Disability-Free Life Expectancy in Egypt[1]

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Abstract

In Egypt, it has been observed that in the last few decades life expectancy has increased noticeably and is expected to keep rising in the next few decades. However, there is not enough evidence to help us decide whether the additional years would be lived in good health or otherwise. Therefore, the paper aims to estimate the disability-free life expectancy (DFLE) in Egypt according to sex, age, disability's level of severity and domain of disability, by using the national data of "Household Observatory Survey in Egypt, 2016, 13 round" and applied Sullivan method. The survey applied the short set of questions on functional difficulties that have been suggested by UN-WG. The results revealed that, according to the level of "any-disability", the DFLE for men and women population is 85% and 82% of the total life expectancy, respectively. In absence of severe and complete disability, men and women live 95% of their lifetime without suffering from this level of disability. As one grows older (men and women), the ratio of the disability-free period she or he is expected to live to her/his total lifetime diminishes rapidly. The ratios of the expected life with functional difficulties in vision and mobility to total life span are the highest and the lowest in the instance of functional limitations in communication.

Keywords: DFLE – Disability – Sullivan - Egypt.

الملخص

ارتفع متوسط العمر المتوقع عند الميلاد فى مصر خلال العقدين الماضيين، ومن المتوقع أن يستمر في الارتفاع. وهو ما يدعونا إلى محاولة التعرف على ما إذا كان هذا الارتفاع فى العمر المتوقع يصاحبه تحسن فى جودة الحياة أم لا، لذلك يهدف البحث إلى تقدير متوسط العمر المتوقع الخالي من الإعاقة في مصر حسب كلا من النوع، والعمر ومستوى شدة الإعاقة ونوع الإعاقة، وذلك من خلال المسح القومي "مرصد أحوال الأسرة المصرية لعام ٢٠١٦ – الدورة ١٣" والذى استند إلى مجموعة الأسئلة الموجزة التي أعدّها فريق واشنطن المعنيّ بإحصاءات الإعاقة، وقد تم تطبيق طريقة سوليفان لتقدير توقع البقاء على قيد الحياة. وأشارت النتائج إلى أنه وفقاً لتعريف الإعاقة بسيطة فأكثر فإن نسبة سنوات البقاء الخالية من الإعاقة إلى إجمالى السنوات المعاشة تصل إلى ٨٥٪ و٨٢% للرجال والسيدات على التوالى. وفي غياب الإعاقة الشديدة والتامة، فمن المتوقع أن يعيش الرجال و السيدات ٩٥٪ من حياتهم دون معاناة من هذا المستوى من الإعاقة، وكلما ارتفع العمر –بغض النظر عن النوع ومستوى شدة الإعاقة– فإن نسبة الفترة الخالية من الإعاقة التي من المتوقع أن يعيشها الفرد تنخفض سريعًا. كما أشارت النتائج إلى أن نسبة البقاء على قيد الحياة فى حالة إعاقة تبلغ أقصاها بين الافراد المصابين بإعاقات الرؤية والحركة، وتبلغ أدناها بين المصابين بإعاقات التواصل مع الاخرين.

الكلمات الدالة: توقع البقاء على قيد الحياة الخالى من الإعاقة – الاعاقة – طريقة سوليفان – مصر

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List of Abbreviations

DFLE	Disability-Free Life Expectancy
DLE	Disability Life Expectancy
LE	Life Expectancy
HLE	Healthy Life Expectancy
ADLs	Activities of Daily Living
IADLs	Instrumental activities of daily living
GALI	Global Activity Limitation Instrument
UN-WG	United Nations Washington Group
HOS	Household Observatory Survey
IDSC	Egyptian Cabinet Information and Decision Support Center
CFM	Child Functioning Module
UN-DESA	United Nations- Department of Economic and Social Affairs, Population Division
UN-ESCAP	United Nations- Economic and Social Commission for Asia and the Pacific

Disability-Free Life Expectancy in Egypt

1. Background

There are several approaches to assessing a population's health. One of the most important measures is life expectancy (LE). However, it is increasingly seen as too crude to measure a population's health as it does not consider chronic disease and disability (POST, 2006). In recent years, self-reported overall health status has been continuously used to calculate healthy life expectancy (HLE), which is a measure of the balance between length and quality of life. Health expectancies can be measured in several ways including life expectancy in good perceived health, disability- free life expectancy (DFLE), and chronic disease-free life expectancy. These measures combine data on both morbidity and mortality to provide a single summary measure (Jagger et al., 2006; Rogers and Crimmins, 2011). DFLE is the most commonly used measure of population health. It serves as an indicator to evaluate and monitor a given community's health status, helps predict health costs, and helps measuring the impact of health policies and interventions, therefore it is valuable for decision makers, as one of the main goals of health policies is increasing disability-free life. As DFLE is adjusted for the size and age structure of the population, it allows direct comparison of different populations or subgroups and analyses of changes over time (AIHW, 2012).

Trends in life lived with disability that have accompanied the rise in life expectancy during this century have been subject to extensive debate. There are three types of theories about the changes in disability that go with extended life expectancy. First: An optimistic perspective argues that with improvements in survival, the prevalence of disability will decrease and if morbidity is "compressed" into a shorter period of time at the end of life, therefore, the proportion of life lived with disability will also decrease. (Fries, 1980). Second: A pessimistic perspective predicts that the proportion of life lived with disability will increase as mortality declines and the prevalence of chronic disorders will rise. Third, moderate perspective, predicts that the progression of chronic diseases to severe disability will be slowed by medical intervention, which will

lead to a decline in the prevalence of severe disability, but a rise in the prevalence of mild disability (Murray et al., 1997; Manton, 1982).

Previous studies mentioned that there are different approaches that have been taken in generating the prevalence estimates of disability include: 1) "self-identification as disabled", in this instance the respondent is directly asked if they are disabled. 2) The so-called activities of daily living (ADLs), e.g., performing personal care activities such as dressing, bathing, and feeding oneself. 3) Instrumental activities of daily living (IADLs). This approach is similar to ADLs except that IADLs are higher order tasks (e.g., managing money, shopping or maintain the household). 4) Participation is one of methods asks if the person has some conditions which affect a particular social role such as attending school or being employed (Mont, 2007). 5) GALI is also a measure of activity limitation developed by members of Euro-REVES. Studies on healthy life years utilizing GALI have been conducted mainly for EU countries (Robine et al., 2003). And 6) Recently, The United Nations Washington Group on Disability Statistics (UN-WG), UNICEF, and UNESCO developed the UN-WG short set and extended set of questions on functioning as well as the Child Functioning Module (CFM).

Although this multiplicity in disability measurement methods leads to different estimations of DFLE and thus complicates making international comparisons, the numerous studies applied different measures of disability from a wide range of countries show that the prevalence of disability increases with age and reaches substantial levels at ages 65 years and above (Ritchie and Polge, 2003), women are more often disabled than men, unmarried, lower educated, and poor persons have greater chances of being disabled (Albrecht and Verbrugge, 2000).

In Egypt, it has been observed that in the last few decades life expectancy has increased noticeably and is expected to keep rising in the next few decades. However, there is not enough evidence to help us decide whether the additional years would be

lived in good health or otherwise. Studies that meant to measure healthy life expectancy are dearth. Shortage and inadequate data on individuals with disabilities were a deterrent to have an accurate estimates of disability. The major source of such shortage is variation in disability definitions, difficulties in data collection, and the cross-sectional methods of data collection. Few studies conducted in Egypt in this concern and were mainly focused on the elderly group and gender differences. There are only three studies, to the best of author's knowledge, dated back to 1990s that aimed to estimate healthy life expectancy: Lamb et al. in 1994 and Romieu and Robine 1994, both are cited in Jagger et al. 2011. Lamb (1997) attempted to measure disability in terms of inability to perform at least one of the six activities of daily living (ADL), focusing on elder population (60+) comprised 1179 persons. The study pointed out that the number of years expected to be disability-free is the same for both Egyptian men and women above the age of 60. Nevertheless, men are expected to live less years than women with disability, which means that men enjoy more disability free years compared to women. In addition, the older women get, the more disabled they become compared to men.

The problem of the study: considering that the process of population ageing has important demographic, health, economic and social consequences, it is crucial for policymakers in Egypt to know whether these additional years are characterized by health or disability. In other words; the questions are: Are Egyptians living longer, healthier lives or are they living longer lives with poor health conditions? What's the level of severity of disability will Egyptians suffer and what are the most common types of disabilities among people with disabilities? How is Egypt compare with other countries? To answer these questions, **this research aims** to estimate the disability-free life expectancy (DFLE) in Egypt according to sex, disability domains and their degree of severity.

2. Data

Our data resource is the nationally representative survey "Household Observatory Survey, round 13, 2016," (HOS 2016) that was conducted by the Egyptian Cabinet Information and Decision Support Center (IDSC). To identify individuals with

disabilities, the survey applied the short set of questions on functional difficulties that have been suggested by UN-WG (2008). It is the first time in Egypt to conduct a nation-wide survey to identify individuals with disability using this approach. This approach overcomes the shortcomings of the simple question "Do you have a disability?" These six questions address six domains: functional limitation in three domains; vision, hearing, remembering and concentrating[2]. And activity limitation (participation restrictions) in the other three domains; mobility, self-care, and communication. These domains, however, tend to miss some respondents with self-reported difficulties because not all functional domains are fully covered; mainly, psychological difficulties (e.g., learning and making decision components). Additionally, the UN -WG short set of questions tends to provide underestimate of disability prevalence among children as it undercounts primarily children with developmental disabilities-- not children with physical or sensory disabilities[3], as stated by UN-ESCAP (2014, pp:8-9) "Childhood functioning is more varied than functioning in adults and identifying functional difficulty is confounded by underlying variation in typical childhood development," for more details, (see Cappa et al., 2018; Loeb et al., 2018; UN- WG, 2008). Each question's response categories are no difficulty, some difficulty, a lot of difficulty and totally unable to do it.

The data were collected from a sample of households, 11,592 households with 49,431 individuals, based on stratified, multi-stage and cluster design. The survey was designed to provide estimates for the country, for the six major geographic regions and the 27 governorates.

In measuring disability prevalence, we resorted to the following criterion: If an individual has a score of 'some difficulty' in at least one domain, she or he will be considered having "any-disability". If a more conservative cut-off was selected - at least one domain is scored "a lot of difficulty" or "totally unable to do it", the individual will

[2] Mental disabilities are screened through the only two questions remembering and concentrating. They tend to miss some population because they exclude learning and making decision components. The WG chose to focus on the earlier two because the concepts of the latter two vary across different cultures and economic situations, Mont (2007, pp: 19).

[3] As noted by Loeb et al. (2018:498) "In children, manifestations of disabilities are different by nature, intensity and impact from those of adults, as are associated activities, participation and the environment in which activities and participation are achieved."

be having "severe disability". Accordingly, the estimated prevalence rates of "any disability" and "severe disability" are 11.4% and 3.14% among the sample population aged 5 + years, respectively. The estimated severe disability rate is very close to the level in the world (3%) cited by the WHO's World Report on Disability (WHO, 2011). Also, results are very close to those obtained from Egypt census 2017(10.67%)[4], a matter that gives credibility to the survey estimates. Interestingly enough, the survey and census 2017 estimates of the rate of "any-disability" among the population (5+) are dramatically greater than that obtained from census 2006 (11.4% vs. 0.7%). However, we should keep in mind that this dramatic variability is mainly rooted in the differences in definition of disability and techniques of identifying people with disabilities.

3. Methodology

Calculations of health expectancy to date have been almost exclusively done using the Sullivan's method (Sullivan, 1971)[5]. The Sullivan's simple health indicator "disability free life expectancy (DFLE)" combined mortality data with the prevalence rates of disability. The data requirements are simple and easily available; it only requires two types of data: (1) Age-sex-specific- prevalence rates of disability and (2) mortality data (period life tables) (Jagger et al., 2014). The former is calculated, in our study, from the mentioned national survey and the latter is depending on the Egypt Life tables published by United Nations – Population division 2017. Sullivan's method assumes that prevalence data are nearly unchanging in the near future. It also provides unbiased and consistent estimates even if the stationarity assumption is not met (Imai and Soneji, 2007; cited in Jagger and Robine, 2011).

3.1 Estimation of Disability Free Life Expectancy (DFLE)

If we assume two states called Disability-free (DF) and with disability (D) then the Disability-Free Life Expectancy at age x (DFLEx) and the life expectancy with disability (DLEx) are defined by (Jagger et al. 2014):

[4] In measuring disability, Egypt census 2017 used the UN-WG's short set of questions.

[5] Starting in the early 1980s, many studies have utilized the Sullivan method to calculate DFLE estimations in several countries. For instance, Robine et al., (2000) estimated DFLE for 50 countries. This method was also used to examine trends in DFLE in many countries, see for example, Lieu et al., 2009; Murakami et al., 2010; AIHW, 2012 and, Mandich and Margolis, 2014.

$$DFLE_x = \frac{1}{l_x}\sum_{i=x}^{\omega} L_i(\mathrm{DF}) \qquad (1)$$

$$DLE_x = \frac{1}{l_x}\sum_{i=x}^{\omega} L_i(\mathrm{D}) \qquad (2)$$

Where L_i(DF) and L_i(D) are the number of person years lived from age x onwards in the states DF (without disability) and D (with disability) respectively.

$$L_i(\mathrm{DF}) = (1 - \pi_i)\, L_i$$

$$i = 0, \ldots\ldots, \omega L_i(\mathrm{D}) = \pi_i L_i$$

Where π_i *: is the prevalence of disability at age i.*

L_i : The total number of years lived by the cohort in the interval [x, $x+n$)

l_x: The number surviving to age x,

$$DFLE_x = \frac{1}{l_x}\sum_{i=x}^{\omega} (1 - \pi_i)\, L_i \qquad (3)$$

$$DLE_x = \frac{1}{l_x}\sum_{i=x}^{\omega} \pi_i L_i \qquad (4)$$

$$e^x = DFLE_x + DLE_x \qquad (5)$$

Where e^x: The life expectancy at age x

3.2 Estimation of Standard Error of DFLE

The prevalence of disability by single- or five-year age groups shows fluctuation due to sampling variation. Mortality rates are also subject to random variation. Since the Sullivan health expectancy combines such mortality and morbidity rates, it too is subject to random variation. To assess the size of this random variation, we shall calculate the standard error of DFLE.

If the sample size of the survey producing the prevalence ratios is not very large compared to the population on which the mortality data are based, then the variation resulting from the mortality rates is negligible and this part of the variance can be ignored. The variance of the expectation of surviving without disability can be calculated as follows:

$$S^2_{(DFLE_x)} \approx \frac{1}{l_x^2} \sum_{x=0}^{\omega} L_x^2 \; S^2_{(1-\pi_x)} \qquad (6)$$

$$S^2_{(1-\pi_x)} = S^2_{(\pi_x)} = \frac{\pi_x (1-\pi_x)}{N_x} \qquad (7)$$

Where $S^2_{(\pi_x)}$: the variance of the prevalence of disability

Nx: the number of persons in the age interval (x, x+n) participating in the prevalence survey.

$$S^2_{(DFLE_x)} \approx \frac{1}{l_x^2} \sum_{x=0}^{\omega} L_x^2 \frac{\pi_x (1-\pi_x)}{N_x} \qquad (8)$$

The standard error of DFLE is the square root of $S^2_{(DFLE_x)}$.

The main benefits of the Sullivan's method are that it requires only cross-sectional data and that it can be used for monitoring trends over time if panel data are not available.

4. Results

This section comprised four sub-sections. Sub-section 4.1 presents trends in life expectancy in Egypt. Age-sex prevalence rates of any-disability and severe disability in Egypt by disability domains are presented in Sub-section 4.2. And estimates of disability-free life expectancy (DFLE) by disability level of severity and type are presented in sub-sections 4.3 and 4.4.

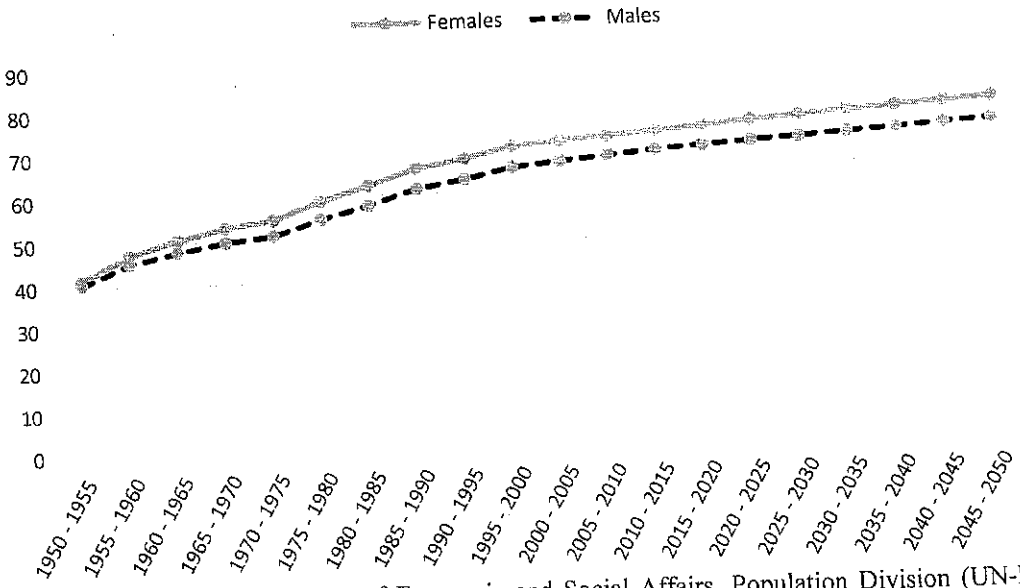
4.1 Trends in life expectancy in Egypt

Figure 1 plots life expectancy at birth for both sexes for Egypt from 1950 to 2050. The positive improvement in mortality rates over the 20th century cannot be missed. As exhibited in table 1, the life expectancy increased from 58 to 69.5 years (11.5 years) for men and from 62 to 74.1 years for women (12.1 years)[6] during a span of 30 years and are expected to reach 73.9 and 78.9 years in 2050 for men and women, respectively. The

[6] Birth expectancy in Egypt shows that women's age increase compared with men is lower than that of some countries such as Denmark: 79 and 83, England: 79 and 82; France: 79 and 85 for men and women, respectively (Population Reference Bureau 2017), where the women's life expectancy surpasses men's from 4 to 6 years in these countries, but only increases for about 2 years in Egypt.

well-documented increase in life expectancy in Egypt indicates that the decline in infant and child mortality shared greatly in the gain in expectation of life, while mortality rates among the oldest age groups show trivial improvement. As exhibited in the table, life expectancy at age 60 increased by only 0.68 years and 0.18 years for men and women, respectively, in a span of 30 years. The corresponding figures at age 80 are 0.39 years and 0.16 years.

Figure 1: Life expectancy at birth by sex: Egypt 1950 - 2050



Source: United Nations, Department of Economic and Social Affairs, Population Division (UN-DESA). 2017. "World Population Prospects: The 2017 Revision, Key findings & advance tables." ESA/P/WP/248.

Table 1: Trend in life expectancy estimates at different ages in Egypt by sex.

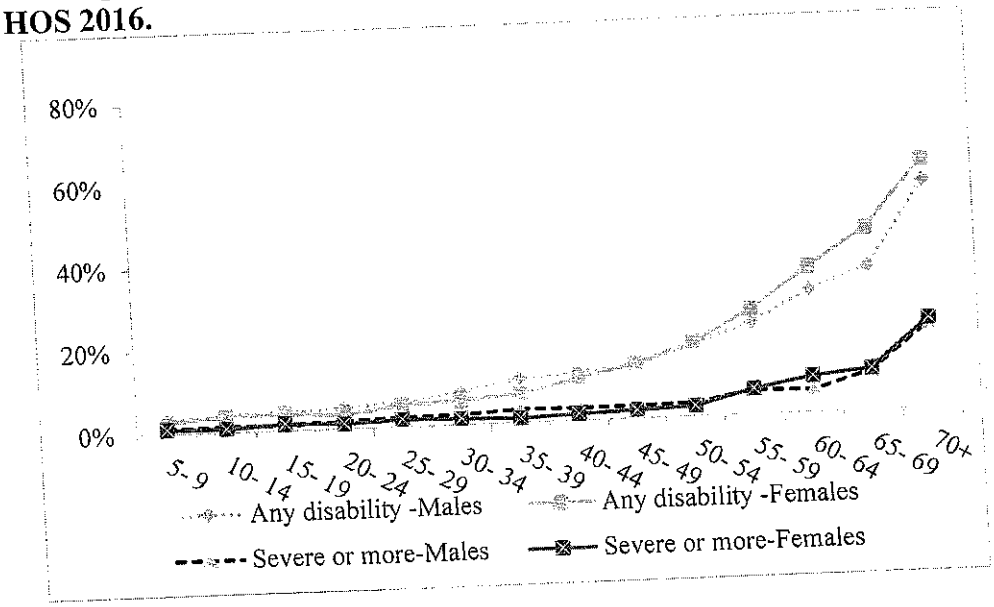
Age	Men		Women	
	1980-1985	2010-2015	1980-1985	2010-2015
At birth	57.66	68.15	62.0	74.1
At age 60	15.37	16.05	18.21	18.39
At age 80	5.17	5.56	6.23	6.39

Source: Compiled from United Nations, Department of Economic and Social Affairs, Population Division (UN-DESA). 2017. "World Population Prospects: The 2017 Revision, Key findings & advance tables." ESA/P/WP/248.

4.2 Prevalence of disability in Egypt by sex, age and domain

Figure 2 shows the age-sex specific prevalence rates of disability[7] according to the disability degree of difficulty. Disability is positively correlated with ageing, the prevalence of disability starts to increase at a faster pace after age 50 for both sexes and for two levels of disability, notably for any-disability, whiles for severe disability it increases with age at a slower pace. Men suffer from any- and severe-disabilities slightly greater than women, especially during their twentieth to fortieth. Conversely, notable differential prevalence between the two sexes starts in the age group (50-55) with more women than men suffer from disability, especially any-disability. For example, among every 100 men in the age group 65-60, there are 35 men with "any-disabilities". This number rises to 56 among the elderly age group (70+ years). These numbers are estimated for women by 45 and 61, respectively. In addition, the results in figure 2 suggest that the prevalence of severe disability is estimated around 1% for children in the age group 5-9, both sexes, rises to 20.9% and 21.9% for men and women in the age group 70+, with almost 20-fold increase. A finding emerged is that the variation between the two sexes is exited in level of any-disability compared with severe disability.

Figure 2: Age -and sex –specific prevalence of any-disability of individuals 5+ years: HOS 2016.



[7] This estimated prevalence in Egypt excludes children in age group (0-5).

In comparison with some Arab countries, the prevalence of severe disability in Egypt reveals no significant difference. Among Egyptian adults in the age group (25-44) the prevalence is 2.2% and amounts to 10.9% among the oldest age group 65+. The corresponding estimates in the Arab countries stay below 3% for people aged 25-44 years, and generally under 5% for ages 45-64 years in all countries. For instance, in Oman, the disability prevalence rises from 2.8% for those aged 45-64 years to 15.8% for those aged 65 and above, more than fivefold increase. In Yemen, similarly, the rate climbs from 3.5% to 20% between these two mentioned age groups (ESCWA, 2018). Morocco is an exception, the prevalence reaches 8.7%, and then the prevalence rises drastically 31.2% among Moroccans in the age group 65+ years.

Irrespective of the level of severity, functional difficulties[8] in mobility and vision are the most prevalent domains of disabilities in Egypt, Figures 3 and 4[9]. Vision is the most common disability (any-disability) in young ages and in adulthood followed by mobility, then hearing till the age of 60-64; afterwards, functional limitations in mobility emerges.

[8] It worth mentioning that an individual can suffer from more than one type of disability.
[9] Due to the small number of observations with disability, particularly severe disability, we were not able to provide age-sex-specific disability rates by domain.

Figure 3: Age-specific disability rates (any) by disability's domain, HOS 2016.

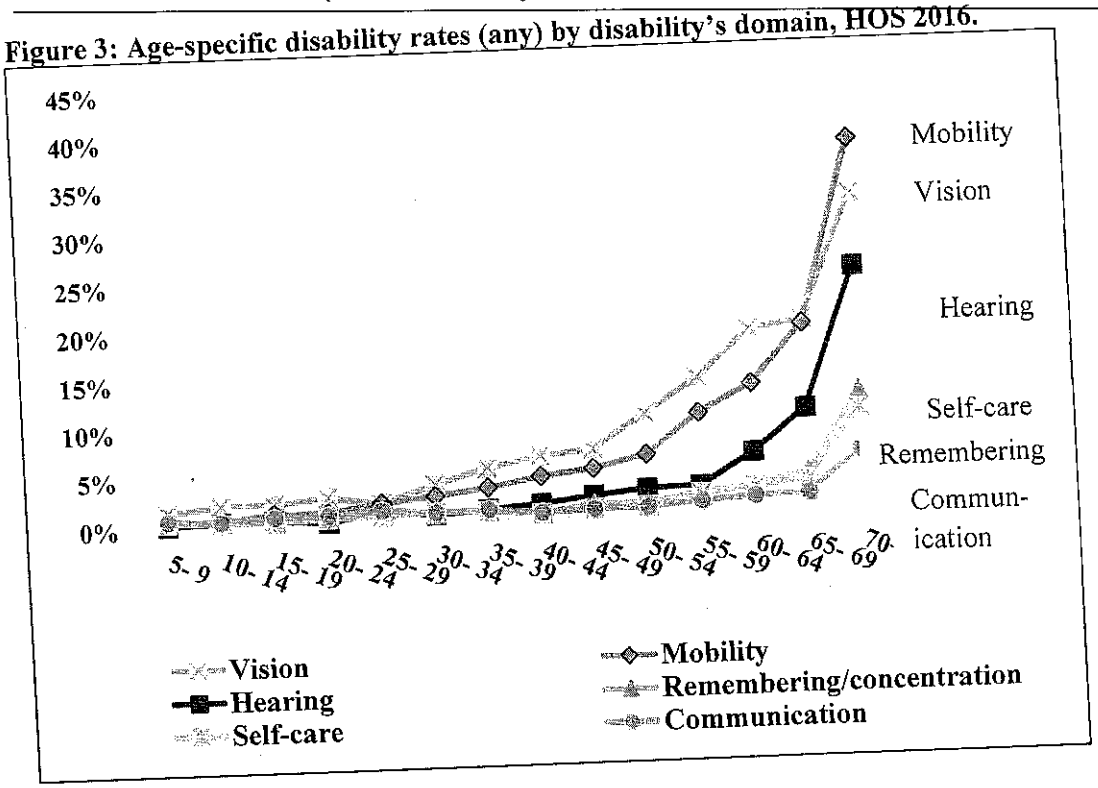
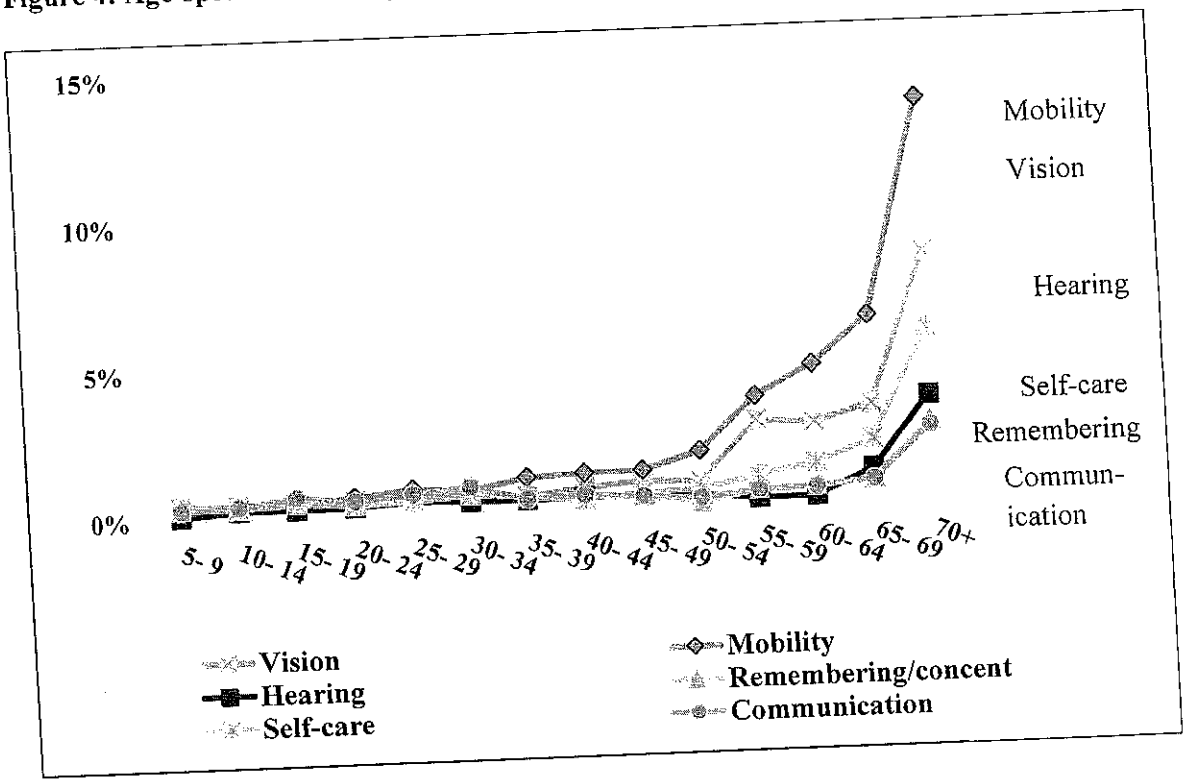


Figure 4: Age-specific disability rates (severe) by disability's domain, HOS 2016.



Among the elderly group of 70+ years, the functional difficulties in mobility and vision, any and severe, represent the most widespread types of disability. The prevalence rates reach 40.4% followed by vision (35.3%) and in the instance of severe difficulties the prevalence rates reach the levels 13.6% and 8.4% for mobility and vision, respectively. It is interesting to notice that in the instance of severe-disability, limitations in self-care occupies the third rank. This pattern does not vary compared to some Arab countries: Oman, Iraq, Jordan, Palestine, Morocco and Yemen, where the functional difficulties in mobility are the most common type of disability. In the case of any disability, it ranges from 34% in Oman and Iraq to 26% in Yemen, followed by vision disabilities, that ranges between 26.5% in Iraq and Palestine to 18.5% in Jordan (ESCWA, 2018).

4.3 Disability-free life expectancy (DFLE) by level of severity

Although UN-Population Division estimate of the life expectancy is 69.5 years for men in Egypt, results reveal that, according to "any-disability" definition, table 2 shows that the DFLE for men population is 58.9 years (representing 85% of the total life expectancy), which implies that, men are expected to live 10.6 years with "any-disability" which represents 15% of their actual lifetime. Women are expected to live for 74.1 years, in which the DFLE reaches 60.9 years. Women are expected to live 13.2 years with "any-disability" (which represents 18% of the total life span). The DFLE and the gap in expected disabled years between men and women decreases as age increases. It worth mentioning that the difference in life expectancy between both sexes is dropped when an estimate of any-DFLE is produced (4.6 years vs. 2.6 years).

When disability measured as "severe-disability", table 2 shows that the disability-free life expectancy for men is 66.3 years and 70.2 for women, with almost 4 years more for women, therefore 95% spent free of severe-disability for both men and women. The number of disabled years for women is slightly higher than men, the difference between them ranged from 0 in age group (80-84) and 0.9 year in age groups from (40-45) to (60-64).

Table 2: Life expectancy (e_x) and disability-free life expectancy (DFLE) by sex: HOS 2016

Age	e_x		Any-disability				Severe-disability			
			DFLE		Disabled years		DFLE		Disabled years	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
0	69.52	74.08	58.9	60.9	10.6	13.2	66.3	70.2	3.2	3.8
1-4	69.67	74.19	58.9	60.8	10.7	13.4	66.4	70.3	3.3	3.9
5-9	65.98	70.50	55.2	57.1	10.7	13.4	62.7	66.6	3.3	3.9
10-14	61.13	65.61	50.5	52.4	10.6	13.2	57.9	61.8	3.2	3.8
15-19	56.25	60.69	45.8	47.6	10.4	13.1	53.1	56.9	3.2	3.8
20-24	51.44	55.78	41.2	42.9	10.2	12.9	48.3	52.1	3.1	3.7
25-29	46.68	50.90	36.7	38.2	10.0	12.7	43.7	47.2	3.0	3.7
30-34	41.95	46.05	32.2	33.5	9.8	12.5	39.0	42.5	2.9	3.6
35-39	37.24	41.24	27.8	29.0	9.4	12.3	34.4	37.7	2.8	3.5
40-44	32.55	36.45	23.6	24.5	9.0	12.0	29.9	33.0	2.7	3.5
45-49	27.97	31.71	19.5	20.1	8.5	11.6	25.4	28.3	2.5	3.4
50-54	23.72	27.19	15.6	16.1	8.1	11.1	21.3	23.8	2.5	3.4
55-59	19.91	22.92	12.2	12.4	7.7	10.5	17.5	19.6	2.4	3.3
60-64	16.25	18.80	9.1	9.2	7.1	9.6	13.9	15.6	2.3	3.2
65-69	12.96	15.06	6.5	6.5	6.4	8.6	10.7	12.1	2.3	2.9
70-74	10.05	11.66	4.3	4.4	5.8	7.3	7.8	8.9	2.2	2.8
75-79	7.59	8.80	2.6	3.0	5.0	5.8	5.5	6.2	2.1	2.6
80-84	5.66	6.56	1.4	2.0	4.3	4.6	3.5	4.3	2.2	2.2
85+	4.13	4.89	0.8	1.4	3.3	3.5	2.4	2.9	1.7	1.9

Figure 5 shows the proportion of the expected time living without disabilities to the total life time[10] that decreases with age and the burden is clearly increasing among the older age groups across the two measurements for disability.

A man-woman comparison, based on measurement of any-disability, two lower lines in Figure 5 show that men have better chances than women to live a longer disability-free period. That the proportion of the any-DFLE to the total lifetime is higher for men than it is for women in all age groups except two; (80-84) and (85+). Also, as one grows older, the proportion of the disability-free life they are expected to live in their total lifetime diminishes rapidly. While it reaches 85% and 82% for men and women at birth, these proportions dropped to 61% and 59% for men and women aged 50, then 51% and 41% at ages 65 respectively.

It can be derive from Figure 5 that the proportion of any-disability life expectancy (DLE) for men and women at birth is about 15% and 18% of the total life time, up to almost 50% at ages 65 for both men and women. Percent of DLE to total life is higher among women compared to men in all age groups except for the last two age groups (i.e 80-84 years and 85+ years).Women aged 45 years will spend 36% of the remaining life time with disability up to 57% and 71% at ages 65 and 85 years. The corresponding estimates among men are 30%, 49% and 80%, respectively.

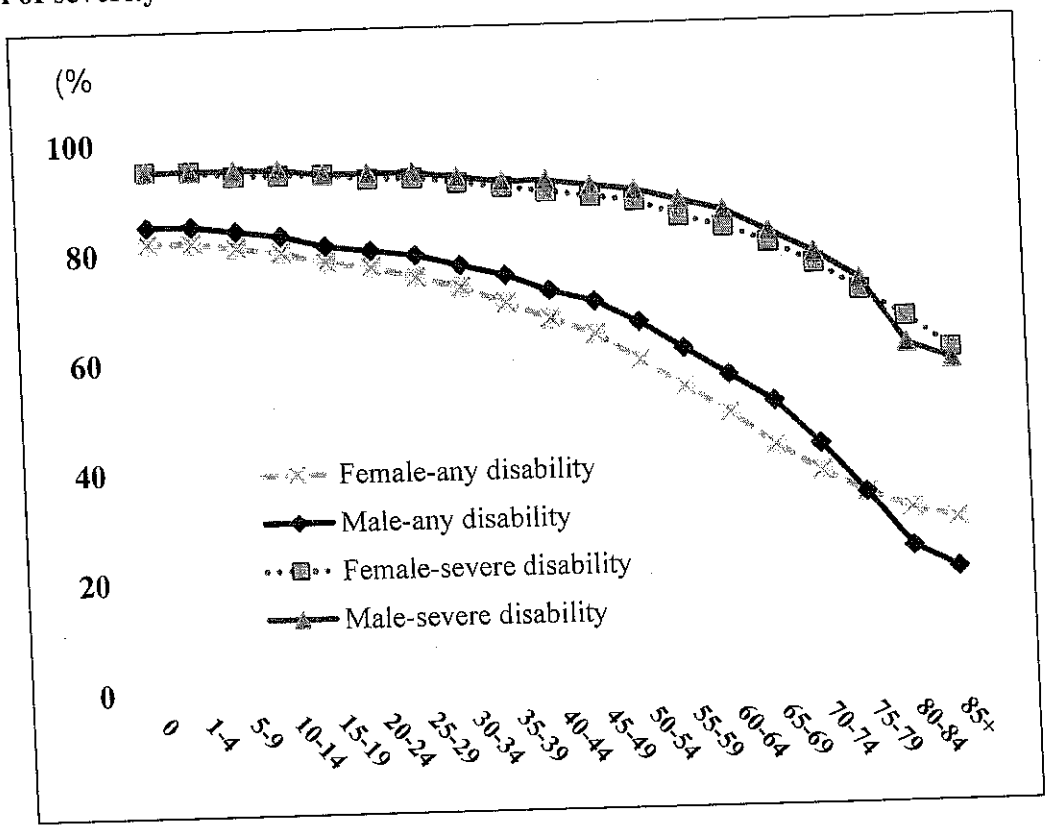
Figure 5 -the upper two lines-- indicates that there are no evident differences between men and women in the proportion of life expected to be lived free of severe-disability to total lifetime in most age groups, except for the two age groups (80-84) and (85+), where the proportion of severe DFLE among women is higher than men among these age group. Women live 66% and 60% of their life is free of severe -disability compared with 61% and 58% for men in the same two age groups.

The proportions of life with severe disability is estimated for men at birth by 4.7%; this goes up to 7.6% at the age 35, and 9.1% at the age 45. The situation is even worse for the

[10] Calculated by dividing the years of life expectancy without disability to the total life expectancy, Table 1.

elderly; men aged 65 will suffer from severe disability by 14.2% of their remaining years, and those aged 85 will suffer from severe disability by 42% of their remaining years. The corresponding proportions for women are 5.2%, 6.7%, 8.5% and 10.8% at birth, 20, 35, and 45 years respectively. The situation worsens significantly for elderly women; it reaches 19.6% at the age 65. If women lived to age 85 or more they would suffer from disability for 39.7% of their remaining years.

Figure 5: The proportion of the DFLE to total lifetime according to sex, age and level of severity



Adult men have higher DFLE than women at younger ages-- regardless of the severity level of disability-- but this pattern of disparity diminishes with advancing in age and may "crossover[11]" at about 75 to 80 years of age, when Egyptian men may show lower DFLE. This pattern of findings reflects the relation between age and life expectancy for men and women.

4.4 Disability life expectancy by disability's domain

As the number of individuals with severe disability in the study population is small, we restrict the estimation of disability life expectancy according to disability's domain to the first measure of disability, i.e., those who have "any-disability" and to all sample population without disaggregation by sex. Results, table 3, shows the proportion of the expected life at birth with functional difficulties in vision and mobility to total life span are the highest (10% and 9%, respectively), and lowest in the instance of functional limitations in communication (1%). Additionally, for all six functional difficulties; the proportion of life expectancy with disability to total life time increases along with age to reach levels as high as, at age 65-69 almost one third of the expected life are lived with limitations in vision and mobility and rise at age 85+ to reach remarkable levels, 52% and 65%, respectively. And about 20%, 10%, 11% and 5% of the expected life at age 65-69 are lived with limitations in hearing, remembering and concentration, self-care and communication, respectively, which are doubled and more than tripled at age 85+ (35%, 28%, 36% and 18%, respectively). Moreover, it is important to notice that the proportion of life expectancy with disability to total life time increases along with age at a faster rate, more than that for vision and mobility, in the instance of functional limitations in self-care, communication and remembering and concentration.

[11] It is considered an indicator of significant variations in mortality risk associated with age, as differences in mortality between populations or population subgroups rarely stay constant, but rather produce intersection points (Liu et al. 2008). As argued by Lynch et al. 2003; p. 457, "Mortality crossover, however, is only one aspect of mortality that can be considered when evaluating differences between populations. Mortality compression and deceleration - the rate at which the mortality hazard curve changes shape (steepens) across time and the age at which mortality rates cease to grow exponentially across age - constitute important aspects of mortality that must also be considered to understand overall mortality pattern differences".

Table 3: Life expectancy and the proportion of DLF to total life expectancy by domain of disability: HOS 2016

Age	e_x	% of life expectancy with any disability					
		Vision	Hearing	Remembering/ Concentration	Mobility	Self-care	Communi cation
0	71.75	10%	4%	2%	9%	2%	1%
1-4	71.88	10%	4%	2%	9%	2%	1%
5-9	68.19	10%	4%	3%	10%	3%	2%
10-14	63.33	11%	5%	3%	10%	3%	2%
15-19	58.43	12%	5%	3%	11%	3%	2%
20-24	53.57	13%	6%	3%	12%	3%	2%
25-29	48.75	14%	6%	3%	13%	3%	2%
30-34	43.96	15%	7%	4%	14%	4%	2%
35-39	39.21	16%	7%	4%	16%	4%	2%
40-44	34.48	18%	8%	4%	18%	4%	2%
45-49	29.82	20%	9%	5%	20%	5%	2%
50-54	25.45	22%	11%	6%	23%	6%	3%
55-59	21.43	25%	13%	7%	27%	7%	3%
60-64	17.57	29%	16%	8%	31%	9%	4%
65-69	14.07	32%	19%	10%	36%	11%	5%
70-74	10.94	37%	24%	13%	42%	15%	7%
75-79	8.28	42%	31%	17%	47%	19%	9%
80-84	6.20	46%	36%	23%	56%	28%	15%
85+	4.61	52%	35%	28%	65%	36%	18%

5. Discussion and policy implications

Availability of the estimates and understanding trends in health and disability-free life expectancy are important for planning and policy. For instance, changes in the age of full right to social security should be made with knowledge of estimates and trends in disability-free life expectancy rather than total life expectancy. Although, life expectancy increased markedly over 40 years in Egypt, research concerning studying and monitoring health life expectancy are lacking.

The aim of research is to contribute in providing a quantitative evidence base for empirically-grounded health disability sensitive policies by providing the first estimates of DFLE using information from the nationally representative and performance-based measures of disability data set in Egypt. The availability of such indicator in Egypt is very important for decision-makers, as one of the health goals is to raise the disability-

free life expectancy, and for evaluating the population's health. The current research is focusing on estimating the disability- free life expectancy (DFLE) by sex, age and disability's domain by using the data that implemented the suggestion of UN-WG short list of questions to measure disability.

The estimate of disability in Egypt (11.4%) is comparable with the international level, where it is estimated by 12.6% in the United States, 6.7% in Australia, and ranges from 11.1% (France) to 18.2% (Denmark) in the EU countries (El-saadani and Metwally, 2019).

Estimates from studies around the world show that young men have a higher disability prevalence than young women (ESCWA, 2018). There is some evidence that this starts to reverse around the age of 50. Among those 65 years and older, women consistently report a higher prevalence of disability than men (ESCWA, 2018). Egypt follow this global pattern. The increase in the prevalence of disability is starting at age 55 and above for both sexes.

The burden of disability is more pronounced among women than men, regardless of the severity of disability. This pattern demonstrates the men-women health-survival paradox, Egyptian women live longer in total than men and have more years with disability. Although the life expectancies and positive health expectancies are higher for Egyptian women than for men, the proportion of DFLE to total life expectancy is lower for women- which is congruent with most studies. This may be explained by the relatively higher survival of women after the development of these disabilities (Robine and Ritchie, 1991; Mor et al., 1994; Robine et al. 1999; EHEMU 2007).

In the light of the foregoing results, it is clear that as far as severe disability is considered the percent of DFLE in to total lifetime among men is higher than that of women, gender-based variations do exist. An exception was found for the two oldest age groups, where the proportion is higher for women than for men. In comparison with other countries, Belgium women had a DFLE at birth of 66.6 years and thus 82% (66.6 years

out of a total LE of 81.4 years) were spent free of disability and for men the LE at birth was 75.4 years of which 63.4 years, or 84% would be free of disability (EHEMU, 2007). The total life expectancy at birth is 77.8 and 82.8 years for Austrian men and women respectively in 2003 of which DFLE at birth were 59 years (representing 76.1%) for men and 62 years for women (75%) spent without all disabilities[12]. The gap between men and women is slightly increased in the instance of severe disability level[13], DFLE were 72.4 years (93.0%) and 74.5 years (90.0) spent without severe disabilities for men and women, respectively (AIHW, 2006).

The majority of the global DFLE estimations are focused on the older ages, i.e. 60, 65 or 80 years. Egyptian people suffer from disability in these ages compared with other countries. The proportion of DFLE to life expectancy at age 60 years for men and women, respectively, in Egypt are 56% and 48.9%, while in China 2006; 74.3% and 72.1% (Liu et al., 2009); in Canada 2007 84.1% and 71.8% (Mandich and Margolis, 2014) and in Bangladesh 2010 are 59.3% and 51.6% (Tareque et al., 2013).

At age 65, it worth to mention that Egypt comes in an intermediate position for the proportion of DFLE to total lifetime compared to corresponding estimates of other countries. It is estimated by 51% and 43% for men and women in Egypt, respectively. This proportion reached to maximum, on average, in Sweden, Ireland, Malta, German, and Denmark by 70% and 64.6% for men and women, respectively. While it reached to minimum, on average, in Hungary, Greece, Portugal, Croatia and Estonia by 37.6% and 32% for men and women, respectively (The European Health and Life Expectancy Information System, 2018).

Results revealed that people with vision and mobility limitations are the most suffering compared to their peers with other disabilities' domains, they live longer years with disability more than their peers with other disability types.

[12] Disability measured as the presence of one or more of 17 limitations, restrictions or impairments that lasted, or were likely to last, for at least 5months, and which restricted everyday activities.

[13] Severe or profound core activity limitation is a subset of all disability and is defined as sometimes, or always, needing personal assistance or supervising with one or more core activities of self-care, mobility or communication.

Our findings have implications for policy making regarding improving the quality of the older population in Egypt. Also, it suggests that greater focus on quality rather than quantity of life and identifying the risk factors that are more common among the elder women and men may be an effective strategy for extending their active life.

6. Recommendations

1. Further research on disability types as well as causes of disability is essential. Comparable data are still needed in this field to track DFLE and investigating its changes in relation to the actual lifetime of the individuals as Egypt is witnessing increase in its aged population.

2. Enhanced attention to older men and women who are suffering from difficulties, notably in mobility functions, which may contribute to the lack of participation and their isolation and other preventable causes among older people could extend their active life and help offset the impending long-term care pressures related to population aging.

3. Improving health services for the people with disabilities through the development of early detection programs, provision of treatment and medical rehabilitation services through comprehensive health insurance for people with disabilities and training of medical staff to deal with various disabilities.

4. More awareness programs are required to integrate people with disabilities into society, which can have a positive impact on the culture of non-reporting of disability.

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