

Prevalence of dementia and mild cognitive impairment in Morocco: A population-based study

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Research Article

Keywords: Telephone mobile, Screening, Prevalence, Dementia, Mild Cognitive Impairment, Morocco

Posted Date: October 22nd, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-11054017/v1>

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Additional Declarations: No competing interests reported.

Abstract

Background

Dementia and mild cognitive impairment (MCI) represent growing public health concerns, particularly in low- and middle-income countries, where population-based epidemiological data remain limited. This study aimed to estimate the prevalence of dementia and MCI among Moroccan adults aged ≥ 60 years and to examine associated sociodemographic and health-related factors.

Methods

A nationwide cross-sectional telephone survey was conducted between March and June 2025 among 1,662 adults aged ≥ 60 years across all 12 administrative regions of Morocco. The target sample was allocated proportionally to regional population size, and mobile telephone numbers were randomly selected within regional pools using computerized selection. First-stage cognitive screening was conducted in Moroccan Darija using the telephone version of the Montreal Cognitive Assessment (T-MoCA) and the AD-8. Participants were considered screen-positive if they had a T-MoCA score ≤ 16 or an AD-8 score ≥ 2 . All screen-positive participants underwent a second-stage telephone assessment conducted by neurologists under the supervision of a senior professor of neurology. Diagnoses were established within the DSM-5 framework based on cognitive and functional assessment.

Results

Among the 1,662 participants, 388 screened positive and underwent second-stage assessment. Of these, 85 met the criteria for dementia and 303 for MCI. The crude prevalence of dementia was 5.1% (85/1,662; 95% CI: 4.15–6.28) and increased to 11.6% (95% bootstrap CI: 8.8–14.5) after weighting for age, sex, and region according to the 2024 Moroccan General Population and Housing Census. The corresponding crude and population-weighted prevalence estimates for MCI were 18.2% (303/1,662; 95% CI: 16.45–20.16) and 23.6% (95% bootstrap CI: 20.5–26.9), respectively.

Conclusion

This nationwide study provides epidemiological data on dementia and MCI among adults aged ≥ 60 years across all 12 administrative regions of Morocco. The findings indicate a substantial burden of cognitive impairment in the study sample and may contribute to future research and healthcare planning.

INTRODUCTION

Dementia represents a major public health challenge worldwide, particularly among older adults. The condition is characterized by a progressive decline in memory and other cognitive domains, frequently associated with behavioral and psychological disturbances, ultimately leading to loss of functional independence. Dementia is associated with high mortality and imposes significant emotional, social, and economic burdens on patients, caregivers, healthcare systems, and society as a whole [1].

Dementia is an umbrella term for several diseases that are mostly progressive. Alzheimer's disease, the most common form of dementia, represents 60–70% of cases. Other major forms include vascular dementia, dementia with Lewy bodies, and frontotemporal dementia [2].

Approximately 55.2 million people have dementia worldwide, with over 60% living in low- and middle-income countries, according to the Global Status Report on the Public Health Response to Dementia, 2021 [3], and the World Health Organization, 2017 [1]. Life expectancy is increasing in almost every country. Older age is strongly associated with a higher prevalence of dementia [4]. The number of people living with dementia is expected to rise to 78 million by 2030 [1]. In 2019, dementia was the seventh leading cause of death worldwide. It accounted for 1.6 million deaths and 28.3 million disability-adjusted life-years, according to the Global Status Report on the Public Health Response to Dementia (2021) [5]. In Morocco, based on our study's prevalence data and projected population growth, the number of people affected by dementia could reach approximately 300,000 by 2030. This projected local burden accentuates the need for prompt measures to successfully address and manage dementia in the country.

Approximately two-thirds of individuals living with dementia reside in low- and middle-income countries [6]. In Morocco, Alzheimer's disease is estimated to affect approximately 200 000 persons [7]. However, diagnosing dementia in Morocco continues to be challenging, with many cases likely remaining unrecognized. This study aims to estimate the dementia and the MCI prevalence in Morocco and examine the influence of sociodemographic factors.

METHODS

Targeted population:

Inclusion criteria:

In 2025, Morocco's population was 36,828,330 [8]. The study included individuals aged 60 years and older. The age threshold of 60 years was selected to reflect the Moroccan context, where population longevity remains lower than in many high-income countries and 60 years corresponds to the statutory retirement age for a substantial proportion of the population. Therefore, using a threshold of 60 years was considered appropriate for investigating dementia and MCI among older adults in the Moroccan population to provide an accurate assessment of dementia within this age group.

Exclusion criteria:

Telephone numbers corresponding to companies, public administrations, schools, or other organizations rather than individuals or residential households were considered ineligible. Individuals who explicitly declined to participate after answering the telephone were classified as refusals. Individuals were considered unreachable when no contact could be established after seven separate telephone call attempts. Individuals who answered the telephone but were unable to complete the interview because of a medical condition, a language or speech disorder, or severe hearing impairment that prevented effective telephone communication were also excluded. Individuals of non-Moroccan nationality were excluded, as the target population of the study was Moroccan adults aged 60 years and older.

Sampling process:

The sample size was calculated using the formula for cross-sectional surveys having qualitative variables [9].

Sample size = $(Z_{1-\alpha/2}^2 p(1-p))/d^2$

$Z_{1-\alpha/2}$ refers to a standard normal variate, which is a value used in statistics when calculating sample size. A type 1 error at 5% means there's a 5% chance of incorrectly declaring a result significant ($P < 0.05$). In this formula, $Z_{1-\alpha/2} = 1.96$ corresponds to a 95% confidence level. The expected prevalence (p) was set at 3.5%, based on available epidemiological data, and the absolute precision (d) was set at 1%. The minimum required sample size was therefore estimated at 1,298 participants. To account for potential non-response and incomplete data, the sample size was increased by 20% to 1,558 participants. Ultimately, 1,662 participants were included in the study.

The telephone sampling frame consisted of mobile telephone numbers provided by the professional call center "AFCOTEC Services Casablanca" responsible for the first-stage survey. The call center maintained a separate pool of mobile telephone numbers for each of the 12 administrative regions and could assign each number to its corresponding region. Within each regional pool, mobile telephone numbers were selected randomly using computerized software. The target number of participants allocated to each region was proportional to the population size of that region. Data were collected between March and June 2025.

Number of mobile telephone calls/contacts and achieved participants by region: Rabat-Salé-Kénitra: 224; Casablanca-Settat: 352; Marrakesh-Safi: 224; Drâa-Tafilalet: 21; Dakhla-Oued Ed-Dahab: 22; Béni Mellal-Khénifra: 40; Guelmim-Oued Noun: 21; Fès-Meknès: 224; Oriental: 112; Souss-Massa: 144; Tanger-Tétouan-Al Hoceïma: 187; Laâyoune-Sakia El Hamra: 31.

Rabat-Salé-Kénitra (18,194 km²; 5,088,656 people) is in the northwest, bordering the Atlantic Ocean. Rabat is both the regional and national administrative capital. Casablanca-Settat, the largest economic region (20,166 km²; 7,651,096 people), has Casablanca as its

capital. Marrakesh-Safi, also in the northwest (39,167 km²; 4,864,187 people), has Marrakesh as its capital. Daraa-Tafilalet, with Errachidia as its capital, covers 105,383 km² and has a population of 1,643,144. Dakhla-Oued Ed-Dahab, in the far south, spans 142,865 km² and has a population of 186,611. Béni Mellal-Khénifra lies in central Morocco, on the Tadla plain between the High Atlas and Middle Atlas Mountains, with a population of 2,510,799 over 28,374 km². Guelmim-Oued Noun, bordering Souss-Massa (north), Laâyoune-Sakia El Hamra (south), Algeria and Mauritania (east), and the Atlantic Ocean (west), has a population of 417,663 across 58,268 km² as of 2024.

Procedure and data collection:

The flowchart in Fig. 1 summarizes all steps followed to collect data:

Flow diagram

Flow diagram

Records removed before the screening:

- Autoresponder records (n = 333).
- Busy lines (n = 520).
- Records without response (n = 701).
- lines of companies; associations; offices; and those who refuse to participate in the study (n = 3549)
- Duplicated case = 0

Telephone calls automatically launched by the system

(N = 6765)

Phase I : Screening

Respondent who met the inclusion criteria and which participated in the study.

(N = 1662)

Non-suspect cases according to the first screening questionnaire: (N = 1274)

Suspected cases: (N = 388)

Phase II : Diagnosis

People with dementia (N = 85)

People with MCI (N = 303)

Figure 1. Flow diagram of participant recruitment, screening, and diagnostic confirmation.

Screening step:

The T-MoCA used in this study was administered in Moroccan Darija. It was derived from the culturally adapted Moroccan MoCA by retaining the items that could be administered by telephone and had a maximum score of 22 points. The T-MoCA assesses cognitive domains that can be evaluated remotely and was used as a screening rather than a diagnostic instrument [10, 14, 15].

Before the nationwide survey, the feasibility and performance of telephone administration were evaluated in a pilot study involving 60 Moroccan adults aged ≥ 60 years in the Kénitra region. Mean scores were 15.47 ± 4.85 for telephone administration and 16.27 ± 4.30 for paper administration, with no statistically significant between-group difference ($p = 0.49$). This pilot evaluation assessed feasibility and comparability of mean performance and was not used as an independent ROC validation of the T-MoCA cut-off.

The AD-8 was developed in response to the need for a brief, reliable instrument to differentiate normal cognitive aging from very mild dementia. Conventional cognitive tests are often not very sensitive at this early stage, whereas caregiver-report measures may prove more effective. The instrument was developed by combining expert clinical judgment and statistical modeling at Washington University in St. Louis [12]. The AD-8 consists of eight items that enable clinicians to quickly identify cognitive impairment. It takes an average of 3 minutes to administer; the items require dichotomous (yes/no) responses and can be grouped into four conceptual domains: memory, endurance, executive functions, and complex functions [13].

At the beginning of each telephone contact, the age of the respondent was ascertained to determine eligibility. When the mobile phone owner was aged 60 years or older and agreed to participate, the T-MoCA was administered directly to the participant. When the person answering the selected mobile number was younger than 60 years, that individual was not eligible for cognitive screening. However, if an individual aged 60 years or older was present and agreed to participate, that older individual could participate and completed the T-MoCA.

Whenever a family member was available, the AD-8 was administered to the family member as an informant regarding the participant's cognitive and functional changes. When no family informant was available, the participant completed the AD-8 directly. When a younger family member initially answered the telephone and an eligible older participant was present, the younger family member could provide the AD-8 information while the older participant completed the T-MoCA.

A T-MoCA score ≤ 16 was predefined as a positive cognitive screening result. This operational threshold was proportionally derived from the MoCA threshold of $\leq 23/30$, taking into account the reduced maximum score of 22 points for the telephone version ($23 \times 22/30 = 16.86$). Furthermore, a comparable threshold has been used in previous epidemiological surveys employing the T-MoCA, supporting its use as an operational screening cut-off in the present study. For the AD-8, a score ≥ 2 was considered a positive screen for suspected cognitive impairment according to the established reference for the instrument [12]. The instruments were used in parallel; a participant was classified as screen-positive if either the T-MoCA score was ≤ 16 or the AD-8 score was ≥ 2 .

Among the 1,662 participants who completed first-stage screening, 388 met at least one of the predefined screening criteria (T-MoCA ≤ 16 or AD-8 ≥ 2) and were referred for second-stage confirmatory assessment.

Before data collection began, call-center staff received specific training on the screening procedure from the supervising senior professor of neurology. Training covered administration of the T-MoCA and AD-8 item by item, including standardized wording and sequence of questions and recording of responses. At the beginning of data collection, administration of the screening instruments by call-center staff was supervised by the senior professor of neurology to ensure that procedures were correctly and consistently applied.

Participants with severe hearing impairment that made telephone communication and completion of the cognitive assessment impossible were excluded. Participants with less severe hearing impairment were eligible when the interview remained feasible; interviewers could increase voice volume and, when necessary, assistance from an accompanying person was used to facilitate communication. Visual impairment was based on participant-reported visual difficulties and did not preclude participation because the T-MoCA retained only items that could be administered without visual material.

Confirmation step:

All 388 participants who screened positive during the first stage underwent a second telephone interview conducted exclusively by neurologists under the supervision of a senior professor of neurology. Cognitive symptoms were reassessed and functional impairment was explored through structured questions addressing whether cognitive difficulties had resulted in loss of independence, inability to manage personal finances, behavioral disturbances attributable to the cognitive disorder, cessation of occupational activities because of cognitive difficulties, or impairment of social or family relationships.

Functional impairment was assessed through these structured questions rather than through a standardized ADL/IADL scale. Cognitive and functional findings were considered together within the DSM-5 diagnostic framework. Cognitive impairment associated with loss of independence or significant interference with everyday functioning supported a diagnosis of Major Neurocognitive Disorder (dementia), whereas cognitive impairment with preserved functional independence supported a diagnosis of Mild Neurocognitive Disorder (hereafter referred to as mild cognitive impairment [MCI]).

The neurologists conducting the confirmatory assessment had access to the first-stage T-MoCA and AD-8 results and were therefore not blinded to screening status. Potential alternative or contributing explanations for cognitive symptoms, including depression and other relevant psychiatric conditions, current medication use, and potential medication-related effects, were explored clinically; no

standardized psychiatric assessment scale was administered. The initial diagnostic classification was made by the neurologist conducting the assessment. Cases in which classification was uncertain or required further discussion were reviewed with the supervising senior professor of neurology, who made the final diagnostic decision. Of the 388 screen-positive participants, 85 met criteria for dementia, and 303 for MCI.

Statistical analysis:

Crude prevalence estimates were calculated as the proportion of participants meeting the diagnostic criteria for dementia or MCI. To account for differences between the study sample and the demographic structure of the target population, prevalence estimates were weighted using iterative proportional fitting (raking). The weighting procedure calibrated the sample to the age (60–69 and ≥ 70 years), sex, and administrative-region distributions of the Moroccan population aged ≥ 60 years, based on the 2024 General Population and Housing Census (RGPH 2024) of the High Commission for Planning (HCP). Weighted prevalence estimates were calculated for dementia and MCI, with 95% confidence intervals derived from 1,000 bootstrap replications. Sensitivity analyses limiting extreme weights were also performed to assess the robustness of the weighted estimates.

Factors such as age, sex, occupation, education, and urban or rural residence were examined. Additionally, information on ongoing medical treatment and medication use was collected to assess their potential associations with cognitive outcomes. Conventional univariate binary logistic regression, a statistical analysis that examines relationships between two groups and predictor variables, was used to assess the association between dementia and each explanatory variable. For the multivariate model, we included variables that were significantly associated with dementia or mild cognitive impairment in univariate analysis ($P < 0.05$). Specifically, the covariates included in the multivariate logistic regression were age, sex, education level, place of residence (urban vs. rural), occupation category, diabetes, hypertension,

cardiovascular diseases, gait disturbance, vision and hearing loss, smoking, alcohol use, and history of stroke or sleep disorder. These variables were selected based on statistical significance in univariate testing and established relevance in the scientific literature as potential confounders of associations with cognitive outcomes. We adopted a parsimonious regression model by removing non-significant variables using a backward-elimination approach to boost model fit and efficiency. For all analyses, 95% confidence intervals were calculated from the best-fitting model. A two-sided P -value < 0.05 was considered statistically significant. Statistical software used for analyses: Data analysis was carried out using IBM SPSS Statistics version 27.0.1.

The target sample was allocated across the 12 administrative regions proportionally to regional population size.

RESULTS

Sociodemographic parameters:

Table 1 presents the sociodemographic data for 1,662 participants. The mean age of the participants was 65.41 years (± 3.67). The youngest participant was 60 years old, and the oldest was 83 years old. The prevalence by region is shown in Fig. 2.

Screening and confirmatory steps:

Automated calls were made to mobile telephone numbers randomly selected by computerized software within regional pools provided by the professional call center “AFCOTEC Services Casablanca. A total of 1,662 respondents met the eligibility criteria and completed the first-stage screening. Among the 1,662 participants who completed first-stage screening, 388 met at least one predefined screening criterion ($T\text{-MoCA} \leq 16$ or $AD\text{-}8 \geq 2$) and underwent second-stage telephone assessment by neurologists. Of these, 85 met the confirmatory criteria for dementia, 303 for MCI.

The crude prevalence of dementia was 5.1% ($85/1,662$; 95% CI: 4.15–6.28). After calibration to the age, sex, and regional distribution of the Moroccan population aged ≥ 60 years according to the 2024 General Population and Housing Census (RGPH 2024), the weighted prevalence was 11.6% (95% bootstrap CI: 8.8–14.5). The crude prevalence of MCI was 18.2% ($303/1,662$; 95% CI: 16.45–20.16), whereas the corresponding population-weighted prevalence was 23.6% (95% bootstrap CI: 20.5–26.9).

Table 1

Sociodemographic characteristics of total respondents (N = 1662), persons with dementia (n = 85), and persons with MCI (n = 303).

Sociodemographic characteristics		Whole sample N = 1662		Persons with Dementia N = 85		Persons with M.C.I N = 303		Person Normal N = 1274	
		Number (N)	(%)	Number (N)	(%)	Number (N)	(%)	Number (N)	(%)
<i>Residence</i>	Rural	574	34,5	47	8,2	171	29,8	356	62,0
	Urban	1088	65,5	38	3,5	132	12,1	918	84,4
<i>Gender</i>	female	692	41,6	54	7,8	190	27,4	448	64,7
	Male	970	58,4	31	3,2	113	11,6	826	85,1
<i>Education level</i>	Analphabetete	152	9,1	27	17,8	80	52,6	45	29,6
	Primary	327	19,7	32	9,8	124	37,9	171	52,3
	College	407	24,5	17	4,2	63	15,5	327	80,3
	Secondary	470	28,3	7	1,5	34	7,2	429	91,3
	University	306	18,4	2	0,6	2	0,6	302	98,7
<i>Age groups</i>	60–64 y	714	43	11	1,5	84	11,8	619	86,7
<i>Average: 65,41 year; SD:3,67.</i>	65–69 y	744	44,8	32	4,3	161	21,6	551	74,1
	≥ 70 y	204	12,3	42	20,6	58	28,4	104	51
<i>Profession</i>	Unemployed	9	0,5	1	11,1	0	0,0%	8	88,9
	Housewife	436	26,2	46	10,5	163	37,4	227	52,1
	Farmer or Artisan	474	28,5	24	5,1	92	19,4	358	75,5
	Laborer or Employee	49	2,9	0	0,0	3	6,1	46	93,9
	Retirement	662	39,8	13	2,0	42	6,3	607	91,7
	Officials and employees	32	1,9	1	3,1	3	9,4	28	87,5
<i>Gait</i>	Normal gait	1469	88,4	43	2,9	236	10,0	1190	81,0
	Abnormal gait	193	11,6	42	21,8	67	34,7	84	43,5
<i>High blood pressure</i>	No	1236	74,4	46	3,7	213	17,2	977	79,0
	Yes	426	25,6	39	9,2	90	21,1	297	69,7
<i>Diabetis</i>	No	1105	66,5	29	2,6	143	12,9	933	84,4
	Yes	557	33,5	56	10,0	160	28,7	341	61,2
<i>cardiovascular problems</i>	No	1426	85,8	65	4,6	242	17	1119	78,5
	Yes	236	14,2	20	8,5	61	25,8	155	65,7
<i>Stroke</i>	No	1653	99,5	84	5,0	302	18,23	1267	76,6
	Yes	9	0,5	1	11,1	1	11,1	7	77,8
<i>Hereditary Alzheimer's</i>	No	1646	99,0	83	5,0	301	18,3	1262	76,7
	Yes	16	1,0	2	12,5	2	12,5	12	75,00
<i>sleep problems</i>	No	1555	93,6	76	4,9	279	17,9	1200	77,2

	Yes	107	6,4	9	8,4	24	22,4	74	69,2
Tobacco and alcohol users	No	1318	79,3	64	4,8	243	18,4	1011	76,7
	Yes	344	20,7	21	6,1	60	17,4	263	76,4
Vision and Hearing impairment	No	756	45,5	12	1,6	110	14,5	634	83,9
	Yes	906	54,5	73	8,0	193	21,3	640	70,6

Table 2
Results of univariate and multivariate analysis for dementia and Mild Cognitive Impairment

Univariate and multivariate analysis	Odds Ratio				95% Confidence Interval				P-value			
	Dementia		MCI		Dementia		MCI		Dementia		MCI	
Uni	Multi	Uni	Multi	Uni	Multi	Uni	Multi	Uni	Multi	Uni	Multi	
Residence	2.464	1.566	3.073	1.667	1.587–3.827	0.923–2.656	2.381–3.966	1.230–2.260	< 0.001	0.096	< 0.001	0.001
Sex	2.564	3.611	2.870	2.456	1.630–4.033	1.624–8.026	2.219–3.714	1.633–3.694	< 0.001	0.002	< 0.001	< 0.001
Education level	2.383	1.502	2.760	2.210	1.933–2.937	1.139–1.981	2.420–3.147	1.874–2.606	< 0.001	0.004	< 0.001	< 0.001
Age: 60–64 years (ref.)	–	–	–	–	–	–	–	–	–	–	–	–
65–69 years	2.874	1.642	2.070	1.420	1.437–5.747	0.780–3.460	1.555–2.762	1.009–2.000	0.003	0.224	< 0.001	0.024
≥ 70 years	16.667	4.587	2.976	1.210	8.333–33.333	1.873–11.236	2.037–4.348	0.567–1.721	< 0.001	0.001	< 0.001	0.763
Profession	1.803	1.070	1.984	1.122	1.470–2.211	0.789–1.451	1.764–2.232	0.949–1.326	< 0.001	0.663	< 0.001	0.179
Gait	0.108	0.378	0.360	0.828	0.069–0.171	0.211–0.680	0.259–0.499	0.531–1.291	< 0.001	0.001	< 0.001	0.405
High blood pressure	2.607	1.326	1.286	0.840	1.676–4.055	0.795–2.210	0.977–1.695	0.605–1.168	< 0.001	0.280	0.073	0.300
Diabetes	4.147	1.468	2.711	1.700	2.616–6.575	0.864–2.495	2.103–3.495	1.249–2.314	< 0.001	0.156	< 0.001	0.001
Cardiovascular problems	1.939	0.985	1.705	1.414	1.151–3.265	0.536–1.809	1.235–2.355	0.955–2.092	0.013	0.961	0.001	0.083
Stroke	2.335	0.992	0.559	0.502	0.289–18.885	0.106–9.316	0.070–4.488	0.044–5.784	0.427	0.994	0.584	0.580
Sleep problems	1.787	1.536	1.322	1.408	0.869–3.674	0.679–3.475	0.825–2.121	0.816–2.429	0.114	0.303	0.246	0.219
Tobacco and alcohol users	1.274	2.246	0.935	1.812	0.767–2.117	1.046–4.822	0.685–1.276	1.184–2.773	0.350	0.038	0.670	0.006
Vision and hearing impairment	5.433	2.524	1.590	0.911	2.927–10.085	1.281–4.976	1.229–2.056	0.664–1.250	< 0.001	0.007	< 0.001	0.564

Note: $p \leq 0.05$ indicates statistical significance.

Prevalence of dementia and MCI:

Among the 1,662 participants surveyed, 85 individuals were diagnosed with dementia and 303 with MCI, corresponding to crude prevalence estimates of 5.1% (95% CI: 4.15–6.28) and 18.2% (95% CI: 16.45–20.16), respectively. After weighting for age, sex, and administrative region according to the demographic distribution of the Moroccan population aged ≥ 60 years, the estimated prevalence increased to 11.6% for dementia (95% bootstrap CI: 8.8–14.5) and 23.6% for MCI (95% bootstrap CI: 20.5–26.9). As detailed in Table 1,

cognitive impairment showed a marked age-related increase. The crude prevalence of dementia and MCI increased from 1.54% and 11.76%, respectively, among participants aged 60–64 years, to 4.3% and 21.63% among those aged 65–69 years, and reached 20.5% and 28.43% among those aged ≥ 70 years. This strong age gradient, together with the underrepresentation of participants aged ≥ 70 years in the study sample relative to the national population, largely explains the higher population-weighted prevalence estimates.

Univariate Analysis:

Table 2 presents the results of the univariate and multivariate logistic regression analyses, identifying several factors significantly associated with dementia and mild cognitive impairment (MCI).

Increasing age emerged as the strongest association, with the odds of dementia rising two- to sixteen-fold across age groups and the odds of MCI approximately doubling. Female sex was associated with a higher likelihood of both dementia and MCI. Higher educational attainment showed a significant inverse association, whereas low education or illiteracy was associated with nearly twice the odds of cognitive impairment. Rural residence was associated with a twofold higher odd of dementia and a threefold higher odd of MCI compared with urban residence. Occupational status was also significantly associated with cognitive outcomes, with lower odds observed among participants in higher-responsibility occupational categories. Among clinical factors, abnormal gait, diabetes, cardiovascular disease, hypertension, and sensory impairments were significantly associated with cognitive impairment. Diabetes was associated with higher odds of dementia fourfold and MCI twofold, while cardiovascular disease was associated with approximately twofold higher odds of dementia and MCI in the univariate analysis. Hypertension was significantly associated with dementia but not MCI. Vision and hearing impairments showed the strongest observed associations, increasing the odds of dementia approximately fivefold and MCI by 1.5-fold. In contrast, stroke, sleep disorders, smoking, and alcohol consumption were not significantly associated with dementia or MCI in the univariate analysis. Although the odds ratio for stroke suggested higher odds of dementia, this association was not statistically significant.

Multivariate Analysis:

Table 2 summarizes the multivariate logistic regression analysis. Age remained a significantly associated factor, with individuals aged 65–69 years showing a twofold higher odds of MCI, while those aged ≥ 70 years had a fivefold higher odds of dementia. Female sex was independently associated with both conditions, with women exhibiting approximately three times the odds of dementia and twice the odds of MCI compared with men. Low educational attainment remained significantly associated with both cognitive outcomes, with approximately twofold higher odds of MCI and 50% higher odds of dementia. Rural residence was not independently associated with dementia after adjustment. Normal gait showed an inverse association, particularly against dementia, whereas abnormal gait was significantly associated with dementia. Diabetes remained independently associated with MCI, whereas its association with dementia was no longer statistically significant after adjustment. Tobacco and alcohol use were significantly associated with both outcomes in the multivariate model, with approximately twofold higher odds of dementia and 80% higher odds of MCI. Vision and hearing impairments were strongly associated with dementia, with approximately 2.5-fold higher odds, whereas no significant association was observed with MCI. Occupational status, cardiovascular disease, hypertension, stroke, and sleep disorders were not independently associated with either dementia or MCI after adjustment, although some showed modest, non-significant differences in odds.

DISCUSSION

This study provides nationwide epidemiological data on dementia and MCI among adults aged 60 years and older across all 12 administrative regions of Morocco. The crude prevalence observed in the study sample was 5.1% for dementia and 18.2% for MCI. These estimates should be interpreted in light of the sampling and methodological characteristics of the study.

An important finding of the present study is the difference between crude and population-weighted prevalence estimates. The crude prevalence of dementia was 5.1%, whereas the prevalence increased to 11.6% after weighting for age, sex, and administrative region according to the demographic structure of the Moroccan population aged ≥ 60 years. Similarly, MCI prevalence increased from 18.2% to 23.6% after weighting. This difference was largely driven by the age distribution of the study sample, in which individuals aged 60–69 years were overrepresented and those aged ≥ 70 years were underrepresented compared with the national population. Because the prevalence of cognitive impairment, particularly dementia, increased markedly with age in our sample, the crude estimates underestimated the burden that would be expected after accounting for the demographic structure of the target population. The weighted estimates may therefore provide a more representative approximation of the population burden of dementia and MCI among Moroccan adults aged ≥ 60 years, although they should be interpreted in light of the increased statistical uncertainty introduced by weighting.

The target sample was allocated proportionally to regional population size, and mobile telephone numbers were randomly selected within regional pools using computerized selection. The two-stage design combined initial cognitive screening with a subsequent clinical assessment of screen-positive participants by neurologists.

Telephone-based cognitive assessments help identify dementia and MCI when in-person evaluation is not possible. Research conducted by Herrer Abdulrahman and his group in the Netherlands has revealed that, in a senior population, the Telephone Interview for Cognitive Screening (TICS) was a relevant diagnostic screening tool for ruling out dementia [16].

Tools like the phone MoCA and the "Ascertain Dementia 8-item Informant Questionnaire" are useful for assessing older adults during health emergencies, such as the COVID-19 pandemic. A study conducted by Marcio Soto-Añari and his team showed that the psychometric properties of the MoCA (Montreal Cognitive Assessment) and AD-8 tools were reliable, particularly during health emergencies, when telemedicine and tele-neuropsychology were indispensable for monitoring and assessing older adults [17].

Telephone interviews allow coverage of large geographical areas and can reduce logistical barriers to participation. However, telephone-based sampling does not inherently reduce selection bias and may introduce coverage bias when individuals without access to the sampling frame are excluded. However, this mode of assessment introduces several important limitations. Telephone-based assessments of cognitive status are generally less accurate than in-person assessments. There is a risk of misclassification due to the inability to directly observe nonverbal cues, perform certain hands-on neurological or cognitive tests, or assess functional abilities more thoroughly, which can lead to underestimation or overestimation of dementia and MCI cases. Furthermore, telephone

screening is associated with specific problems, such as hearing loss that limits testing and an inability to use the telephone as a functional consequence of cognitive impairment [18]. Telephone screening for dementia has acceptable sensitivity and specificity and offers considerable advantages in participant access, especially in low- and middle-income countries [19]. Nevertheless, researchers must interpret the findings taking these limitations into account and consider complementary strategies to reach underrepresented populations in future studies.

Age is strongly associated with dementia and MCI, with the prevalence of both conditions increasing substantially with advancing age [1]. This age-related pattern has been consistently reported across epidemiological studies [20, 21].

For example, a prevalence study in Australia found that dementia incidence increases rapidly with age. There were fewer than 1 case per 1,000 Australians under 60, 71 per 1,000 among those aged 75–79, and 428 per 1,000 among those aged 90+ [22].

Our findings are consistent with the literature showing a strong association between advancing age and the prevalence of neurocognitive disorders. In the univariate analysis, age was found to be significantly associated with both of these clinical conditions, dementia and mild cognitive impairment (MCI), across both age groups. In the multivariate analysis, however, age retained a statistically significant association with dementia only in the ≥ 70 age group, whereas its association with MCI was observed in the 65–69 age group.

Examination of age-stratified data (Table 1) highlights a progressive relationship between advancing age and the prevalence of both conditions. Specifically, the prevalence of dementia and MCI was 1.5% and 11.8%, respectively, in the 60–64 age group; 4.3% and 21.6% in the 65–69 age group; and 20.6% and 28.4%, respectively, among individuals aged 70 years and older. These data show a progressive and significant increase in the prevalence of neurocognitive disorders as a function of age.

Sex differences have been reported in the prevalence of dementia and MCI, with distinct patterns observed between men and women across populations. In the Swedish brief report, they examined sex differences among 16,926 women and men aged 65+ in the Swedish Twin Registry. The male percentage with dementia is 18.54%, and the female percentage is 25.16% [23]. Women have been reported to have a higher lifetime prevalence of dementia than men [24]. One possible explanation is the longer life expectancy of women compared with men. Because dementia prevalence increases substantially with advancing age, greater longevity may partly contribute to the higher prevalence observed among women [25]. In our study, the mean age of participants was 65.41 ± 3.67 years (range: 60–83 years). The prevalence of dementia and MCI among men was 3.2% and 11.6%, respectively, compared with 7.8% and 27.4% among women. A similar sex difference has been reported in India, where dementia prevalence was 9.03% among women compared with 5.77% among men [26].

Educational attainment has also been consistently associated with dementia and MCI. Maccora et al. reported an association between lower educational attainment and higher dementia prevalence, while emphasizing that heterogeneity in the definition and measurement of education complicates comparisons across studies and the formulation of clear policy recommendations [27]. Reporting years of

schooling or literacy level may therefore facilitate cross-study comparisons. Higher educational attainment has generally been associated with lower odds of dementia, although the strength and consistency of this association may vary across populations and settings. Occupational characteristics may also be associated with cognitive outcomes; individuals engaged in medium- to high-complexity occupations have been reported to show lower rates of dementia than those in less complex occupations [28].

A comparison of our prevalence rates with those of North African countries shows that most have rates nearly identical to Morocco's. The Hajem team in 2014 found that dementia affected 4.6% of people over the age of 65 in Tunisia [29].

In Algeria, a prevalence of 4.19% was observed among people aged 60 and older [30]; a systematic review of the MENA region found a prevalence of 4.93% [31]. In Egypt, the prevalence of dementia ranged from 2.01% to 5.07% and increased with age, particularly among those over 80 years of age [32]. These rates are nearly identical and similar to those reported in our study in Morocco. The same review of the MENA region found a prevalence of 6.86% [31].

Comparisons with prevalence estimates from other countries should be interpreted cautiously because differences in age structure, sampling strategies, diagnostic procedures, and the use of crude versus standardized or weighted estimates can substantially influence reported prevalence.

The pooled crude prevalence of dementia in Nigeria was 4.9%, with prevalence significantly higher in women (6.7%) compared to men (3.1%) [24]. The overall prevalence of dementia in Benin was 3.7%. The prevalence increased with age and was higher among women than men [33].

Some European estimates reported prevalence rates of approximately 2.1%–2.44% [34]. Direct comparison with the present estimate should be made cautiously because differences across studies may reflect age distributions, sampling frames, diagnostic criteria, screening instruments, educational profiles, and study periods rather than healthcare-system characteristics alone.

The variability observed across North African studies may partly reflect differences in study populations, age thresholds, sampling procedures, cognitive screening instruments, diagnostic definitions, and whether estimates were crude or standardized. These methodological differences limit direct comparison of prevalence estimates across countries.

In Japan, over the next 25 years, the prevalence of dementia among people aged 65 years and over would exceed 25% nationwide, including metropolitan areas, with a time lag from rural areas [35]. Japan is one of the world's most affected countries due to its status as a "super-aged society." As of 2024, more than 29.3% of Japan's population is aged 65 or older, a proportion projected to exceed one-third by 2045 [36].

In 2022, 4.0% of adults in the United States aged 65 and older reported ever having received a dementia diagnosis. The percentage of adults with a dementia diagnosis was similar for men (3.8%) and women (4.2%). The percentage of adults with a dementia diagnosis increased with age, from 1.7% in those aged 65–74 to 13.1% in those aged 85 and older, and decreased with rising education level, from 7.9% in adults aged 65 and older with less than a high school diploma to 2.2% in those with a college degree or higher. Overall, the number of older adults with a dementia diagnosis did not differ significantly by interview mode (telephone or in person) [37].

The meta-analysis showed that the prevalence of dementia in China was 6%, and the prevalence of Alzheimer's disease (AD) was 5%. The subgroup analysis showed that the prevalence rates of dementia in rural (6%) and urban areas were similar (6%). Deaths due to dementia increased over time [38].

The estimated dementia prevalence for adults ages 60 + in India is 7.4% (8.8 million Indians), with significant differences by age 60–64y, $P = 2.94\%$; 70–74y, $P = 10.30\%$; 85 + y, $P = 25.41\%$; and by sex: male 5.77%, female 9.03%; and urban 5.34%, rural 8.35% differences [26].

A community-based study in Saudi Arabia was conducted by the team of Alkhunizan in 2018 on a sample of 171 subjects with a mean age of 67 ± 6 years. The prevalence of dementia was 6.4%, and that of MCI was 38.6% [39]. In the Kingdom of Saudi Arabia, dementia was identified in 3.37% of participants. The most prevalent subtype was late-onset Alzheimer's disease (35.6%), followed by unspecified dementia (18.4%). Significant differences between sexes were observed [40].

A systematic review has shown that prevalence studies indicate dementia is common in Middle-East countries, with rates ranging from 1.1% to 2.3% among people aged 50 and older and from 13.5% to 18.5% among those aged 80 and older [41]. Similarly, comparisons with studies conducted outside North Africa should take into account differences in demographic structure, educational characteristics, study periods, case ascertainment methods, and standardization procedures.

Several limitations should be considered when interpreting our findings. First, although population weighting improved the demographic representativeness of the prevalence estimates, the substantial underrepresentation of participants aged ≥ 70 years required relatively large weights for some observations, thereby increasing statistical uncertainty. Nevertheless, sensitivity analyses limiting extreme weights yielded broadly consistent estimates, supporting the robustness of the main weighted findings. Furthermore, despite the random selection of telephone numbers by computerized software within regional pools, the extent to which the available mobile-number pools covered all eligible Moroccan adults aged ≥ 60 years could not be independently quantified; some degree of coverage or selection bias therefore cannot be excluded. Third, cognitive screening was conducted remotely by telephone. Participants with severe hearing impairment preventing effective telephone communication were excluded, whereas those with less severe hearing impairment were included when communication remained feasible, sometimes requiring increased voice volume or assistance from an accompanying person. Hearing difficulties may therefore have influenced telephone-based cognitive performance and contributed to misclassification. Sensory impairments were participant-reported rather than established using standardized audiometric or ophthalmological assessment. Fourth, although the T-MoCA was derived from the culturally adapted Moroccan MoCA and telephone administration was evaluated in a preliminary pilot study, the operational cut-off of ≤ 16 was not independently established through ROC analysis in the present nationwide sample. Fifth, the AD-8 was preferably administered to a family informant; when no family informant was available, it was completed directly by the participant, and this variation in administration may have affected screening performance. Sixth, functional impairment in the second-stage assessment was evaluated through structured clinical questions rather than a standardized ADL/IADL instrument. Psychiatric conditions and potential medication-related effects were explored clinically by neurologists, but no standardized psychiatric instrument was administered. The neurologists conducting the confirmatory assessment had access to the first-stage screening results and were therefore not blinded. Finally, because the study was cross-sectional, the observed associations cannot establish temporal or causal relationships between the investigated factors and dementia or MCI.

Despite these limitations, the study provides data from all 12 administrative regions of Morocco and used a two-stage design combining initial cognitive screening with subsequent clinical assessment of screen-positive participants by neurologists.

CONCLUSION

This nationwide cross-sectional study provides epidemiological data on dementia and mild cognitive impairment among adults aged ≥ 60 years across all 12 administrative regions of Morocco. The crude prevalence was 5.1% for dementia and 18.2% for MCI, while population weighting for age, sex, and administrative region yielded prevalence estimates of 11.6% and 23.6%, respectively. The difference between crude and weighted estimates highlights the importance of accounting for the demographic structure of the target population, particularly the age distribution, when estimating the burden of cognitive impairment. Several sociodemographic, lifestyle, sensory, and health-related characteristics were associated with cognitive outcomes. These findings contribute to a better characterization of cognitive impairment among older adults in Morocco and may help inform future epidemiological research and healthcare planning. Given the cross-sectional design and other methodological limitations, the findings should nevertheless be interpreted with appropriate caution. Further population-based longitudinal studies using standardized diagnostic assessments are warranted to confirm these estimates and better characterize factors associated with cognitive decline among older adults in Morocco.

Declarations

Statement of Ethics:

Investigators obtained verbal consent for both the initial survey and the follow-up diagnostic calls, ensuring that participants understood the purpose and voluntary nature of their involvement. Consent was documented by recording verbal confirmations during calls, with the audio files securely stored in a database accessible only to the study team. The study was registered as a thesis project and received approval from the Doctoral Studies Center at Sidi Mohammed Ben Abdellah University. There were no anticipated risks to participants. Informed consent included a thorough explanation of the objectives, procedures, potential risks, and participants' rights, including the right to withdraw at any time without consequence. Confidentiality was emphasized throughout the process, with all data kept secure and available only to the study team. This careful approach was designed to respect participants' autonomy and privacy, while fostering trust and transparency throughout the study.

Conflict of Interest Statement:

“The authors have no conflicts of interest to declare.”

Zouhayr Souirti

Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation.

Funding Sources:

This study was supported by the Moroccan Society of Clinical Neurophysiology.

Author Contribution

A. B. Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation. Z. S. Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation.

Acknowledgement

We thank the Ministry of Health for its guidance, logistics, and valuable collaboration on this study, namely Omar Bouram, Hanane Nechchach, Malika Mernissi, Nada El Mamoun, and Abdelghani Dghimer. Their contribution was essential to our work and to advancing cognitive health research in Morocco. We would also like to thank the resident doctors and PhD. Students for their contribution to the success of this national project, namely Nada El Yaagoubi, Imane Khydor, Ikram Laamouri, Mansour Fatima Zahrae, Chaymae Ait Hsine, El Mehdi Abiza, Imane Lamrani, Safae Farrai, Marouane Mergaoui, Said El Aakri, Doaae Charkani El Hassani.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

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Figures

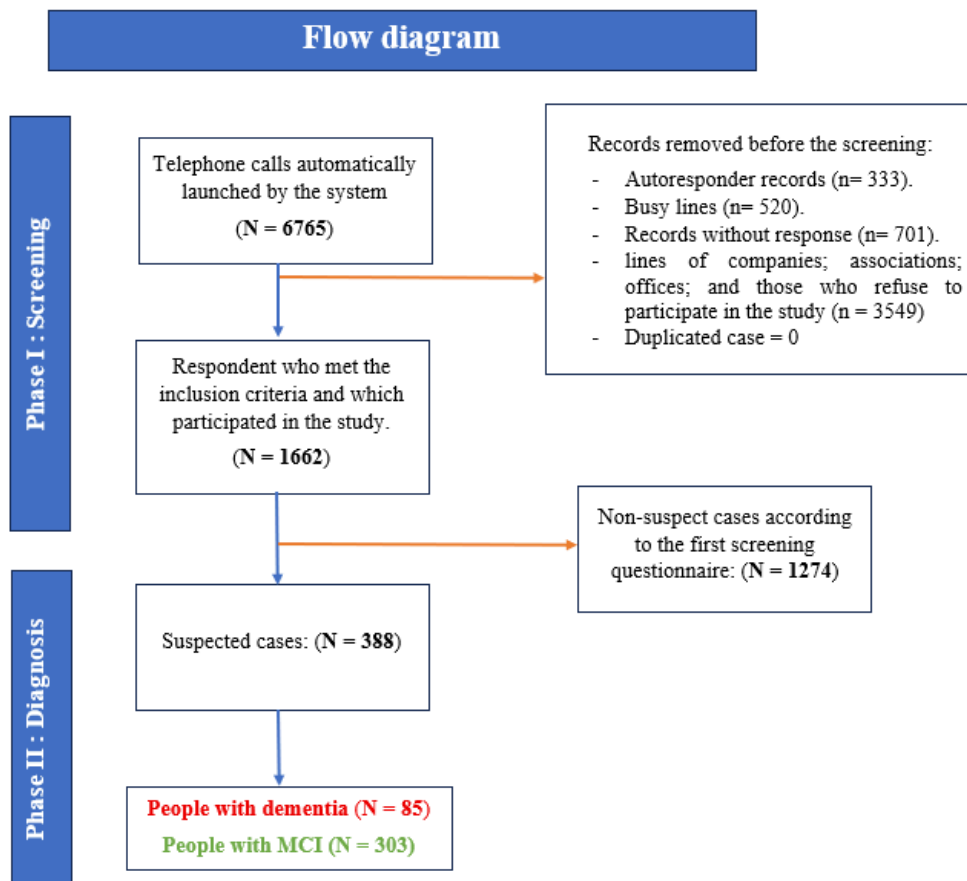


Figure 1

Flow diagram of participant recruitment, screening, and diagnostic confirmation.

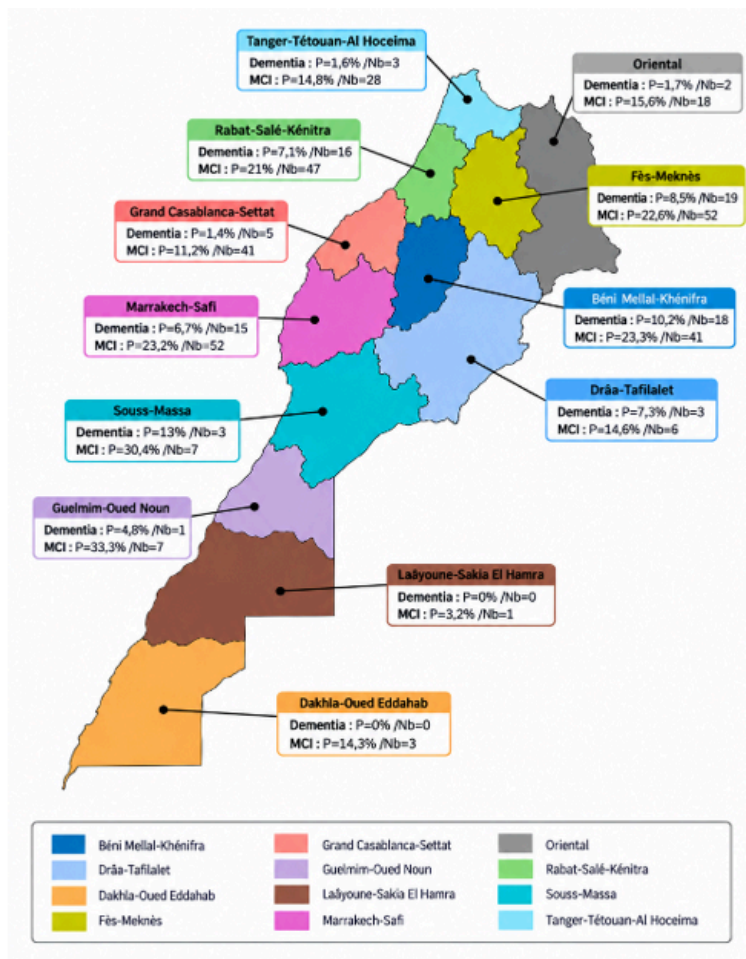


Figure 2

The relevant dementia and MCI (Mild Cognitive Impairment) prevalence according to Moroccan regions. Nb: Number of estimated people with dementia and MCI in each region. P: Prevalence of people with dementia and MCI in percentage.