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# Exploration of Risk Factors for Mild and Major Neurocognitive Disorders in A Sample of Elderly Population

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## ABSTRACT

**Background:** Early identification and management of modifiable risk factors for neurocognitive disorders is becoming more important to slow progression of the disease, which would be very beneficial for both the patient and the caregiver.

**Aim:** Assessing risk factors for mild and major neurocognitive disorders among a sample of elderly population in Suez Canal Area.

**Patients and Methods:** This cross-sectional comparative analytical study was conducted on a sample of 156 elderly people ≥60 years old in Suez Canal Area over the period from March 2022 to February 2023. Study tools included a semi-structured clinical interview to assess sociodemographic, medical and lifestyle risk factors, DSM-5 criteria to diagnose mild and major neurocognitive disorders, The Montreal Cognitive Assessment scale to assess cognitive function, and The Activities of Daily Living Questionnaire to assess functional impairment and dependency.

**Results:** Mild and major neurocognitive disorders have multiple sociodemographic, medical and lifestyle risk factors, including: aging, lower education, female gender, non-married status, unemployment and physical work, lower income, less physical, cognitive and social activities, increased number of chronic diseases and family history of cognitive impairment.

**Conclusion:** Multiple modifiable risk factors for mild and major neurocognitive disorders could be identified, and their management may contribute to lowering burden of neurocognitive disorders.

**Keywords:** Risk factors, Neurocognitive disorder, Cognitive impairment, Elderly.

## INTRODUCTION

Mild neurocognitive disorder (mild NCD) and major neurocognitive disorder (major NCD) are characterized by cognitive decline that develops slowly in elderly population. The difference between mild and major neurocognitive disorders is mainly based on the severity of symptoms. Major NCD is characterized by significant cognitive decline and the development of dependence in daily life activities, while mild NCD is characterized by mild cognitive decline not affecting independence in daily activities. To be diagnosed, delirium and other mental disorders should be ruled out [1].

Previous studies have identified risk factors for neurocognitive disorders, including sociodemographic factors (e.g., sex, age, years of education and living conditions), health factors (e.g., hearing loss, cardiovascular diseases, hypertension, diabetes) and lifestyle factors (e.g., smoking and lack of physical activity) [2].

Identifying modifiable risk factors is essential element of preventive measures for mild and major neurocognitive disorders and is necessary for designing and implementing public health programs and healthcare policies that target high-risk groups [3].

This study aimed to investigate risk factors for neurocognitive disorders among a sample of elderly population in Suez Canal Area.

## PATIENTS AND METHODS

### Participants

This cross-sectional study was performed on 156 participants aged ≥60 years old in Suez Canal Area, Egypt, over 12 months from March 2022 to February 2023. Study participants were recruited from two settings: 78 subjects from geriatric homes and 78 subjects from primary health care centers by convenience sampling.

### Eligibility criteria

The following subjects were excluded from participation in the study: people with mental retardation or a severe uncontrolled medical condition, people with a mental disorder or drug intake (e.g.: anticholinergic drugs, antipsychotics, etc.) that may interfere with cognitive testing, as well as people with severe visual, hearing, speech, or functional impairment that would limit their participation in the study.

### Procedure

The researchers conducted a detailed semi-structured interview with each participant to collect the following data:

1) Sociodemographic data, occupational data regarding current work status and occupational style (physical work vs. brainwork) and income.
2) Lifestyle factors such as smoking, substance use, participation in cognitive, physical and social



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activities, and family history of cognitive impairment.
3) Chronic health conditions, medication history and adherence to treatment.

We diagnosed subjects having neurocognitive disorders by the DSM-5 criteria [4] and the Montreal Cognitive Assessment Scale (MoCA), and classified study subjects according to cognitive status into three groups: normal cognition, mild neurocognitive disorder, and major neurocognitive disorder. We explored association of cognitive function with variable risk factors.

**Tools:**

***1. The Montreal Cognitive Assessment Scale (MoCA):***

It is a 30-point test assessing several cognitive domains including attention/working memory, short-term memory, visuospatial abilities, language, executive functioning, and orientation. One additional point is added to illiterate participants. The Arabic version was translated and validated by **Rahman and El Gaafary** [5].

***2. The Activities of Daily Living Questionnaire (ADLQ):***

It assesses the degree of dependency in performing basic activities of daily living including six functional domains: bathing, dressing, going to the toilet, transferring, continence, and feeding.

Each domain had a score of 0 (complete dependence), 0.5 (partial independence), or 1 (complete independence). A score of 6 indicated complete independence and 0 complete dependence. The used Arabic version was translated and validated by **Nasser and Doumit** [6].

**Ethical Approval**

**Participants signed informed written consent after acknowledgement about the study, and the research proposal was approved by the Ethical Committee of Suez Canal University, Faculty of Medicine (IRB: 4778; 3 January 2022). This study has been carried out following The Helsinki Declaration.**

***Statistical analysis***

All statistical analyses were performed using the *SPSS* (Statistical Package for The Social Sciences) version 26. Continuous data were presented as mean, standard deviation (SD), median, and range and were compared by independent t-test for normally distributed data and by Mann-Whitney U test and Kruskal Wallis test for non-normally distributed data. Categorical data were presented as frequency and percentage and were compared by Chi-Square test or Fisher's exact test. Spearman correlation test was used for correlations and multiple logistic regression analysis for predicting factors was also used. The $p$ <0.05 value indicated the level of significance.

**RESULTS**

Mean of age was significantly higher in major NCD group compared to normal and mild NCD groups, and most males had normal cognition compared to females. The majority of normal cognition group were married (51.4%) and highly educated compared to mild and major NCD groups with highly significant difference. Most of major NCD group lived in geriatric homes (85.7%) while 62.8% of normal cognition group lived with their families. Most of unemployed participants had mild NCD, and subjects who were still working had less neurocognitive disorders compared to retired and unemployed subjects. The majority of subjects with brainwork and enough income with saving had normal cognition (Table 1).

**Table 1:** Association between sociodemographic variables and cognitive function

| Variables | Normal cognition (*n*=70) | Mild NCD (*n*=58) | Major NCD (*n*=28) | *p* value |
|---|---|---|---|---|
| **Gender, n (%)** | | | | |
| Male | 50 (71.4) | 29 (50) | 15 (53.6) | **0.035***[a] |
| Female | 20 (28.6) | 29 (50) | 13 (46.4) | |
| **Age, n (%)** | | | | |
| Mean± SD | 67.0± 4.8 | 68.1± 6.2 | 73.6± 6.7 | **<0.001****[b] |
| 60-69 | 46 (65.7) | 28 (48.3) | 8 (28.6) | |
| 70-79 | 22 (31.4) | 27 (46.6) | 14 (50) | |
| ≥ 80 | 2 (2.9) | 3 (5.2) | 6 (21.4) | |
| **Marital status, n (%)** | | | | |
| Single | 0 | 2 (3.4) | 2 (7.1) | **<0.001****[c] |
| Married | 36 (51.4) | 18 (31) | 2 (7.1) | |
| Widowed | 18 (25.7) | 24 (41.4) | 18 (64.3) | |
| Divorced | 16 (22.9) | 14 (24.1) | 6 (21.4) | |
| **Educational level, n (%)** | | | | |
| Illiterate | 0 | 6 (10.3) | 14 (50) | **<0.001****[a] |
| Primary school | 8 (11.4) | 16 (27.6) | 0 | |
| Preparatory school | 8 (11.4) | 22 (37.9) | 10 (35.7) | |
| Secondary school | 26 (37.1) | 10 (17.2) | 4 (14.3) | |
| University graduate | 28 (40) | 4 (6.9) | 0 | |
| **Number of children** | | | | |
| Mean± SD | 3.1± 1.4 | 3± 1.5 | 3± 1.6 | 0.684[b] |
| **Living condition, n (%)** | | | | |
| Geriatric homes | 26 (37.1) | 28 (48.3) | 24 (85.7) | **<0.001****[c] |
| With a family member | 16 (22.8) | 14 (24.1) | 2 (7.1) | |
| Nuclear family | 14 (20) | 6 (10.3) | 2 (7.1) | |
| Extended family | 14 (20) | 10 (17.2) | 0 | |
| **Work status, n (%)** | | | | |
| Retired | 50 (80) | 30 (51.7) | 16 (57.1) | **<0.001****[c] |
| Unemployed | 2 (2.9) | 16 (27.6) | 10 (35.7) | |
| Still working | 12 (17.1) | 12 (20.7) | 2 (7.1) | |
| **Occupational style, n (%)** | | | | |
| None | 2 (2.9) | 16 (27.6) | 10 (35.7) | **<0.001****[a] |
| Brainwork | 34 (48.6) | 2 (3.4) | 0 | |
| Physical work | 34 (48.6) | 40 (69) | 18 (64.3) | |
| **Income, n (%)** | | | | |
| Not enough | 18 (25.7) | 20 (34.5) | 18 (64.3) | **0.001***[a] |
| Enough | 32 (45.7) | 32 (55.2) | 8 (28.6) | |
| Enough with saving | 20 (28.6) | 6 (10.3) | 2 (7.1) | |

a: Chi-square test, b: Mann-Whitney test, c: Fisher Exact test,*: significant,**: highly significant

Mild NCD and major NCD were significantly associated with pulmonary disease and heart disease. There was a highly significant association with bone and joint disorders, hyperlipidemia, and with adherence to treatment (Table 2).

**Table 2:** Association between chronic medical diseases and cognitive function

| Variables | Normal Cognition (*n*=70) | Mild NCD (*n*=58) | Major NCD (*n*=28) | *p* value |
|---|---|---|---|---|
| **Diabetes mellitus, n (%)** | | | | |
| No | 52 (74.3) | 38 (65.5) | 14 (50) | 0.068[a] |
| Yes | 18 (25.7) | 20 (34.5) | 14 (50) | |
| **Duration of diabetes mellitus, n (%)** | | | | |
| < 10 years | 2 (11.1) | 4 (20) | 0 | 0.215[b] |
| ≥ 10 years | 16 (88.9) | 16 (80) | 14 (100) | |
| **Treatment of diabetes mellitus, n (%)** | | | | |
| Insulin | 12 (66.7) | 12 (60) | 4 (28.6) | 0.078[a] |
| Oral hypoglycemic | 6 (33.3) | 10 (50) | 10 (71.4) | 0.102[a] |
| **Hypertension, n (%)** | | | | |
| No | 40 (57.1) | 24 (41.4) | 14 (50) | 0.207[a] |
| Yes | 30 (42.9) | 34 (58.6) | 14 (50) | |
| **Cerebrovascular (Stroke or TIA), n (%)** | | | | |
| No | 70 (100) | 56 (96.6) | 26 (92.6) | 0.063[b] |
| Yes | 0 | 2 (3.4) | 2 (7.1) | |
| **Heart disease, n (%)** | | | | |
| No | 60 (85.7) | 40 (69) | 18 (64.3) | **0.027***[a] |
| Yes | 10 (14.3) | 18 (31) | 10 (35.7) | |
| **Pulmonary disease, n (%)** | | | | |
| No | 70 (100) | 52 (89.7) | 24 (85.7) | **0.003***[b] |
| Yes | 0 | 6 (10.3) | 4 (14.3) | |
| **Bone and joint disorders, n (%)** | | | | |
| No | 48 (68.6) | 42 (72.4) | 8 (28.6) | **<0.001****[a] |
| Yes | 22 (31.4) | 16 (27.6) | 20 (71.4) | |
| **Thyroid disease, n (%)** | | | | |
| No | 68 (97.1) | 56 (96.6) | 28 (100) | >0.624[b] |
| Yes | 2 (2.9) | 2 (3.4) | 0 | |
| **Cancer, n (%)** | | | | |
| No | 64 (91.4) | 58 (100) | 26 (92.6) | 0.079[b] |
| Yes | 6 (8.6) | 0 | 2 (7.1) | |
| **Hyperlipidemia, n (%)** | | | | |
| No | 50 (71.4) | 26 (44.8) | 10 (35.7) | **<0.001****[a] |
| Yes | 20 (28.6) | 32 (55.2) | 18 (64.3) | |
| **Obesity, n (%)** | | | | |
| Normal | 34 (48.6) | 28 (48.3) | 12 (42.9) | 0.322[b] |
| Overweight | 4 (5.7) | 0 | 2 (7.1) | |
| Obese | 32 (45.7) | 30 (51.7) | 14 (50) | |
| **Number of physical illnesses, n (%)** | | | | |
| Mean± SD | 1.6± 1.5 | 2.3± 1.4 | 3± 1.8 | 0.074[c] |
| Median (Range) | 1 (0-5) | 2 (0-5) | 3 (0-7) | |
| **Adherence to treatment, n (%)** | | | | |
| No | 18 (34.6) | 8 (16) | 16 (61.5) | **<0.001****[a] |
| Yes | 34 (65.4) | 42 (84) | 10 (38.5) | |

a: Chi square test, b: Fisher Exact test; c: Kruskal Wallis test*: significant,**: highly significant
TIA: Transient ischemic attack

No significant association was found between cognitive function and smoking or history of substance use (Table 3).

**Table 3:** Association of smoking and substance use with cognitive function

| Variables | Normal cognition (*n*=70) | Mild NCD (*n*=58) | Major NCD (*n*=28) | *p* value |
|---|---|---|---|---|
| **Smoking** | | | | |
| Never smoker | 15 (21.4) | 15 (25.9) | 8 (28.6) | 0.535[a] |
| Ex-smoker | 15 (21.4) | 9 (15.5) | 2 (7.1) | |
| Current smoker | 40 (57.1) | 34 (58.6) | 18 (64.3) | |
| **History of Substance use** | | | | |
| No | 66 (94.3) | 56 (96.6) | 27 (96.4) | 0.878[a] |
| Yes | 4 (5.7) | 2 (3.4) | 1 (3.6) | |

a: Fisher Exact test

Mild NCD patients had significantly lower physical, cognitive, and social activities than elderly with normal cognition and significantly higher than major NCD. Family history of cognitive impairment was significantly higher among mild NCD group. Major NCD group had significantly lower ADLQ score (Table 4).

**Table 4:** Association of lifestyle risk factors, family history of cognitive impairment and ADL score with cognitive function

| Variables | Normal cognition (*n*=70) | Mild NCD (*n*=58) | Major NCD (*n*=28) | *p* value |
|---|---|---|---|---|
| **Physical activity (hours/week), n (%)** | | | | |
| <1 | 8 (11.4) | 12 (20.7) | 16 (57.1) | **<0.001****[a] |
| 1-2 | 32 (45.7) | 30 (51.7) | 10 (35.7) | |
| > 2 | 30 (42.9) | 16 (27.6) | 2 (7.1) | |
| **Cognitive activity, n (%)** | | | | |
| No | 44 (62.9) | 56 (96.6) | 28 (100) | **<0.001****[a] |
| Yes | 26 (37.1) | 2 (3.4) | 0 | |
| **Social activity (times/week), n (%)** | | | | |
| 0-3 | 10 (14.3) | 16 (27.6) | 21 (75) | **<0.001****[b] |
| 4-6 | 36 (51.4) | 30 (51.7) | 7 (25) | |
| 7-9 | 24 (34.3) | 12 (20.7) | 0 | |
| **Family history of cognitive impairment, n (%)** | | | | |
| No | 66 (94.3) | 46 (79.3) | 26 (92.9) | **0.029***[b] |
| Yes | 4 (5.7) | 12 (20.7) | 2 (7.1) | |
| **ADLQ score** | | | | |
| Mean± SD | 6± 0 | 6± 0 | 4.2± 0.9 | **<0.001****[b] |

a: Chi-square test, b: Fisher Exact test, *: significant,**: highly significant. ADLQ: Activities of Daily Living Questionnaire.

MoCA total score showed significant positive correlations with educational level, income, physical activity duration and ADLQ score. It also showed significant negative correlations with age, number of physical illnesses, family history of cognitive impairment, female gender, single marital status, and retired work status (Table 5).

**Table 5:** Correlation between MoCA total score and other study variables

| Variables | MoCA Total Score | |
|---|---|---|
| | r | *p* value |
| Gender (female) | -0.174 | **0.030*** |
| Age | -0.334 | **0.000**** |
| Marital status (single) | -0.219 | **0.006*** |
| Education (university) | 0.700 | **0.000**** |
| Work status (retired) | -0.206 | **0.010*** |
| Income | 0.359 | **0.000**** |
| Number of physical illnesses | -0.321 | **0.000**** |
| Physical activity duration (hour/week) | 0.388 | **0.000**** |
| Family history of cognitive impairment | -0.373 | **0.006*** |
| ADLQ score | 0.468 | **<0.001**** |

*: significant,**: highly significant, *MOCA:* Montreal Cognitive Assessment.

Family history of cognitive impairment, physical work, bone and joint disorders, and age were significant positive predictors for mild NCD. Meanwhile, adherence to treatment, education, increased cognitive activity and physical activity duration were significant negative predictors for mild NCD (Table 6).

**Table 6:** Multiple logistic regression analysis for predictors of mild neurocognitive disorder

| Predictor | B | 95% CI | Exp(B) | *p* value |
|---|---|---|---|---|
| Age | 2.040 | 0.22-0.970 | 1.041 | **0.016*** |
| Education (preparatory) | -4.667 | 6.297-1795.774 | 106.337 | **0.001*** |
| Occupation style (physical work) | 3.457 | 0.003-0.292 | 0.032 | **0.002*** |
| Bone and joint disorders | 2.636 | 2.399-81.288 | 13.964 | **0.003*** |
| Adherence to treatment | -4.262 | 0.002-0.122 | 0.014 | **0.000**** |
| Cognitive activity | -3.878 | 4.155-562.565 | 48.346 | **0.002*** |
| Family history of cognitive impairment | 3.943 | 0.002-0.236 | 0.019 | **0.002*** |
| Physical activity duration | -2.771 | 0.031-0.950 | 3.276 | **0.011*** |

*: significant,**: highly significant.

Number of chronic diseases, family history of cognitive impairment and age were significant positive predictors for major NCD, while physical activity duration, preparatory education and income were significant negative predictors for major NCD (Table 7).

**Table 7:** Multiple logistic regression analysis for predictors of major neurocognitive disorder

| Predictor | B | 95% CI | Exp(B) | *p* value |
|---|---|---|---|---|
| Age | 2.200 | 0.014-0.871 | 0.111 | **0.037*** |
| Education (preparatory) | -1.524 | 0.038-1.165 | 3.716 | **0.021*** |
| Income | -4.554 | 0.000-0.611 | 0.011 | **0.028*** |
| Number of chronic diseases | 3.219 | 2.249-277.940 | 25.000 | **0.009*** |
| Physical activity duration | -3.672 | 0.15-0.412 | 9.872 | **0.002*** |
| Family history of cognitive impairment | 1.691 | 0.073-0.708 | 1.997 | **0.011*** |

*: significant.

## DISCUSSION

In this study, we aimed to assess risk factors associated with mild and major neurocognitive disorders, in order to provide interventions for modifiable risk factors in elderly population.

Age correlated negatively with MoCA total score, and it was a predictor for both mild and major neurocognitive disorders. This could be explained by aging-related factors such as nerve cell degeneration, higher risk of cardiovascular disease, and changes in nucleic acid and cell structure. This finding agrees with multiple previous studies [7–9].

Education had a positive correlation with MoCA total score, and low education was a predictor for both mild and major neurocognitive disorders. These results are consistent with previous research [7,9,10]. Higher education levels may lead to increased cognitive reserve of the brain that protects against age-related cognitive impairment, and can also be linked to better socioeconomic status and following a healthy lifestyle.

Our study showed a significant association between female gender and neurocognitive disorders. This may be attributed to hormonal differences and decreased estrogen levels in females after menopause [11]. However, this association is controversial, as it was supported by some studies [9,10] while other studies showed no gender difference [7].

Regarding marital status, neurocognitive disorders had significant association with being widowed, while majority of normal subjects were married. This is in agreement with other studies [9,12]. This may be attributed to lack of emotional support and social interaction that can provide daily cognitive stimulation. However, other studies found no association [8].

Our study found no association between number of children and cognitive function, although an Egyptian study found a significant relationship between contact frequency with children and positive cognitive function [13]. We did not assess contact with offspring, which may have had a confounding effect.

Association of neurocognitive disorders with being retired or unemployed is consistent with other studies [8,14]; as cognitive impairment would make it difficult to work, or employment may act the same as education in improving cognitive reserve of the brain.

Neurocognitive disorders were more common among those who had physical work compared to

brainwork, and physical work was a positive predictor for mild NCD. Our results are in line with a literature review of Egyptian studies by **Sabry *et al.*** [8]. Physical work may provide less cognitive stimulation compared to brainwork, and may be associated with other factors like low education and lower income.

Participants with higher income had better cognitive function, and it was a negative predictor for major NCD. This is consistent with other studies [15,16], and may be linked to the level of education and access to care and treatment.

Our results showed significant association with heart disease, in line with previous research [17] interpreting this association by heart disease resulting in decreased cerebral blood flow and being a risk factor for cerebral emboli.

Pulmonary disease was also associated with cognitive impairment, which is supported by other studies [13,18] explaining this by hypoxic damage to the brain resulting from poor pulmonary function, or the presence of shared risk factors.

There was a significant association of neurocognitive disorders with bone and joint disorders, which were predictors of mild NCD. This finding is consistent with other studies [19,20] attributing it to shared risk factors such as aging, systemic inflammation, vitamin D deficiency, and physical inactivity.

We found no significant association between neurocognitive disorders and history of cancer, although previous research linked cognitive impairment to cancer and its treatments [21]. This finding may be due to the low presentation of cancer cases in our sample (5.1% only).

The current study showed highly significant association between hyperlipidemia and cognitive impairment, which is in line with previous research [12,22].

There was no significant association between obesity and neurocognitive disorders, similar to another Egyptian study by **Abdulsalam *et al.*** [23]. The relationship between obesity and cognitive function is conflicting as some researchers found that obesity in mid-life is a predictor of cognitive impairment at old age while it is protective at late life [24,25]. Our relatively small sample may have led to the inability to observe any association.

We found a highly significant association between adherence to treatment and normal cognitive function, and it was a negative predictor for mild NCD. This association is established in previous studies [26,27]. The relationship is reciprocal as non-adherence to treatment causes increased severity and complication of diseases, while impaired memory may decrease adherence to treatment.

No association was found between neurocognitive disorders and diabetes mellitus or hypertension, in agreement with **Khater and Abouelezz** [28], but previous studies have shown a significant relationship [18,29], while **Amer *et al.*** [30] found a significant association with hypertension but not with diabetes mellitus.

We found no significant association between neurocognitive disorders and history of cerebrovascular disease or thyroid disease, which was inconsistent with the literature that shows an increased risk [18,31,32]. This may be due to the very low presentation of those subjects in our sample (2.6% each).

In the current study, neurocognitive disorders were associated with number of chronic diseases, which were predictor for major NCD. This result is in agreement with other studies showing that multimorbidity was significantly associated with cognitive impairment, even more than the severity of each disease separately [9,16].

There was no significant association between smoking and neurocognitive disorders, which agrees with results of an Egyptian literature review by **Sabry *et al.*** [8], although cognitive impairment was linked to smoking in some other studies [10,33].

There was no significant association between history of substance use and cognitive impairment in our study; although one study [34] documented this association in old age people. This result may be due to the small number of substance users in our sample (4.5%). Substance use is often denied due to stigma in the community [9].

Physical activity had a highly significant association with normal cognition and was a negative predictor for both mild NCD and major NCD. These results are consistent with previous studies [33,35] proposing that physical activity significantly improves the management of cardiovascular risk factors, and may increase the production of neurotransmitters, and support neurogenesis and synaptic plasticity.

There was a highly significant association between cognitive activity and normal cognition, and it was a negative predictor for mild NCD. This is in line with other studies [33,36]. Activities requiring mental effort such as reading, crosswords or Sudoku puzzles may stimulate more brain wiring and neuroplasticity.

There was a highly significant association between social activity and normal cognition. This result is in line with previous research [36]. Social interaction on a regular basis stimulates the mind and can enhance cognitive reserve.

Family history of cognitive impairment was found to have a significant association with neurocognitive disorders, being a positive predictor for both mild and major neurocognitive disorders. This is in agreement with previous studies [9,12,29], and emphasizes the hereditary component of neurocognitive disorders.

In the current study, the score of Activities of Daily Living Questionnaire (ADLQ) was associated with major NCD and correlated positively with MoCA total

score. This result is in line with previous research [37]. Difficulties in performing the activities of daily living may be due to the poor physical function and muscle strength coexisting with cognitive impairment in elderly.

## CONCLUSION

Mild NCD and major NCD have multiple risk factors, from which the most important are higher age, lower education, female gender, non-married status, unemployment and physical work, lower income, less physical, cognitive and social activities, increased number of chronic diseases and family history of cognitive impairment. Controlling modifiable risk factors can contribute to lowering burden of neurocognitive disorders.

## DECLARATIONS

**Conflicting interests:**
The authors declare no potential conflict of interest.
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## REFERENCES

1. **Morley J, Morris J, Berg-Weger M *et al.* (2015):** Brain health: the importance of recognizing cognitive impairment: an IAGG consensus conference. Journal of the American Medical Directors Association, 16(9):731-739.
2. **Bos I, Vos S, Frölich L *et al.* (2017):** The frequency and influence of dementia risk factors in prodromal Alzheimer's disease. Neurobiology of Aging, 56, 33-40.
3. **Roberts R, Cha R, Mielke M *et al.* (2015):** Risk and protective factors for cognitive impairment in persons aged 85 years and older. Neurology, 84(18):1854-1861.
4. **American Psychiatric Association (2013):** Diagnostic and Statistical Manual of Mental Disorders. https://psycnet.apa.org/record/2013-14907-000
5. **Rahman T, El Gaafary M (2009):** Montreal Cognitive Assessment Arabic version: reliability and validity prevalence of mild cognitive impairment among elderly attending geriatric clubs in Cairo. Geriatrics and Gerontology International, 9(1):54-61.
6. **Nasser R, Doumit J (2009):** Validity and reliability of the Arabic version of activities of daily living (ADL). BMC Geriatrics, 9: 1-7.
7. **Abou Gabal M (2023):** Assessing the Correlation between the Socioeconomic Level and Cognitive Function among Older Adults in Egypt (Doctoral dissertation, The American University in Cairo (Egypt)). https://fount.aucegypt.edu/etds/2132/
8. **Sabry N, Tadros G, Odejimi O (2021):** A systematic review of the prevalence of mental disorders, cognitive impairment and dementia amongst older adults populace in Egypt. BJPsych Open, 7(S1):S286-S286.
9. **Tawfik A, Hamza S, Adly N *et al.* (2024):** Pattern of cognitive impairment among community-dwelling elderly in Egypt and its relation to socioeconomic status. Journal of the Egyptian Public Health Association, 99(1):4.
10. **Assaf G, El Khoury J, Jawhar S *et al.* (2021):** Mild cognitive impairment and modifiable risk factors among Lebanese older adults in primary care. Asian Journal of Psychiatry, 65, 102828.
11. **Zhuang L, Yang Y, Gao J (2019):** Cognitive assessment tools for mild cognitive impairment screening. Journal of Neurology, 268:1615–1622
12. **Jia L, Du Y, Chu L *et al.* (2020):** Prevalence, risk factors, and management of dementia and mild cognitive impairment in adults aged 60 years or older in China: a cross-sectional study. The Lancet Public Health, 5(12):e661-e671.
13. **Moustafa S, Gaballah N, Heikal S *et al.* (2023):** Impact of family support on the cognitive functions of Egyptian elderly. https://www.medrxiv.org/content/10.1101/2023.03.02.23286696v1
14. **Abdelrahman H, El Gaafary M (2014):** Validation of Arabic version of Saint-Louis-University-Mental-Status (SLUMS)-Examination and prevalence of cognitive impairment in community dwelling Egyptian older adults. Middle East Journal of Age and Ageing, 83(1492):1-9.
15. **Chaaya M, Phung K, Atweh S *et al.* (2018):** Socio-demographic and cardiovascular disease risk factors associated with dementia: results of a cross-sectional study from Lebanon. Preventive Medicine Reports, 9: 1-5.
16. **Hayajneh A, Rababa M, Alghwiri A *et al.* (2020):** Factors influencing the deterioration from cognitive decline of normal aging to dementia among nursing home residents. BMC geriatrics, 20: 1-9.
17. **Sweed H, Tawfik H, Mohamed M (2016):** Cognitive impairment assessment by Mini cog test in Egyptian elderly patients and the relation with comorbidities and functional impairment. The Egyptian Journal of Geriatrics and Gerontology, 3: 1-3.
18. **Chen T, Yiao S, Sun Y *et al.* (2017):** Comorbidity and dementia: a nationwide survey in Taiwan. PLoS One, 12(4):e0175475.
19. **Ebrahimpur M, Sharifi F, Shadman Z *et al.* (2020):** Osteoporosis and cognitive impairment interwoven warning signs: community-based study on older adults—Bushehr Elderly Health (BEH) Program. Archives of Osteoporosis, 15: 1-9.
20. **Weber A, hung Mak S, Berenbaum F *et al.* (2019):** Association between osteoarthritis and increased risk of dementia: a systemic review and meta-analysis. Medicine, 98(10):e14355.
21. **Lange M, Joly F, Vardy J *et al.* (2019):** Cancer-related cognitive impairment: an update on state of the art, detection, and management strategies in cancer survivors. Annals of Oncology, 30(12):1925-1940.
22. **Hottman D , Chernick D, Cheng S *et al.* (2014):** HDL and cognition in neurodegenerative disorders. Neurobiology of Disease, 72: 22-36.

23. **Abdulsalam S, Aly M, Mousa S (2020):** Mild Cognitive Impairment in Obese Elderly. Master thesis. **DOI:** https://doi.org/10.3889/oamjms.2020.4245
24. **Natale G, Zhang Y, Hanes D *et al.* (2023):** Obesity in late-life as a protective factor against dementia and dementia-related mortality. American Journal of Alzheimer's Disease and Other Dementias®, 38: 15333175221111658.
25. **Smith L, Shin JI, Oh H *et al.* (2022):** Body mass index and mild cognitive impairment among middle-aged and older adults from low-and middle-income countries. Journal of Alzheimer's Disease, 85(3):1095-1105.
26. **Crespo T, Andrade J, de Farias L *et al.* (2020):** Adherence to medication, physical activity and diet among older people living with diabetes mellitus: correlation between cognitive function and health literacy. IBRO reports, 9: 132-137.
27. **Fadil H, Sammman W, Elshafie R (2023):** Prevalence of nonadherence to medications among geriatric patients in Al-Madinah Al-Munawara City's Hospitals, Kingdom of Saudi Arabia. International Journal of Clinical Practice, 1:5.
28. **Khater M, Abouelezz N (2011):** Nutritional status in older adults with mild cognitive impairment living in elderly homes in Cairo, Egypt. The Journal of Nutrition, Health and **A**ging, 15: 104-108.
29. **EL Tallawy H, Farghaly W, El Hamed M *et al.* (2019):** Prevalence of Alzheimer dementia in Upper Egypt (desert areas). The Egyptian Journal of Neurology, Psychiatry and Neurosurgery, 55: 1-6.
30. **Amer M, Mousa S, Khater M *et al.* (2012):** Prevalence of mild cognitive impairment among older adults living in Mansoura city, Egypt. Middle East Current Psychiatry, 19(1):3-7.
31. **Alkhawaldeh A, Alsaraireh M, ALBashtawy M *et al.* (2024):** Assessment of cognitive impairment and related factors among elderly people in Jordan. Iranian Journal of Nursing and Midwifery Research, 29(1):120-124.
32. **Elbadawy A, Mansour A, Abdelrassoul I *et al.* (2020):** Relationship between thyroid dysfunction and dementia. The Egyptian Journal of Internal Medicine, 32: 1-9.
33. **Barnes D, Yaffe K (2011):** The projected effect of risk factor reduction on Alzheimer's disease prevalence. The Lancet. Neurology, 10(9):819–828.
34. **Ros-Cucurull E, Cardona-Rubira C, García-Raboso E *et al.* (2017):** Cognitive impairment associated with drug use in old age people. European Psychiatry, 41(S1):s876-s876.
35. **Kumar M, Srivastava S, Muhammad T (2022):** Relationship between physical activity and cognitive functioning among older Indian adults. Scientific Reports, 12(1):2725.
36. **Salem G, Amin S, Elserafy T *et al.* (2020):** Prevalence, types and different predictors of Dementia, s diseases among people, community based study, Egypt. The Egyptian Family Medicine Journal, 4(2):64-79.
37. **Mohamed M, Sayed H (2022):** Intrinsic capacity factors and activities of daily living among older adults residents of geriatric homes. Egyptian Journal of Health Care, 13(2):718-736.