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A systematic review of the prevalence of mental and neurocognitive disorders amongst older adults' populace in Egypt

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Abstract

Background: Mental and neurocognitive disorders are the leading cause of disabilities amongst the older adult populace worldwide. The population of the older adult in Egypt is fast growing. The national census in 2017 revealed a 2.56% increase in the older adult population from the 2006 census, and these figures are expected to double by year 2031. This study aims to review current evidence about the prevalence of mental and neurocognitive disorders amongst older adult population in Egypt.

Results: A systematic review was carried out, and 16 studies met the inclusion criteria outlined in this study. Four main mental and neurocognitive disorders were identified: depression, anxiety, cognitive impairment and dementia. The reported prevalence of depression, anxiety, dementia and cognitive impairment are 23.7–74.5%, 14.2–72%, 3.66–39.2% and 1.74–51.4%, respectively. Anxiety and depression were positively correlated with the female gender, increasing age and lower educational status. Also, cognitive impairment and dementia were positively correlated with age, illiteracy or low education. However, there appears to be inconsistencies in the diagnostic tools used.

Conclusion: Egypt aging population is growing, and this research brings to forefront the scale of mental and neurocognitive disorders amongst the older adult population. This may help ensure evidence-based initiatives are put in place and priority is given to resource allocation for geriatric mental and neurocognitive disorders in Egypt.

Systematic review registration: PROSPERO [CRD42018114831](https://www.crd42018114831)

Keywords: Mental disorders, Cognitive impairment, Dementia, Older adults, Egypt, Prevalence, Sociodemographic factors, Systematic review, Neurocognitive disorders

Background

Globally, the older adult population is fast growing, and this is subsequently reflected in the prevalence of old age-related diseases [1, 2]. Mental and neurocognitive disorders are the leading causes of disabilities amongst older population worldwide [3–5]. For, instance, mental disorders such as depression have been estimated to affect more than 300 million individuals globally and it is the single largest contributor to global disability [5].

The impact of mental and neurocognitive disorders is multifaceted affecting the individual, family and relatives as well as the economy of such countries [6]. For instance, the estimated cost per person in a year dementia in low-income countries is approximately £686 (\$868) and £2456 (\$3109) in lower-middle income countries like Egypt [7].

The population of the older adults in Egypt is fast growing. In Egypt, old age classification begins at age 60, which is the same as the age of retirement [8, 9]. There are now proposals to change retirement age to 65 years by 2027, and this perhaps may change the definition of old age in

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the future [10]. The national census in 2017 revealed a 2.56% increase from the 2006 census, and it is expected that the older adult population will double by year 2031, with a projected increase of 11.5% forecasted [11].

Internationally, research which focuses on examining trends of mental and neurocognitive disorders amongst older adults' group is limited. Furthermore, uncertainties exist about prevalence and correlates of mental and neurocognitive disorders amongst older adults especially in the Middle East region and Egypt in particular. Therefore, this study aims to review current evidence about the prevalence of mental and neurocognitive disorders amongst older adult population in Egypt. Furthermore, sociodemographic correlates of these conditions will be investigated.

Research questions

- What is the prevalence of mental and neurocognitive disorders amongst older adult populace in Egypt?
- What are the sociodemographic correlates of mental and neurocognitive disorders amongst older adult populace in Egypt?
- What are the current gaps in research about mental and neurocognitive disorders amongst older adult populace in Egypt?

Methods

This systematic review was developed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2009 checklist [12] and the documented in a protocol (PROSPERO registration number: CRD42018114831) [13].

Search strategy

Electronic search was conducted on November 1, 2018, on five key databases (MEDLINE, PsychINFO, EMBASE, AMED and PUBMED). All databases were searched from their date of inception. In addition, we carried out key journal searching, citation searching, reference list scanning and relevant internet resources to ensure this systematic review contains all possible studies and also ascertain that studies not indexed in the five databases listed above were included in this review.

Prior to commencing the literature search, the Centre for Reviews and Dissemination as well as PROSPERO was accessed to identify if there had been a previous or ongoing systematic review carried out in Egypt. We found one study by Elshahidi et al. [3] that had carried out a systematic review on the prevalence of dementia in Egypt. However, our study is focused around mental and neurocognitive disorders using the International

Classification of Disease (ICD) code 10, chapter 5 (F code) for mental and behavioural disorder, of which dementia is a type of neurocognitive disorders. Thus, our study covers a wider range of mental and neurocognitive disorders. Moreover, our inclusion and exclusion criteria are quite different from those recorded in the study by Elshahidi et al. [6].

An updated search was carried out on the 28th of December, 2018; no additional paper was found. Searches included MeSH and text word terms, with combination AND, OR, ADJ Boolean operator and truncation when necessary. The search terms used in this study is detailed in Fig. 1:

Inclusion and exclusion criteria

Studies were included in this review, if they were published in English, cross-sectional prevalence studies, and carried out on adult Egyptians aged 60 and above. In addition, mental and neurocognitive disorders had to be ascertained using any validated diagnostic tools. Validation of diagnostic tools is based on self-reported declaration of the original authors of included papers. We included studies conducted in hospitals (both inpatients and outpatients), residential homes, household surveys and other settings within Egypt. Studies which did not meet any of the criteria detailed above were excluded.

Search outcome

The literature search from the five databases revealed 343 papers; this was reduced to 296 after duplicates were removed. Of the 296 papers, 268 were excluded after screening the title and abstract resulting in 29 papers being retrieved for more details. We also carried out citation scanning, reference list scanning and internet source search and identified 9 more studies that were potentially relevant. Thus, a total of 38 full articles were accessed, and after matching it with the eligibility criteria, 16 studies were included in this study (see [Appendix 1](#) for list of included studies). Figure 2 provides details of the search outcome. Papers were excluded due to age (<60 years or unspecified) and unspecified diagnostic criteria and focusing more on chronic illnesses which co-morbid with mental and neurocognitive disorders. We identified two potentially relevant papers based on the title and abstract; however, both were later excluded when the full article could not be accessed.

Quality assessment

The 16 studies which met the inclusion criteria were assessed using the Herzog et al. [14] modification of the Newcastle-Ottawa scale adapted for cross-sectional studies (see [Appendix 2](#) for a template). This scale

Prevalence OR cross-sectional OR epidemiolog* OR Survey

Mental illness* OR Mental disorder* OR Mental disease* OR Psychiatr* condition* OR Psychiatr* disorder* OR Psychiatr* illness*

elder* OR "old* adult*" OR geriatric* OR "old* person" OR "old* people" OR "old* age" OR "age* people" OR "aging people" OR "age* person" OR "aging person" OR "old* patient*" OR psychogeriatric* OR "aging patient*" OR "age* patient*"

Dementia OR Cognitive dysfunction OR Cognitive impairment* OR Cognitive disorder* OR Neurocognitive Disorder* OR Alzheimer

Egypt*

Fig. 1 Search terms

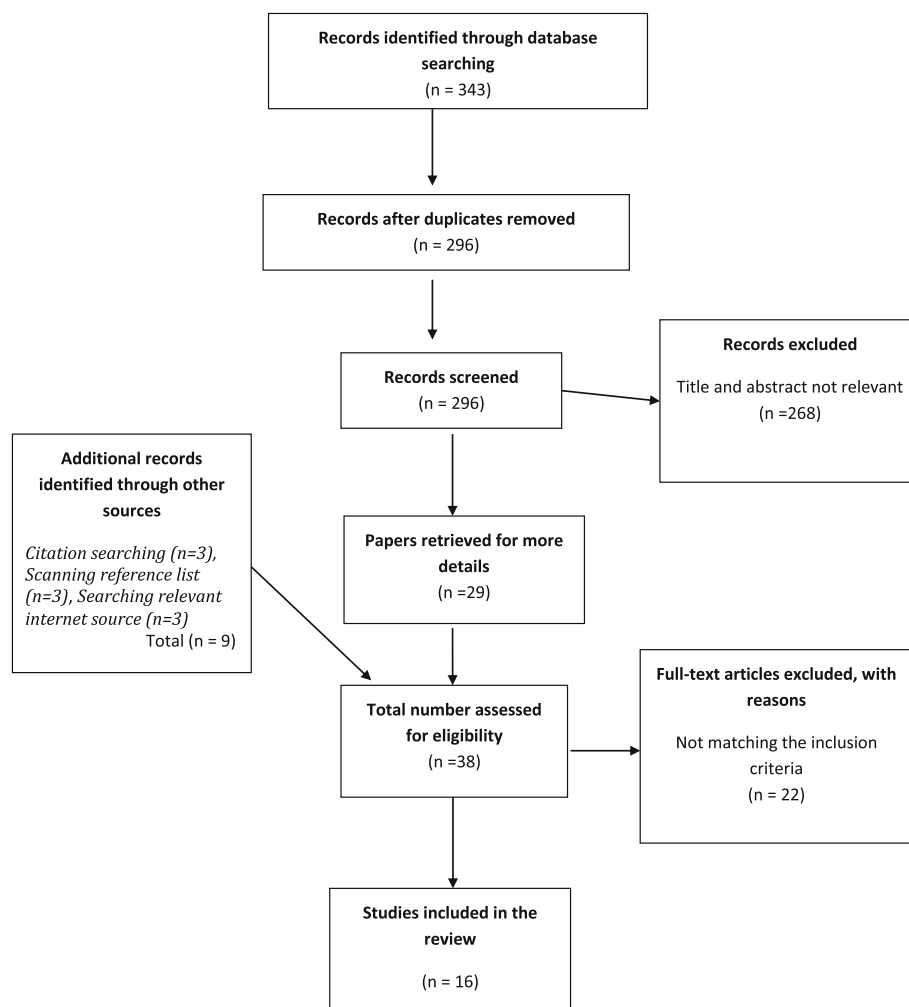


Fig. 2 PRISMA flow illustrating the search outcome

assesses three main domains which are selection, comparability and outcomes. Each study could attain a maximum of 10 points.

In this study, we took out question 4 about exposure risk as it was not relevant to this systematic review. Thus, quality assessment was based on 8 points. We also modified the grading as we realised that using the old grading will wrongly categorise those studies. The new grade scale was 0–2 point, unsatisfactory; 3–4 point, satisfactory; 5–6 point, good; and 7–8 point, very good. See [Appendix 2](#) for the quality assessment of included studies.

Two reviewers assessed the risk of bias, and disagreements were resolved by discussion. Ten of the studies were classed as good, and five were very good with only one classed as unsatisfactory.

Data extraction

Two reviewers performed data extraction, and any disagreements were resolved by discussion. The following information was extracted: first author's name; year of publication; city, settings and duration of the study; demographics; number of participants; method of recruitment; diagnostic test used; mental and neurocognitive disorder studied; prevalence of mental and neurocognitive disorders; existence of co-morbidity, current medication and smoking status.

Results

Demographic information

All studies gathered demographic information such as age and gender. All but one study (study 10) (93.75%) reported information about the educational status of the participants. Marital and employment status were reported by more than half of the papers (56.25%), and less than half (37.5%) examined the living arrangement of participants. Furthermore, less than half of the studies (43.75%) indicated whether participants resided in urban or rural region. Table 1 contains the demographic details of all included studies.

Sample and population

The included studies were conducted in various cities in Egypt of which more than a quarter (37.5%) were from Cairo (studies 1, 2, 4, 11, 14 and 15). The studies were conducted in five major settings: residential homes, community surveys, inpatients, outpatients and community clubs. Of the 16 studies, a quarter (25%) was community surveys (studies 3, 7, 8 and 10). One study (study 5) was a mix of three settings (residential homes, community surveys and inpatient). It was difficult to specify the settings where two studies (studies 11 and 13) were conducted. All studies were cross-sectional prevalence

Table 1 Demographic details of included studies

Study no.	Age	Gender	MS*	LA*	ES*	EDUS*	Res*
1.	X	X				X	
2.	X	X	X		X	X	
3.	X	X	X		X	X	X
4.	X	X	X			X	
5.	X	X	X	X	X	X	
6.	X	X	X	X	X	X	X
7.	X	X			X	X	X
8.	X	X				X	X
9.	X	X			X	X	X
10.	X	X					X
11.	X	X				X	
12.	X	X	X	X		X	
13.	X	X				X	
14.	X	X	X	X	X	X	
15.	X	X	X	X	X	X	
16.	X	X	X	X	X	X	X

MS* marital status, LA* living arrangement, ES* employment and income status, EDUS* educational status, RES* resident in urban or rural region

studies, but two (studies 1 and 11) did not specify data collection period or duration.

Random sampling technique (56.25%) was more commonly used amongst the included papers. All community surveys used this method and provided in-depth information of how randomisation occurred. Three studies (studies 2, 6 and 13) claiming to use this technique were vague in their explanation. For instance, one study (study 2) claimed to have randomly selected the study setting but did not randomly select the participants. Five studies (studies 1, 9, 11, 12 and 14) making 31.25% did not specify the sampling technique, while two studies (studies 4 and 15) making 12% used convenience sampling.

Sample size varied widely with some studies using a small number and others using a large number. The community surveys tend to use a larger sample size. More studies (56.25%) provided details justifying their sample size. One study's (study 5) justification of sample size is unclear. The study made comparison between 3 settings (residential homes, inpatient wards and community survey in a slum area) and claimed 100 participants was the ideal sample size. Table 2 contains details about the sample and population of the included paper

Mental and neurocognitive disorders

This systematic review identified mental disorders, such as anxiety and depression, as well as neurocognitive disorders, such as cognitive impairment and dementia. Majority (81.25%) of the studies were conducted solely to estimate the prevalence of these illnesses; however, three

Table 2 Sample and population of included studies

Study no.	City	Data collection settings	Period of data collection	Sample size	Method of recruitment
1	Cairo	Residential homes	Unspecified	120	Unspecified
2	Cairo	Residential homes	Jan 2014–Mar 2014	240	Randomly selected residential homes but convenient for participants
3	Fayoum	Community survey	Sept 2014–Feb 2015	2219	Multistage stratified cluster random
4	Cairo	Community clubs	9 months starting Aug 2006	268	Convenient
5	Alexandria	A mix*	Mar 2011–Aug 2011	100	Random
6	Zagazig	Inpatient	Apr 2012–Mar 2013	200	Random, sample size not explained
7	Assiut-upper	Community survey	May 1993–Aug 1994	2000	Systematic random sampling
8	Qena	Community survey	Sept 2011–Aug 2013	691	Systematic random sampling
9	Zagazig (Sharkia)	Outpatient	Jun 2004–May 2006	1800	Unspecified
10	Sohag	Community survey	May 2016–Mar 2017	1027	Systematic random sampling
11	Cairo	Unclear	Unspecified	94	Unspecified
12	Assiut	Community clubs	4 months starting Apr 2010	466	Unspecified
13	Mansoura	Community??? Unclear	Dec 2008–June 2009	100	Random??unclear
14	Cairo	Community clubs	?? Over 3 months	284	Unspecified
15	Cairo	Inpatient	May 2005–Oct 2005	100	Convenience
16	Damanhour	Outpatient	Nov 2009–Apr 2010	273	Random

Mix* residential homes, household and inpatient

studies (studies 1, 3 and 11) (18.75%) were conducted to estimate the association of these illnesses with other chronic health conditions. Two studies (studies 4 and 14) were aimed to validate Arabic version of diagnostic tools. For clarity, findings about mental disorders (depression and anxiety) will be presented first; then, neurocognitive disorders (cognitive impairment and dementia) will be discussed later.

Mental disorders

Eight of the 16 included studies reported the prevalence of mental disorders. Amongst these eight studies, two (studies 6 and 15) investigated the prevalence of both anxiety and/or depression with cognitive impairment. Hence, these studies are also reported in the cognitive impairment and dementia section later.

Table 3 illustrates the prevalence of mental disorders reported in this study. Reported prevalence of depression ranged from 23.7 to 74.5% and anxiety from 14.2 to 72%, with mixed anxiety and depression disorder stated as 30% by one study (study 1). The manner two studies (studies 5 and 16) reported prevalence rate was cumbersome, and we will suggest that readers access these papers for further details. The prevalence of anxiety and depression reported varied with the data collection setting. It was noted that residential homes and community clubs had a lower prevalence

compared with inpatient and household community survey.

Generally, depression was detected using the Geriatric Depression Scale (GDS). One study (study 16) detected depression from the participants by conducting psychiatric assessment using Structured Clinical Diagnosis (SCID-1) and arriving at a diagnosis based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). There was inconsistency in the GDS scale format used, more studies utilised the short form version, and only two studies (studies 3 and 15) used the long version. The GDS scale could sometimes be the Arabic version which had been previously validated or one simply translated to Arabic for the purpose of the study. The cutoff point for both the short and long versions of the GDS also varied amongst studies, with some using 5 or 6 points for the short and 10 or 11 for the long version, respectively. Anxiety was reported in three studies (studies 2, 15 and 16), and all three used different kinds of diagnostic tool.

Amongst the eight studies, all except one (study 15) indicated some type of correlation with sociodemographic status. See Table 4 for the relationship between depression and/or anxiety with sociodemographic status. It was mostly stated that depression and anxiety were positively correlated with the female gender. Furthermore, increasing age and lower

Table 3 Prevalence of depression and anxiety

Study no.	Mental/neurocognitive condition studied	Data collection settings	Prevalence rate	Diagnostic tool (*, Arabic version; ^, shorter version; !, longer version; [], cut-off point; ", translated to Arabic)
2	Depression, Anxiety Mixed disorder	Residential homes	Depression = 37.5% Anxiety = 14.2% Mixed disorder = 30%	GDS^* [≥ 5] (5–7 = mild; 8–12 = moderate; ≥ 13 = severe) Hamilton anxiety* [≥ 18]
3	Depression	Household community survey	Depression = 74.5% (Mild = 57.7% and severe = 16.8%)	GDS! [≥ 10] (0–9 = normal; 10–19 = mild; 20–30 = severe)
5	Depression	A mix	See article	GDS^" [≥ 5] (0–4 = no depression; 5–9 = suggestive of depression; > 9 = indicative of depression)
6	Depression Cognitive impairment	Inpatient	Depression = 72% Cognitive impairment = 30%	GDS [≥ 6] MMSE [≤ 23]
10	Depression	Household community survey	Depression = 62.7% (mild, 43.8%; moderate, 18.9% no severe dep)	GDS-15^* [≥ 5] (< 5 = normal; 5–8 = mild; 9–11 = moderate; 12–15 = severe)
12	Depression	Community clubs	Depression = 23.3%	GDS^ [≥ 5]
15	Anxiety Depression Cognitive impairment	Inpatient	Anxiety = 72% Anxiety traits = 35% Depression = 64% Cognitive impairment = 26%	STAI* GDS!" [≥ 11] (11–20 = mild; 21–30 = severe) MMSE*[CI] [≤ 24]
16	Anxiety and depression	Outpatient	See article	MMSE [23, educated participants; 20, illiterate] and DSM-IV (SCID-I)

educational status was reported as positively correlated with depression and anxiety. With regards to marital status, one study (study 2) reported a positive correlation of anxiety with married elderly. Others indicated a positive relationship with those who are divorced, widowed or separated.

Four (studies 3, 6, 10 and 16) of the eight studies reported the residency status (urban or rural) of the study. All four studies reported more participants residing in rural than urban areas. Only one study (study 10) reported a significant increase in the prevalence of depression amongst the rural resident. Generally, it was indicated that both depression and anxiety was

significantly associated with presence of co-morbid chronic diseases, poor perceived health status, having more than one chronic illness and loneliness.

Neurocognitive disorder

Table 5 presents the prevalence of dementia and cognitive impairment. In total, 10 studies reported findings, and this was a mix of cognitive impairment alone (studies 1, 4 and 13), dementia alone (studies 7 and 9), both cognitive impairment and dementia (studies 8, 11 and 14) and both anxiety and/or depression with cognitive impairment (studies 6 and 15).

Table 4 Reported significant positive correlation of depression and anxiety with sociodemographic status

Study no.	Age	Gender	MS*	LA*	EIS*	EDUS*	Res*
2	↑ age with anxiety and mixed disorder	Female	↑ anxiety with married		Low income		
3	Aged 70+	Female	Divorced/widowed		Lower education	Lower education	Males in the urban region
5		Female	Single/widowed	Living with offspring	Low income	Lower education	
6					Low income		
10	Aged 90+	Female					Rural
12	Aged 60–65	Female	Separated/divorced	Living alone		Lower education	
15							
16		Female	Divorced		Low income		

MS* marital status, LA* living arrangement, EIS* employment and income status, EDUS* educational status, RES* resident in urban or rural region

Table 5 Prevalence of cognitive impairment and dementia

Study no.	Mental/neurocognitive condition studied	Data collection settings	Prevalence rate	Diagnostic test (*, Arabic version; ^, shorter version; †, longer version; [], cut-off point; †, translated to Arabic)
1	Cognitive impairment	Residential homes	38.30%	MMSE*; MoCA* [< 26] bonus point given for less than 12 years education
4	Cognitive impairment	Community clubs	34.2 and 44.3% in healthy men and women, respectively	MOCA*, similar to English version, ≤ 26 with no functional impairment = MCI; ≤ 26 with functional impairment = early dementia, bonus point given for less than 12 years education
6	Cognitive impairment Depression	Inpatient	Cognitive impairment = 30% Depression = 72%	MMSE [≤ 23] GDS [≥ 6]
7	Dementia (then further classified as AD*, MID*, MD*, and Sec D*)	Household community survey	Dementia = 4.5% (AD 2.2%, MID 0.95%, MD 0.55%, SeD 0.45%)	MMSE of 28 points [≤ 21] and other diagnostic tools for further classification of dementia (see article)
8	Cognitive impairment Dementia* (then further classified as AD*, VaD*, PDD*, and Mixed*)	Household community survey	Cognitive impairment = 1.74% Dementia = 5.07% (AD 1.74%, VaD 1.3%, PDD 1.01%, MD 0.58%)	MMSE of 28 points [23 educated individuals and 21 illiterate] - MES- Memory and Executive Screening test [> 75 normal; 62–75 MCI; < 62 dementia suspects] and other diagnostic tools for further classification of dementia (see article)
9	Dementia (then further classified as AD*, MD*, VaD*, others, and undet*)	Outpatient	Dementia = 3.66% (AD 1.4%, VaD 1.05%, MD 0.5%, Others 0.44%, Undetermined 0.22%)	Standardized MMSE of 30 points (23 educated individuals and 21 illiterate) and other diagnostic tools for further classification of dementia (see article)
11	Cognitive impairment Dementia	Unclear	Cognitive impairment, 34% Mild dementia, 23.3% Moderate dementia, 8.5% Severe dementia, 7.4	MMSE of 30 points [0–10, severe; 11–20, moderate; 21–25, early dementia; 29–30, MCI]
13	Cognitive impairment	Community??? Unclear	Cognitive impairment = 32%	MMSE* (unspecified but stated that individuals below 24 were excluded) MOCA* [< 26] Bonus point given for less than 12 years education
14	Cognitive impairment Dementia	Community clubs	Cognitive impairment = 51.4% Dementia = 5.6%	MMSE of 30 points SLUMS*, score depends on level of education For high education (normal = 27–30; mild neurocognitive disorder = 21–26; dementia = 1–20) For less high school education (normal = 25–30; mild neurocognitive disorder = 20–24, dementia = 1–19)
15	Cognitive impairment Depression Anxiety	Inpatient	Cognitive impairment = 26% Depression = 64% Anxiety = 72% Anxiety traits = 35%	MMSE*[CI = ≤ 24] GDS* STAI*

AD* Alzheimer's disease, VaD* vascular dementia, MD* mixed dementia, MID* multi-infarct dementia, SeD* secondary dementia, PDD* Parkinson's disease dementia

The reported prevalence of dementia was 3.66–39.2%. All but one study (study 11) indicated a low prevalence rate of dementia. It is not particularly clear why the rate described in this study is particularly high (total dementia rate of 39.2%); perhaps it could be due to the data collection settings unclear. It was stated that participants in this study were recruited from the hospital without indicating if they are outpatient or inpatient. Although, this particular study (study 11) did indicate they excluded individuals with possible health conditions that may affect cognitive function. However, the description of the sample population is unclear and this may impact on prevalence rate of dementia reported. There was a wide range in the reported prevalence of cognitive impairment from 1.74 to 51.4%. Converse to findings about anxiety and depression, household community surveys reported a very low rate (1.74%) compared to all other settings.

Three main types of diagnostic tools were reported in the included studies. Nearly all studies except one (study 4) used the Mini Mental State Examination (MMSE) to detect cognitive impairment and dementia. Three studies (studies 1, 4 and 13) used the Montreal Cognitive Assessment (MoCA) to detect cognitive impairment, and one study (study 14) used Saint Louis University Mental Status (SLUMS). Different versions of the MMSE was used, the Arabic, standardised version of 30 points, or the 28 points versions were used. The three studies which used the MoCA scale all used the Arabic version. Amongst the five studies that investigated the prevalence of dementia, three (studies 7, 8 and 9) used other diagnostic tools to further classify dementia into subtypes.

Table 6 presents studies which show significant positive correlation between cognitive impairment and/or dementia with sociodemographic status. All but one study (study 15) of the 10 studies did not

Table 6 Reported significant positive correlation of cognitive impairment and dementia with sociodemographic status

Study no.	Age	Gender	MS*	LA*	ES*	EDUS*	RES*
1	Age ^C	Female ^C				Illiterate ^C	
4	Age ^C	Female ^C				Low education ^C	
6	Age ^C						
7	Age ^D						
8	Age ^D					Illiterate ^D	Urban areas ^D Industrial areas ^D
9	Age ^D				Manual worker ^D	Illiterate ^D	
11						Low education ^C	
13	Age ^C					Low education ^C	
14					Unemployment ^D	Low education ^D	
15							

D dementia, C cognitive impairment, MS* marital status, LA* living arrangement, ES* employment and income status, EDUS* educational status, RES* resident in urban or rural region

report any significant correlation between dementia and cognitive impairment with sociodemographic status, respectively.

Most of the studies indicated a positive correlation with age, illiteracy and low education with cognitive impairment and/or dementia. Two studies (studies 1 and 4) reported a positive correlation with female gender. Also, being unemployed and a manual worker was strongly associated with dementia. There was no report of a significant correlation between marital status and living arrangement. One study (studies 8) reported a positive relationship between living in urban and industrialised areas with dementia. Furthermore, three studies (studies 1, 13 and 14) stated a positive relationship between cognitive impairment and dementia with depression.

Risk factors of mental and neurocognitive disorders

Some studies reported some risk factors that can affect mental and neurocognitive disorders. Table 7 presents risk factors identified in this systematic review. Risk factors such as the use of medication, smoking and chronic health condition were discussed in the included studies. No study reported the alcohol status of the participants.

Only one study (study 5) (6.25%) indicated if the sampled population were on medications or not at the time of data collection. This study indicated that there was a positive correlation between increased number of medications and depression. Less than half of the studies (31.25%) stated the smoking status; however, there was no report of smoking having a positive association with anxiety, depression, cognitive impairments and dementia. Five studies (studies 4, 6, 10, 11 and 14) did not report if the sample

populations had co-existing chronic health condition. Just one study (study 9) reported a significant association between chronic health condition (hypertension) and dementia.

Discussion

This systematic review reports current evidence about mental and neurocognitive disorders amongst the older adult population in Egypt. Two mental disorders (anxiety and depression) and neurocognitive disorders (cognitive impairments and dementia) were identified in this review. To the best of our knowledge, this is the first systematic review that considers the prevalence of both mental and neurocognitive disorders amongst the older adult populace in Egypt. Moreover, this study investigates sociodemographic factors that could potentially influence these conditions.

It is interesting to note that no single study in this review investigated the wider range of mental disorders such as dissociative disorders, misidentification disorder, obsessive-compulsive disorder, post-traumatic stress disorder, late-onset psychosis and other psychotic features that may be found amongst the older adult population. The strong cultural and religious influence towards mental disorders in Egypt could be attributed to studies not reporting data on substance and alcohol misuse in order to avoid stigmatisation and discrimination [15, 16]. This opinion is supported by Ghanem et al.'s [17] study that examined mental disorders amongst individuals aged 18–64 years. These authors indicated that the low prevalence rate of alcohol and drug dependence reported may be inaccurate due to the fear of being ostracised by family members.

Table 7 Reported risk factors

Study no.	Use of medication	Smoking status	Chronic health condition
1.		X	X
2.			X
3.		X	X
4.		X	
5.	X ⁺		X
6.			
7.			X
8.			X
9.			X ⁺
10.			
11.			
12.			X
13.		X	X
14.			
15.		X	X
16.			X

X⁺ positive correlation

Depression and anxiety are classed as ‘common mental disorders’ whose prevalence continues to rise globally and known as the largest contributor to global disability (WHO, 2017). This study found higher rates of depression and anxiety in females, increasing age and lower educational status. These findings are homogenous in the Middle East North Africa (MENA) countries and also globally [5, 18, 19]. Eloul et al. [18] indicated that the higher depression rate amongst females in MENA countries can be attributed to postpartum depression and the altering roles of females in these countries.

The estimated prevalence of cognitive impairment and dementia in this study were higher than those reported in previous studies [6, 20]. This may be attributed to this review looking at studies conducted in various settings. For instance, Elshahidi et al. [6] study only looked at studies conducted via household surveys. Besides, a higher prevalence of dementia is often noted in institutionalised settings in comparison with other settings [20]. As expected, dementia and cognitive impairment rose with increasing age and illiteracy. This is consistent with previous studies [1, 4, 6, 20, 21].

The inconsistencies in the diagnostic tools may impact on the prevalence reported in some studies. This is because there might be variations in the way mental and neurocognitive disorders are defined and categorised [22]. Moreover, presence of risk factors such as smoking, alcohol, medication and co-existing chronic illnesses may also influence reported prevalence categorised [20–22].

Conclusion

Egypt’s aging population is growing, and there is a need to prioritise research and interventions about mental and neurocognitive disorders amongst this population group. Egypt’s strong cultural and religious influence also calls for public health interventions that educate and help to disabuse myths and misconceptions about mental and neurocognitive disorders. Recommendations for further research is for more studies that explore the wider range of mental disorders like psychosis, alcohol and drug dependence amongst the older adult population. Besides, prevalence studies that categorises cognitive impairment should be conducted. Also, studies should provide an extensive report of the influence of sociodemographic and other risk factors for mental and neurocognitive disorders.

The limitation of this study is that we might have excluded some potentially insightful studies because it did not meet the inclusion criteria. Nevertheless, this systematic review is unique as it contributes knowledge about the current evidence of the prevalence of mental and neurocognitive disorders amongst older adult population in Egypt. It also shed insights into sociodemographic correlates and possible risk factors of mental and neurocognitive disorders amongst the older adult population in Egypt. Moreover, a detailed description of the inclusion and exclusion criteria also will be valuable for other researchers who might want to explore mental and neurocognitive disorders in Egypt and other MENA countries.

Appendix 1

Table 8 Studies included in the systematic review

Included studies	References
Study 1	Khater MS, Abouelezz NF. Nutritional status in older adults with mild cognitive impairment living in elderly homes in Cairo, Egypt. <i>The journal of nutrition, health & aging</i> . 2011 Feb 1;15(2):104-8.
Study 2	Ahmed D, El Shair IH, Taher E, Zyada F. Prevalence and predictors of depression and anxiety among the elderly population living in geriatric homes in Cairo, Egypt. <i>The Journal of the Egyptian Public Health Association</i> . 2014 Dec 1;89(3):127-35.
Study 3	El-Sherbiny NA, Younis A, Masoud M. A comprehensive assessment of the physical, nutritional, and psychological health status of the elderly populace in the Fayoum Governorate (Egypt). <i>Archives of gerontology and geriatrics</i> . 2016 Sep 1;66:119-26.
Study 4	Rahman TT, El Gaafary MM. Montreal Cognitive Assessment Arabic version: reliability and validity prevalence of mild cognitive impairment among elderly attending geriatric clubs in Cairo. <i>Geriatrics & gerontology international</i> . 2009 Mar;9(1):54-61.
Study 5	El Kady HM, Ibrahim HK. Depression among a group of elders in Alexandria, Egypt. <i>EMHJ-Eastern Mediterranean Health Journal</i> , 19 (2), 167-174, 2013. 2013.
Study 6	Esmayel EM, Eldarawy MM, Hassan MM, Mahmoud AA, Mohamed SY. Mental health problems and sociodemographic correlates in elderly medical inpatients in a university hospital in Egypt. <i>Current gerontology and geriatrics research</i> . 2013;2013.
Study 7	Farrag AK, Farwiz HM, Khedr EH, Mahfouz RM, Omran SM. Prevalence of Alzheimer's disease and other dementing disorders: Assiut-Upper Egypt study. <i>Dementia and geriatric cognitive disorders</i> . 1998;9(6):323-8.
Study 8	Khedr E, Fawi G, Abbas MA, Mohammed TA, El-Fetoh NA, Al Attar G, Noaman M, Zaki AF. Prevalence of mild cognitive impairment and dementia among the elderly population of Qena Governorate, Upper Egypt: a community-based study. <i>Journal of Alzheimer's Disease</i> . 2015 Jan 1;45(1):117-26.
Study 9	Zaitoun A, Al Ma'moun A, Sarhan M, Selim A, Mousa G. Epidemiological study of dementia after retirement. <i>Egypt J Neurol Psychiat Neurosurg</i> . 2008;45: 65-74.
Study 10	Aly HY, Hamed AF, Mohammed NA. Depression among the elderly population in Sohag governorate. <i>Saudi medical journal</i> . 2018 Feb;39(2):185.
Study 11	Abdelrahman HM, Elawam AE, Alghitany AN. Cognitive impairment among Egyptian older adults on hemodialysis. <i>Middle East Journal of Age and Ageing</i> . 2014 Jun;83(1195):1-7.
Study 12	Mohamed E, Abd-Elhamed M. Depression among elderly attending geriatric clubs in Assiut city, Egypt. <i>J Am Sci</i> . 2011;7:386-91.
Study 13	Amer M, Mousa S, Khater M, Wahab WA. Prevalence of mild cognitive impairment among older adults living in Mansoura city, Egypt. <i>Middle East Current Psychiatry</i> . 2012 Jan 1;19(1):3-7.
Study 14	Abdelrahman HM, El Gaafary MM. Validation of arabic version of Saint-Louis-University-Mental-Status (SLUMS)-Examination and prevalence of cognitive impairment in community dwelling Egyptian older adults. <i>Middle East Journal of Age and Ageing</i> . 2014 Oct;83(1492):1-9.
Study 15	Hamza S, El Raashid AH, Kahla O. The impact of anxiety, depression and cognitive impairment on functioning in the physically ill elderly in Egypt. <i>Current Psychiatry</i> . 2006 Jul;13(2):152-65.
Study 16	Eissa AM, Hassan GA, Azam H, Sadek HA, El Awam I. Sociodemographic correlates of depression and anxiety disorders among physically ill elderly patients. <i>Middle East Current Psychiatry</i> . 2013 Apr 1;20(2):73-9.

Appendix 2

Newcastle-Ottawa Scale adapted for cross-sectional studies

Cross-sectional Studies:

Very Good Studies: 9–10 points

Good Studies: 7–8 points

Satisfactory Studies: 5–6 points

Unsatisfactory Studies: 0 to 4 points

This scale has been adapted from the Newcastle-Ottawa Quality Assessment Scale for cohort studies to provide quality assessment of cross sectional studies¹.

Selection:

1. Representativeness of the sample:

- Truly representative of the average in the target population. * (all subjects or random sampling)
- Somewhat representative of the average in the target group. * (non-random sampling)
- Selected group of users/convenience sample.

- No description of the derivation of the included subjects.

2. Sample size:

- Justified and satisfactory (including sample size calculation). *
- Not justified.
- No information provided

3. Non-respondents:

- Proportion of target sample recruited attains pre-specified target or basic summary of non-respondent characteristics in sampling frame recorded. *
- Unsatisfactory recruitment rate, no summary data on non-respondents.
- No information provided.

4. Ascertainment of the exposure (risk factor):

- Vaccine records/vaccine registry/clinic registers/hospital records only. **
- Parental or personal recall and vaccine/hospital records. *
- Parental/personal recall only.

Comparability: (Maximum 2 stars)**1. Comparability of subjects in different outcome groups on the basis of design or analysis.****Confounding factors controlled.**

- Data/results adjusted for relevant predictors/risk factors/confounders, e.g. age, sex, time since vaccination, etc. **
- Data/results not adjusted for all relevant confounders/risk factors/information not provided.

Outcome:**1. Assessment of outcome:**

- Independent blind assessment using objective validated laboratory methods. **
- Unblinded assessment using objective validated laboratory methods. **
- Used non-standard or non-validated laboratory methods with gold standard. *
- No description/non-standard laboratory methods used.

2. Statistical test:

- Statistical test used to analyse the data clearly described, appropriate and measures of association presented including confidence intervals and probability level (p value). *
- Statistical test not appropriate, not described or incomplete.

Appendix 3**Table 9** Quality assessment of included studies

Studies	Points	Grading
Studies 1	6	Good
Studies 2	6	Good
Studies 3	8	Very good
Studies 4	5	Good
Studies 5	5	Good
Studies 6	5	Good
Studies 7	8	Very good
Studies 8	8	Very good
Studies 9	7	Very good
Studies 10	8	Very good
Studies 11	5	Good
Studies 12	6	Good
Studies 13	6	Good
Studies 14	5	Good
Studies 15	3	Satisfactory
Studies 16	6	Good

Grading scales

0–2 = Unsatisfactory
 3–4 = Satisfactory
 5–6 = Good
 7–8 = Very good

Abbreviations

WHO: World Health Organisation; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; ICD: International Classification of Disease; GDS: Geriatric Depression Scale; SCID: Structured Clinical Diagnosis; DSM: Diagnostic and Statistical Manual of Mental Disorders; MS*: Marital status; LA*: Living arrangement; EIS*: Employment and income status; EDUS*: Educational status; RES*: Resident in urban or rural region; MMSE: Mini-Mental State Examination; MoCA: Montreal Cognitive Assessment; AD*: Alzheimer's disease; VaD*: Vascular dementia; MD*: Mixed dementia; MID*: Multi-infarct dementia; SeD*: Secondary dementia; PDD*: Parkinson's disease dementia; D: Dementia; C: Cognitive impairment; MENA: Middle East North Africa

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None.

Authors' contributions

OO was responsible for writing the protocol. OO and GT were involved in the conceptualisation of the study. OO and GT designed the search strategy. OO was responsible for the literature search. OO, GT and NS were responsible for the study selection, data extraction and quality assurance. All authors read and approved the final manuscript.

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Not applicable.

Consent for publication

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Competing interests

The authors declare that they have no competing interest.

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