7)	238.5 (197.7-287.8)	519.5 (437.8-612.7)	515.3 (424.6-617.3)
YLDs	46.1 (32.1-61.4)	53.8 (38.1-71.5)	115.1 (80.3-152.2)	116.5 (82.7-153.8)
Deaths	13.5 (11.4-16.1)	16.3 (13.3-19.8)	41.2 (34.3-48.8)	40.6 (33.2-48.7)
Iran				
Prevalence	246.6 (206.9-294.0)	453.1 (383.0-537.8)	914.9 (767.3-1083.5)	903.8 (761.3-1078.5)
DALYs	148.4 (118.2-179.0)	289.8 (233.4-354.7)	578.1 (470.3-698.2)	591.9 (479.4-723.1)
YLDs	33.5 (23.6-45.0)	63.5 (44.3-85.1)	130.0 (91.3-172.8)	129.2 (90.5-171.8)
Deaths	9.2 (7.5-11.1)	20.6 (16.7-25.2)	45.9 (37.5-55.5)	47.6 (39.0-57.6)

Iraq				
Prevalence	321.6 (269.3-382.5)	253.4 (213.4-303.4)	950.7 (798.3-1122.9)	937.1 (784.9-1113.9)
DALYs	213.0 (172.5-260.9)	166.2 (131.9-204.1)	641.7 (527.3-780.7)	630.5 (507.2-775.1)
YLDs	43.8 (30.6-58.2)	34.4 (24.2-46.2)	132.4 (93.0-175.8)	130.9 (92.4-173.0)
Deaths	14.3 (11.6-17.4)	10.9 (8.7-13.6)	51.1 (42.2-62.1)	50.3 (41.0-61.8)
Jordan				
Prevalence	295.0 (246.1-351.4)	329.3 (275.8-391.1)	948.5 (791.4-1131.0)	941.3 (789.2-1117.8)
DALYs	194.4 (158.5-235.8)	209.9 (163.6-265.2)	637.3 (525.7-768.4)	615.2 (487.3-771.5)
YLDs	40.7 (28.5-54.1)	45.7 (31.7-61.1)	133.2 (94.1-176.5)	133.8 (93.3-178.7)
Deaths	13.4 (11.1-16.2)	14.3 (11.3-18.3)	51.2 (42.8-61.5)	49.3 (39.1-61.7)
Lebanon				
Prevalence	509.5 (423.8-605.5)	783.5 (651.4-939.9)	975.9 (811.1-1161.3)	946.9 (794.3-1136.3)
DALYs	333.3 (264.9-416.8)	471.1 (382.9-572.1)	660.5 (529.3-821.4)	577.6 (470.4-701.2)
YLDs	70.6 (49.7-94.0)	111.3 (77.5-148.9)	138.5 (96.2-184.3)	135.6 (94.6-180.8)
Deaths	23.3 (18.7-29.0)	35.5 (29.2-43.4)	54.1 (43.9-66.2)	47.3 (39.2-57.4)
Libya				
Prevalence	249.5 (209.9-297.1)	414.9 (349.7-493.2)	930.8 (780.6-1111.7)	923.8 (774.8-1105.6)
DALYs	173.5 (143.5-210.4)	291.8 (239.2-354.5)	676.1 (561.4-811.8)	667.8 (548.9-810.9)
YLDs	33.9 (23.7-45.5)	57.6 (40.3-76.8)	132.1 (92.9-175.2)	131.3 (91.3-175.7)
Deaths	11.2 (9.4-13.5)	21.3 (17.8-25.7)	55.7 (46.8-66.3)	55.5 (46.5-66.9)
Morocco				
Prevalence	309.9 (260.0-369.1)	586.7 (492.0-693.5)	954.7 (796.3-1131.2)	914.1 (765.3-1085.9)
DALYs	176.0 (132.7-222.0)	374.8 (306.0-457.0)	568.9 (426.8-715.2)	594.4 (484.5-726.9)
YLDs	42.1 (29.1-56.6)	82.4 (57.6-109.2)	135.4 (95.5-179.5)	130.5 (91.0-172.2)
Deaths	10.8 (7.7-13.9)	27.2 (22.2-33.3)	44.3 (31.2-56.2)	47.7 (39.0-58.2)
Pakistan				
Prevalence	155.3 (130.6-186.0)	181.4 (151.9-214.7)	477.8 (400.8-569.0)	457.2 (385.0-542.1)
DALYs	89.7 (71.4-110.5)	116.3 (93.9-143.3)	289.4 (231.7-357.9)	306.3 (249.3-378.6)
YLDs	21.6 (15.0-29.0)	25.5 (17.7-34.0)	68.8 (48.3-91.8)	66.0 (46.2-88.6)
Deaths	6.0 (4.6-7.5)	8.3 (6.7-10.4)	24.1 (18.3-29.9)	26.7 (21.6-32.7)
Palestine				
Prevalence	181.7 (152.6-215.1)	225.3 (189.1-268.1)	953.7 (797.1-1129.9)	938.3 (785.5-1119.6)
DALYs	119.3 (96.8-146.8)	147.5 (121.7-179.2)	655.9 (533.6-804.4)	640.7 (534.5-781.2)
YLDs	25.0 (17.5-33.3)	30.9 (21.5-41.0)	136.3 (95.3-182.1)	133.5 (92.3-176.4)
Deaths	7.9 (6.4-9.7)	9.6 (8.0-11.7)	53.0 (43.2-64.9)	51.6 (43.2-62.2)

Sudan				
Prevalence	222.8 (187.0-264.9)	252.6 (212.2-300.4)	838.6 (701.7-996.1)	815.0 (683.7-969.9)
DALYs	131.4 (105.3-163.1)	161.6 (132.6-195.9)	512.4 (410.2-637.7)	538.2 (442.8-655.3)
YLDs	30.2 (21.3-40.5)	34.7 (24.3-46.4)	118.1 (82.4-156.8)	115.7 (80.9-154.4)
Deaths	8.0 (6.3-10.2)	10.6 (8.7-12.9)	39.9 (31.0-49.5)	43.1 (35.8-52.3)
Syria				
Prevalence	250.0 (209.3-298.2)	377.7 (319.1-445.5)	963.1 (805.6-1148.0)	938.6 (787.7-1109.3)
DALYs	155.8 (128.3-188.3)	241.7 (200.3-291.3)	621.6 (516.6-752.1)	614.0 (512.2-737.3)
YLDs	34.4 (24.0-45.8)	53.1 (37.4-70.9)	137.1 (96.1-181.8)	134.7 (94.2-179.9)
Deaths	10.0 (8.4-12.1)	17.2 (14.3-20.5)	49.2 (41.2-59.2)	48.9 (40.8-58.0)
Tunisia				
Prevalence	400.7 (333.4-477.6)	760.3 (638.3-903.4)	975.4 (814.9-1164.8)	953.3 (799.8-1137.1)
DALYs	263.5 (214.0-319.9)	518.5 (421.3-636.2)	672.4 (555.1-810.2)	657.0 (533.3-810.1)
YLDs	55.1 (37.7-74.4)	108.5 (76.0-144.1)	139.5 (97.2-186.4)	137.1 (95.8-182.8)
Deaths	16.7 (13.9-20.4)	40.7 (32.8-49.9)	55.0 (46.2-65.6)	53.9 (43.4-66.1)
High-income Countries				
Bahrain				
Prevalence	190.0 (160.8-224.6)	222.5 (189.9-260.5)	929.2 (777.8-1102.1)	909.9 (759.3-1075.8)
DALYs	126.6 (103.2-154.6)	142.8 (113.5-177.8)	644.8 (527.5-786.8)	622.7 (500.3-768.7)
YLDs	25.9 (18.2-34.5)	29.9 (21.1-39.8)	130.2 (91.6-172.0)	127.8 (89.7-168.8)
Deaths	8.5 (7.0-10.3)	9.2 (7.4-11.5)	52.0 (42.8-62.8)	51.4 (41.4-64.2)
Kuwait				
Prevalence	133.1 (114.6-156.8)	180.3 (154.0-214.0)	943.0 (791.7-1120.4)	919.0 (772.5-1092.6)
DALYs	81.5 (66.4-98.2)	112.1 (85.4-144.2)	619.2 (499.5-757.5)	615.7 (471.7-792.5)
YLDs	18.1 (12.7-24.2)	24.4 (16.9-32.7)	134.3 (94.1-178.7)	131.5 (91.6-174.9)
Deaths	5.3 (4.3-6.4)	6.7 (5.0-8.7)	49.6 (40.5-60.6)	49.6 (37.7-64.8)
Oman				
Prevalence	190.0 (160.0-226.5)	220.4 (187.9-261.1)	935.8 (788.5-1113.2)	890.3 (749.6-1059.4)
DALYs	125.5 (101.9-152.4)	138.5 (114.8-165.7)	640.2 (524.8-776.8)	584.7 (485.8-705.1)
YLDs	25.9 (18.0-34.5)	30.5 (21.1-40.8)	132.0 (92.6-175.4)	127.6 (89.1-170.7)
Deaths	8.1 (6.6-9.8)	9.4 (8.0-11.2)	51.4 (42.6-62.5)	47.5 (39.9-56.6)
Qatar				
Prevalence	121.7 (104.0-143.1)	118.8 (100.6-139.3)	913.4 (764.1-1090.1)	888.5 (746.2-1055.6)
DALYs	79.3 (63.8-97.5)	73.8 (55.1-97.5)	623.9 (498.0-772.8)	594.1 (451.9-769.4)
YLDs	16.7 (11.7-22.0)	15.9 (11.1-21.3)	129.1 (90.5-171.2)	126.4 (87.9-166.7)
Deaths	5.3 (4.3-6.6)	4.1 (3.0-5.5)	50.6 (40.5-62.3)	48.4 (36.4-62.1)

Saudi Arabia				
Prevalence	218.3 (184.1-260.4)	289.4 (246.5-340.3)	955.3 (799.7-1134.2)	953.2 (798.8-1135.9)
DALYs	137.2 (109.6-169.3)	185.6 (155.3-221.8)	622.0 (499.8-773.8)	637.7 (532.0-771.7)
YLDs	29.8 (20.7-39.6)	40.3 (27.9-53.3)	135.2 (95.5-178.8)	136.8 (95.8-181.8)
Deaths	9.0 (7.2-11.3)	13.2 (11.2-15.8)	49.5 (39.4-62.2)	51.4 (43.3-61.9)
UAE				
Prevalence	98.3 (82.8-116.4)	107.4 (91.4-126.1)	915.1 (764.5-1086.7)	875.5 (734.5-1047.7)
DALYs	59.4 (45.8-75.6)	65.7 (53.2-81.7)	583.3 (460.5-737.2)	584.5 (480.1-719.6)
YLDs	13.2 (9.2-17.5)	14.2 (9.7-19.0)	129.0 (90.2-171.0)	125.1 (87.2-166.1)
Deaths	3.3 (2.5-4.2)	3.3 (2.7-4.1)	46.0 (36.5-58.2)	46.9 (38.9-57.6)
Eastern Mediterranean Region (EMR)				
Prevalence	237.3 (200.8-280.9)	303.7 (257.5-357.1)	760.0 (641.5-901.5)	759.8 (642.9-899.9)
DALYs	145.5 (121.3-174.8)	195.3 (164.3-233.6)	484.6 (405.7-580.8)	503.2 (423.3-603.0)
YLDs	32.5 (22.7-43.3)	42.3 (29.6-56.4)	107.9 (76.0-142.7)	108.5 (76.4-144.3)
Deaths	9.3 (7.9-11.3)	13.6 (11.5-16.4)	38.9 (32.9-46.5)	41.2 (35.0-49.1)

Table 2. All age and age-standardized rates of prevalence, DALYs, YLDs and deaths per 100,000 people for Parkinsonism by country in the Eastern Mediterranean Region between 1990 and 2016

Location	All Age		Age-Standardized	
	1990	2016	1990	2016
Low-income Countries				
Afghanistan				
Prevalence	12.3 (9.6-15.4)	17.4 (13.7-21.8)	53.4 (42.7-67.0)	67.9 (53.9-84.6)
DALYs	6.7 (5.0-8.5)	10.3 (7.9-13.0)	33.2 (24.6-43.5)	45.2 (34.4-58.0)
YLDs	1.4 (0.9-2.0)	2.0 (1.3-2.8)	5.9 (3.7-8.3)	7.5 (4.8-10.5)
Deaths	0.3 (0.2-0.4)	0.5 (0.4-0.7)	2.4 (1.7-3.2)	3.3 (2.5-4.3)
Djibouti				
Prevalence	8.1 (6.4-10.3)	15.7 (12.3-19.7)	32.0 (25.3-40.2)	40.7 (31.9-50.9)
DALYs	4.9 (3.7-6.4)	10.4 (7.6-14.0)	21.8 (16.5-28.4)	29.6 (21.6-39.2)
YLDs	1.0 (0.6-1.4)	1.9 (1.1-2.7)	3.7 (2.3-5.3)	4.7 (2.9-6.7)
Deaths	0.3 (0.2-0.4)	0.7 (0.5-0.9)	1.7 (1.3-2.2)	2.3 (1.7-3.1)
Somalia				
Prevalence	10.1 (7.9-12.8)	10.7 (8.3-13.5)	31.8 (25.2-39.7)	36.2 (28.2-45.3)
DALYs	6.2 (4.6-8.0)	6.7 (5.0-8.9)	21.4 (16.0-27.9)	25.2 (18.7-33.1)
YLDs	1.2 (0.8-1.7)	1.3 (0.8-1.8)	3.7 (2.3-5.2)	4.2 (2.6-5.9)
Deaths	0.4 (0.3-0.5)	0.4 (0.3-0.5)	1.6 (1.2-2.2)	1.9 (1.4-2.6)
Yemen				
Prevalence	14.4 (11.4-18.0)	21.9 (17.3-27.5)	53.1 (42.3-66.4)	77.4 (61.2-96.1)
DALYs	7.3 (5.5-9.4)	11.6 (9.0-14.8)	29.1 (22.0-37.8)	46.1 (35.2-58.6)
YLDs	1.6 (1.0-2.3)	2.5 (1.6-3.6)	5.9 (3.8-8.2)	8.6 (5.5-11.9)
Deaths	0.4 (0.3-0.5)	0.6 (0.5-0.8)	2.1 (1.5-2.8)	3.3 (2.5-4.3)
Middle-income Countries				
Egypt				
Prevalence	33.1 (26.3-41.7)	53.1 (43.0-65.3)	69.7 (55.9-87.1)	98.1 (79.4-120.8)
DALYs	16.7 (12.8-21.2)	26.7 (20.4-34.0)	37.4 (28.7-47.7)	52.8 (40.2-66.8)
YLDs	3.8 (2.4-5.4)	6.1 (3.9-8.4)	7.9 (5.1-11.2)	11.1 (7.2-15.4)
Deaths	0.9 (0.7-1.2)	1.6 (1.2-2.0)	2.6 (2.0-3.4)	3.6 (2.7-4.7)
Iran				
Prevalence	25.9 (20.6-32.5)	73.3 (59.9-91.0)	79.1 (63.3-98.8)	125.3 (101.4-156.0)
DALYs	12.3 (9.4-15.9)	37.1 (28.7-47.1)	42.1 (31.7-54.8)	68.4 (52.3-87.4)
YLDs	3.0 (1.9-4.3)	8.5 (5.6-11.8)	9.0 (5.8-12.8)	14.3 (9.3-19.7)
Deaths	0.7 (0.5-0.9)	2.2 (1.7-2.9)	2.9 (2.2-3.9)	4.7 (3.5-6.2)
Iraq				
Prevalence	23.7 (18.7-29.7)	24.8 (19.6-30.6)	63.5 (50.5-79.3)	77.9 (61.7-96.1)
DALYs	12.9 (9.8-16.7)	13.2 (10.0-17.0)	36.0 (27.4-46.4)	44.4 (33.8-57.2)
YLDs	2.7 (1.7-3.8)	2.8 (1.8-4.0)	7.1 (4.5-10.0)	8.7 (5.6-12.2)
Deaths	0.8 (0.6-1.0)	0.8 (0.6-1.0)	2.5 (1.9-3.3)	3.1 (2.3-4.1)
Jordan				
Prevalence	22.5 (17.9-28.1)	33.6 (27.0-41.1)	65.3 (51.7-81.6)	84.0 (68.3-102.0)
DALYs	12.3 (9.4-15.8)	17.5 (12.9-22.8)	37.3 (28.7-48.1)	46.9 (34.7-61.8)
YLDs	2.6 (1.6-3.6)	3.9 (2.4-5.4)	7.3 (4.7-10.2)	9.5 (6.1-13.2)
Deaths	0.8 (0.6-1.0)	1.1 (0.8-1.4)	2.7 (2.0-3.5)	3.4 (2.4-4.6)

Lebanon				
Prevalence	44.4 (35.3-55.6)	87.7 (69.5-109.1)	76.1 (60.8-95.7)	101.8 (80.9-126.5)
DALYs	23.1 (17.5-30.2)	43.3 (33.0-56.3)	42.2 (31.9-55.8)	51.1 (39.1-65.9)
YLDs	5.1 (3.3-7.3)	10.0 (6.4-14.2)	8.6 (5.5-12.2)	11.6 (7.5-16.4)
Deaths	1.4 (1.0-1.9)	2.9 (2.2-3.8)	3.0 (2.2-4.1)	3.6 (2.7-40.8)
Libya				
Prevalence	22.0 (17.9-27.2)	50.5 (40.6-62.7)	67.4 (55.3-83.0)	95.9 (76.3-120.4)
DALYs	11.9 (9.4-15.1)	27.9 (21.5-35.8)	41.0 (32.4-51.6)	57.6 (44.1-74.4)
YLDs	2.6 (1.7-3.6)	5.8 (3.7-8.2)	7.7 (5.0-10.7)	10.9 (6.9-15.0)
Deaths	0.7 (0.5-0.8)	1.7 (1.3-2.2)	3.0 (2.4-3.9)	4.1 (3.2-5.4)
Morocco				
Prevalence	24.2 (19.3-30.5)	62.1 (49.2-77.5)	62.6 (50.3-78.6)	87.4 (69.5-108.4)
DALYs	10.9 (7.9-14.2)	32.6 (25.0-40.8)	31.4 (22.7-41.3)	48.5 (37.0-61.3)
YLDs	2.8 (1.8-4.0)	7.2 (4.6-9.9)	7.1 (4.6-10.1)	10.0 (6.5-13.7)
Deaths	0.6 (0.4-0.8)	2.1 (1.6-2.7)	2.2 (1.5-2.9)	3.4 (2.6-4.5)
Pakistan				
Prevalence	19.3 (15.1-23.9)	29.4 (23.0-36.7)	49.3 (38.8-61.0)	63.1 (49.4-78.7)
DALYs	8.7 (6.6-11.1)	14.7 (11.1-18.9)	24.1 (18.0-30.6)	33.6 (25.5-43.1)
YLDs	2.3 (1.4-3.2)	3.4 (2.2-4.9)	5.7 (3.6-8.0)	7.2 (4.6-10.3)
Deaths	0.5 (0.3-0.6)	0.9 (0.6-1.1)	1.6 (1.2-2.1)	2.3 (1.7-3.1)
Palestine				
Prevalence	15.2 (12.2-19.0)	22.1 (17.6-27.5)	64.1 (51.4-80.1)	76.8 (61.5-95.0)
DALYs	7.7 (6.0-9.8)	11.5 (8.9-14.4)	36.9 (28.6-46.8)	44.2 (33.6-55.8)
YLDs	1.8 (1.1-2.5)	2.6 (1.6-3.6)	7.3 (4.8-10.2)	8.7 (5.6-12.3)
Deaths	0.4 (0.3-0.5)	0.7 (0.5-0.8)	2.6 (2.0-3.4)	3.1 (2.4-4.0)
Sudan				
Prevalence	18.8 (14.8-23.3)	29.9 (23.8-37.1)	59.0 (46.6-73.6)	81.5 (65.1-101.1)
DALYs	8.9 (6.7-11.3)	15.5 (11.9-19.7)	30.5 (22.9-39.6)	46.0 (35.0-59.6)
YLDs	2.2 (1.4-3.1)	3.5 (2.2-4.8)	6.7 (4.3-9.4)	9.2 (5.9-13.0)
Deaths	0.5 (0.4-0.6)	0.9 (0.7-1.2)	2.1 (1.6-2.8)	3.2 (2.4-4.3)
Syria				
Prevalence	19.0 (15.0-23.8)	40.7 (32.5-50.5)	63.1 (50.3-78.5)	88.9 (70.4-110.6)
DALYs	9.5 (7.4-12.2)	20.9 (16.2-26.6)	34.4 (26.6-44.0)	49.0 (37.6-63.2)
YLDs	2.2 (1.4-3.1)	4.7 (3.0-6.6)	7.2 (4.6-10.2)	10.2 (6.6-14.3)
Deaths	0.5 (0.4-0.7)	1.3 (1.0-1.7)	2.4 (1.8-3.2)	3.4 (2.6-4.5)
Tunisia				
Prevalence	28.7 (22.8-35.8)	75.4 (60.6-93.5)	61.1 (49.1-76.0)	88.5 (70.8-110.5)
DALYs	15.4 (11.9-19.5)	41.9 (31.8-54.0)	35.8 (27.7-45.5)	51.1 (38.6-66.5)
YLDs	3.3 (2.1-4.7)	8.7 (5.5-12.3)	7.0 (4.5-9.9)	10.2 (6.4-14.2)
Deaths	0.9 (0.7-1.2)	2.9 (2.1-3.8)	2.6 (2.0-3.4)	3.7 (2.7-4.9)
High-income Countries				
Bahrain				
Prevalence	20.1 (16.1-24.8)	34.6 (27.5-43.5)	75.7 (60.2-94.6)	97.6 (77.4-122.4)
DALYs	10.3 (8.0-13.2)	16.3 (12.3-21.3)	44.5 (34.4-57.9)	56.0 (41.7-74.4)
YLDs	2.3 (1.5-3.3)	4.0 (2.6-5.8)	8.5 (5.5-12.0)	10.9 (7.1-15.2)
Deaths	0.6 (0.4-0.8)	0.8 (0.6-1.1)	3.2 (2.4-4.2)	4.0 (3.0-5.4)
Kuwait				
Prevalence	17.7 (14.0-22.2)	32.5 (25.9-41.2)	79.0 (63.0-98.0)	107.2 (85.4-133.3)
DALYs	7.7 (5.8-9.8)	14.5 (10.6-19.6)	43.3 (32.4-55.9)	60.8 (43.3-83.2)
YLDs	2.1 (1.3-3.2)	3.9 (2.5-5.7)	9.0 (5.7-12.4)	12.3 (7.9-17.2)

Deaths	0.4 (0.3-0.5)	0.7 (0.5-1.0)	3.0 (2.3-4.0)	4.3 (3.0-6.2)
Oman				
Prevalence	14.2 (11.4-17.7)	31.8 (25.5-39.6)	55.9 (44.4-69.6)	97.4 (77.2-122.0)
DALYs	7.4 (5.7-9.3)	15.4 (12.1-19.4)	32.3 (24.8-41.5)	54.2 (41.9-69.8)
YLDs	1.7 (1.1-2.4)	3.8 (2.4-5.4)	6.3 (4.1-8.9)	11.1 (7.3-15.6)
Deaths	0.4 (0.3-0.5)	0.8 (0.6-1.1)	2.3 (1.8-3.0)	3.8 (2.9-5.0)
Qatar				
Prevalence	17.1 (13.5-21.2)	24.7 (19.3-31.4)	78.6 (63.1-98.4)	105.3 (84.1-131.2)
DALYs	8.1 (6.1-10.4)	11.2 (7.8-15.5)	45.3 (34.3-58.4)	60.5 (42.0-83.0)
YLDs	2.0 (1.3-3.0)	3.0 (1.9-4.4)	8.9 (5.6-12.4)	11.9 (7.6-16.9)
Deaths	0.4 (0.3-0.5)	0.5 (0.3-0.7)	3.2 (2.3-4.2)	4.2 (2.8-6.0)
Saudi Arabia				
Prevalence	16.6 (13.2-20.5)	40.8 (32.5-50.6)	60.9 (48.1-75.5)	100.6 (79.6-125.3)
DALYs	8.3 (6.1-10.7)	19.4 (15.3-24.7)	33.5 (25.1-43.6)	56.1 (43.6-72.3)
YLDs	1.9 (1.2-2.7)	4.8 (3.2-6.8)	6.9 (4.5-9.7)	11.5 (7.4-16.1)
Deaths	0.5 (0.3-0.6)	1.1 (0.8-1.4)	2.4 (1.7-3.2)	3.9 (3.0-5.1)
UAE				
Prevalence	13.4 (10.5-16.7)	26.0 (20.3-33.1)	74.3 (58.9-92.8)	105.1 (83.7-129.3)
DALYs	6.2 (4.5-8.1)	11.5 (8.4-15.3)	40.6 (29.2-54.8)	61.1 (45.9-79.5)
YLDs	1.6 (1.0-2.3)	3.2 (2.0-4.7)	8.4 (5.4-11.7)	11.9 (7.6-16.8)
Deaths	0.3 (0.2-0.4)	0.4 (0.3-0.5)	2.8 (2.0-3.9)	4.2 (3.2-5.5)
Eastern Mediterranean Region (EMR)				
Prevalence	22.6 (18.0-28.1)	40.7 (32.8-50.0)	61.2 (48.6-76.0)	87.1 (69.8-108.2)
DALYs	11.0 (8.4-13.9)	20.7 (16.1-25.9)	32.3 (25.0-41.0)	47.9 (37.4-60.4)
YLDs	2.6 (1.7-3.6)	4.7 (3.0-6.5)	7.0 (4.5-9.7)	9.9 (6.5-13.7)
Deaths	0.6 (0.5-0.8)	1.2 (0.9-1.6)	2.2 (1.7-2.9)	3.3 (2.6-4.3)

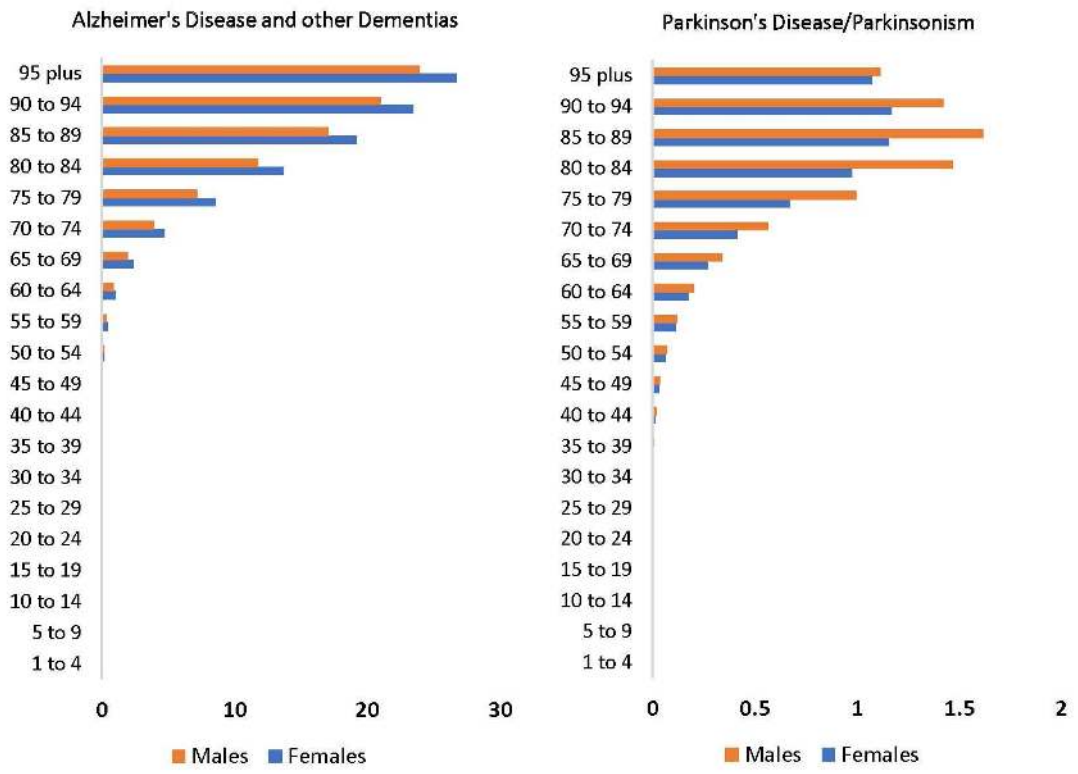

Figure 1. Age-specific prevalence (%) of neurodegenerative diseases in female and male population of the Eastern Mediterranean Region in 2016

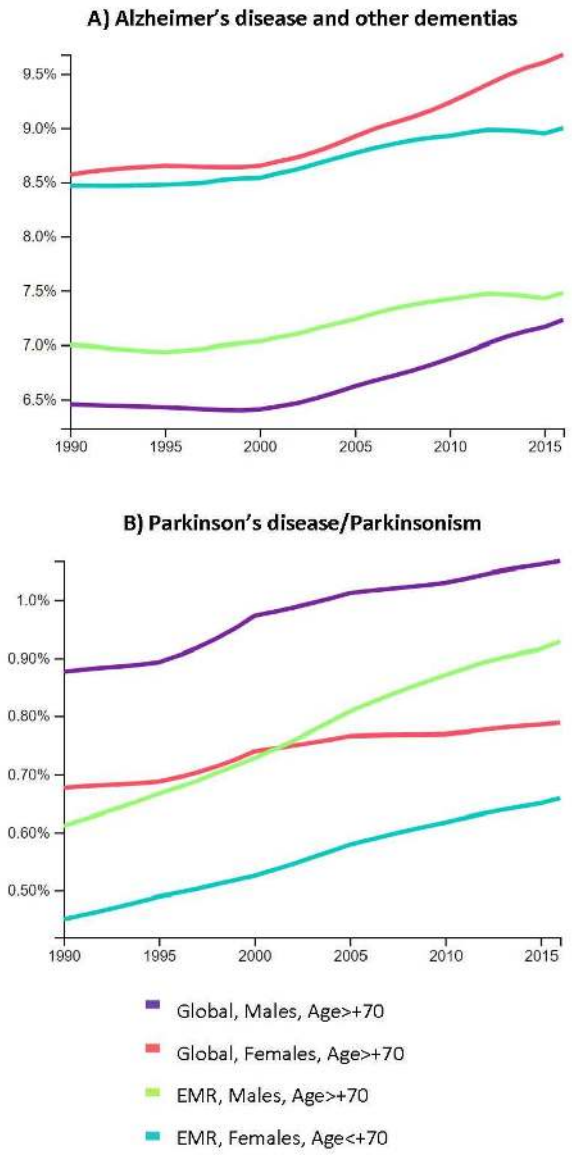

Figure 2. Comparing the annual prevalence rate (in percentage %) of neurodegenerative diseases between the Eastern Mediterranean Region and the entire globe during 1990 and 2016 (Note that prevalence rates are presented as percentages in this Figure where 1% equals 1000 / 100000 people.)

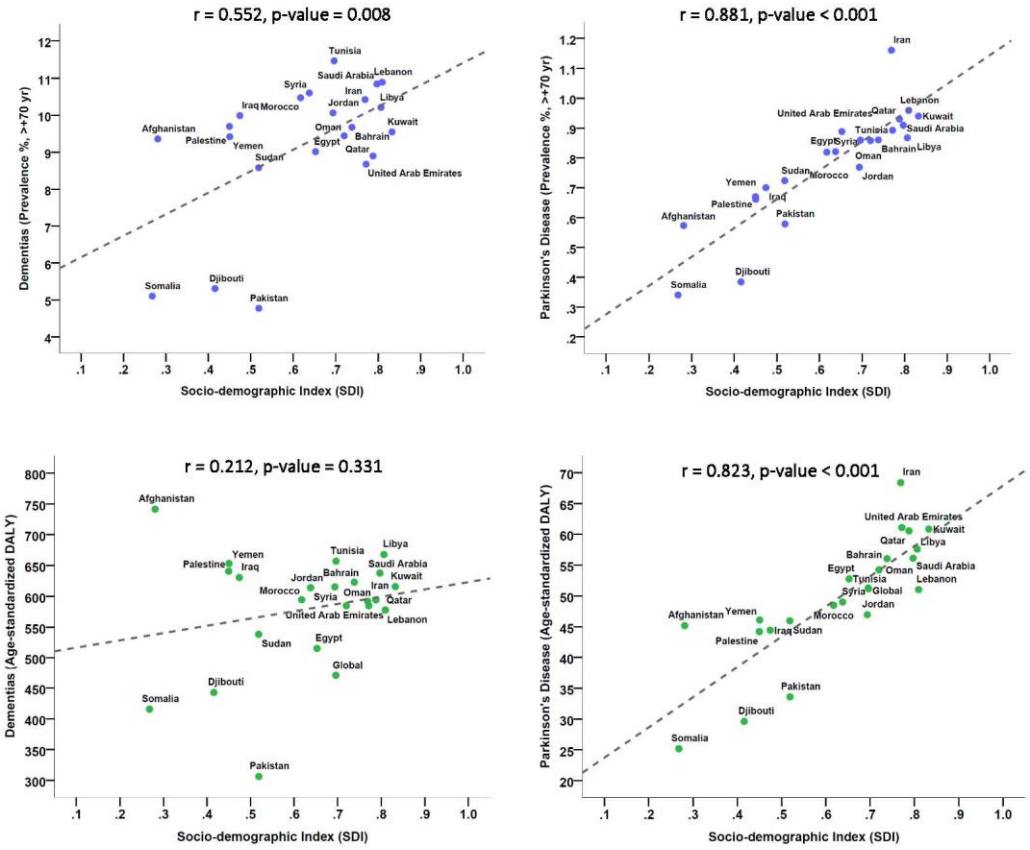

Figure 3. Scatter plots of the bivariate Pearson's correlations between prevalence/burden of neurodegenerative diseases and socio-demographic index (SDI) among population aged >70 years in the Eastern Mediterranean Region in 2016

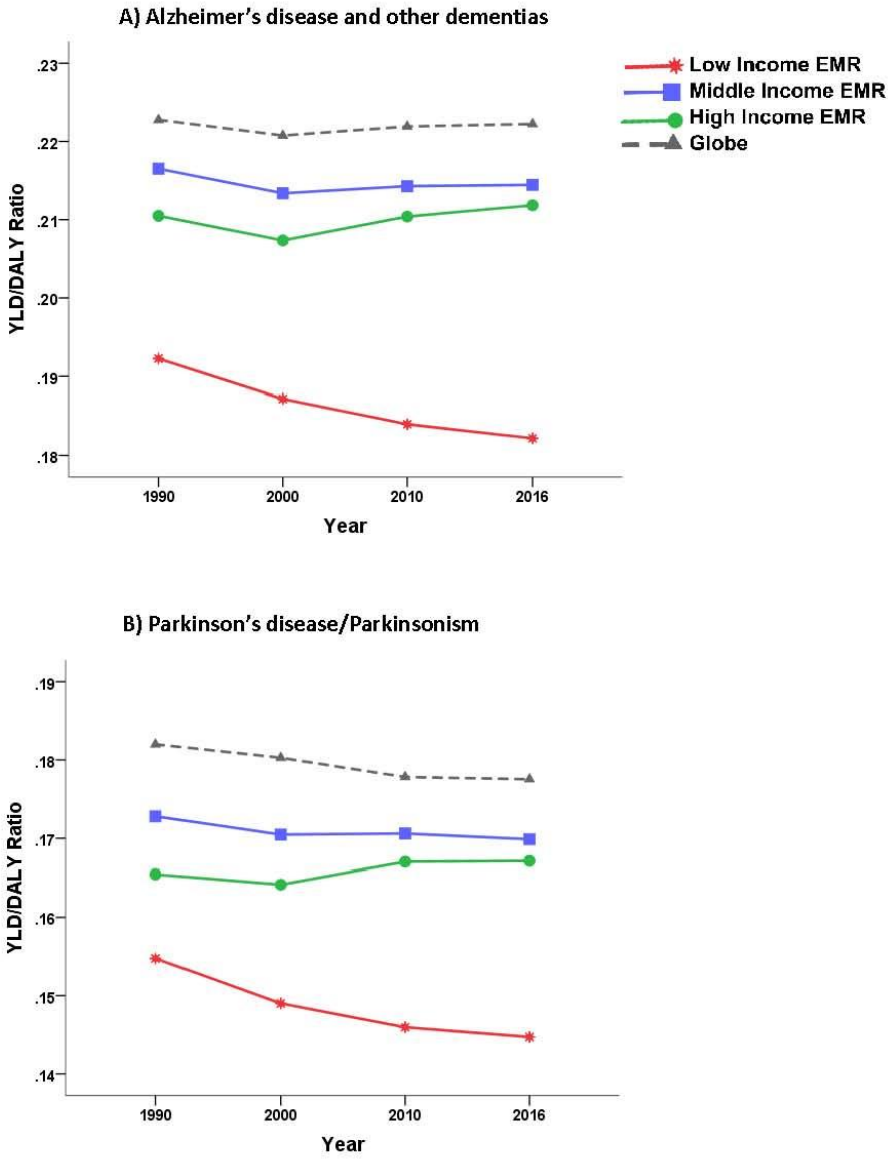

Figure 4. YLD/DALY ratio for neurodegenerative diseases in the Eastern Mediterranean Region within different SDI subgroups over 1990 and 2016