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Prevalence of Self-reported Lifetime Physician-diagnosed Depression in Tunisia: Results of a National Study

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Abstract:

Introduction/Objective: Depression is a disabling mental health disorder affecting over 300 million people worldwide. In Tunisia, population-level data on its prevalence and determinants remain limited. Our study aimed to estimate the prevalence of depression in the Tunisian population and identify associated socio-demographic and clinical factors.

Methods: Data were drawn from the mental health component of the Tunisian Health Examination Survey (2016), a nationally representative study conducted among 9,209 individuals aged ≥15 years. Self-reported, physician-diagnosed lifetime depression was the main outcome. Associations with socio-demographic characteristics and clinical conditions, including rheumatoid arthritis, diabetes, and menopause, were examined.

Results: The study population comprised 4360 men (49.2%) and 4849 women (51.8%), with a mean age of 41.4±17.4 years. The prevalence of self-reported lifetime depression was 4.7%. Multivariate analysis identified female sex (OR=1.53, 95% CI [1.11–2.10]) and age groups 30–64 years (OR=1.81, 95% CI [1.20–2.73]) and ≥65 years (OR=1.82, 95% CI [1.06–3.14]) as factors significantly associated with higher prevalence. Conversely, marriage (OR=0.59, 95% CI [0.42–0.84]) and the absence of rheumatoid arthritis (OR=0.48, 95% CI [0.38–0.60]) were associated with a lower prevalence of the disorder.

Discussion: The findings indicate that self-reported depression in Tunisia is significantly influenced by gender and aging, consistent with global epidemiological trends. The strong association with physical comorbidities, particularly rheumatoid arthritis, underscores the necessity of integrated mental health screening for patients with chronic illnesses. Furthermore, the protective association of marriage suggests that social and family cohesion remain vital factors in the Tunisian sociocultural context.

Conclusion: Depression in Tunisia is shaped by gender, aging, and physical comorbidities. Targeted prevention and integrated screening strategies are needed, especially for vulnerable demographic and clinical groups.

Keywords: Depression, Prevalence, Associated factors, Tunisia, Epidemiology, Mental health.

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1. INTRODUCTION

Depression is a common and disabling mental disorder that, according to World Health Organization (WHO) estimates from 2015, affected more than 300 million people worldwide—representing 4.4% of the global population and acting as the leading contributor to global disability [1, 2]. However, more recent evidence from the Global Burden of Disease (GBD) 2019 study underscores the escalating impact of this condition, identifying depressive disorders as a leading cause of health loss globally that accounts for over 47 million disability-adjusted life years (DALYs) [3, 4]. Notably, the Middle East and North Africa (MENA) region exhibits some of the highest age-standardized prevalence rates worldwide, highlighting a critical public health challenge in this geographic context [5, 6]."

Depression is associated with high morbidity in terms of functional disability, poor quality of life, aggravation of coexisting physical illnesses, and increased risk of other non- communicable diseases such as ischemic heart disease [7]. According to the most recent report from the WHO on depression and other prevalent mental health disorders, depression is identified as the leading contributor to global suicide rates, with projections indicating an increase in this risk in the coming years [1]. Given the profound impact depression has on individuals' lives, it must be prioritized as a key public health issue.

A 2011 comparative study by Bromet *et al*. reported a lifetime depression prevalence of 14.6% in high-income countries compared to 11.1% in low- and middle-income countries (LMICs) [8]. Regionally, the World Health Organization indicates that 16% of the global depressed population resides in the Eastern Mediterranean [1]. However, Ferrari *et al*. highlighted significant challenges in cross-regional comparisons; they estimated a prevalence of 6.6% for Africa and the Middle East, which remains lower than the 8.6% reported in South Asia [9]. Tunisia, an LMIC in North Africa with a population of approximately 12 million [10], requires specific national data to address these regional variations. This demographic landscape is accompanied by an ongoing epidemiological transition, where the focus of the national health burden is shifting from infectious diseases toward non-communicable diseases and increasingly complex mental health challenges.

Following the 2011 Revolution and the socio-economic and political changes it triggered, Tunisia has witnessed a 1.7-fold increase in its suicide rate [11] and a rise in the number of outpatient psychiatric consultations, with major depressive disorder being one of the most common diagnoses (30.8%) [12]. However, large-scale studies specifically focusing on depression in Tunisia remain scarce [13, 14], and no recent research has been conducted using a nationally representative sample.

Previous epidemiological research in Tunisia has primarily focused on specific subpopulations or localized regions, which limits national generalizability. For instance, Bergaoui *et al*. [15] highlighted significant rural–urban disparities in mental health care access across Tunisia, noting that regional imbalances in specialist allocation and facility distribution leave rural populations underrepresented in epidemiological data and underserved by psychiatric services. More recently, Ben Thabet *et al*. [16] identified a high prevalence of depressive symptoms among primary care attendees, yet because the study was conducted in a clinical setting in Sousse, it likely reflects higher morbidity than the general community. These methodological limitations, specifically the localized geographic focus and the reliance on clinical rather than representative community samples, highlight a critical research gap that the nationally representative THES-2016 survey aims to address.

The bidirectional link between chronic physical conditions and mental health is a major public health priority, as evidenced by recent research showing increased depression risks among patients with Retinitis Pigmentosa or post-cataract surgery complications. Our study contextualizes these findings within Tunisia, examining how prevalent comorbidities like rheumatoid arthritis and diabetes correlate with self-reported lifetime physician-diagnosed depression [17, 18].

A key recommendation of Tunisia's national mental health strategy, launched in 2013 [19], was to conduct large-scale epidemiological surveys on depression and other mental health conditions to inform strategy updates. The aim of our study was to estimate the prevalence of depression in Tunisia and to identify its associated socio-economic, demographic, and clinical factors. Furthermore, evaluating factors like rheumatoid arthritis and menopause provides the empirical basis necessary for developing integrated, holistic care models within Tunisia's healthcare infrastructure.

2. MATERIALS AND METHODS

2.1. Contextual Framework

Despite its young demographic and rich cultural heritage, Tunisia continues to grapple with significant mental health obstacles. These include ingrained social stigma, unequal distribution of healthcare resources across regions, and a shortage of specialized psychiatric services. Such barriers emphasize the critical importance of evaluating the national prevalence of depression to better address these systemic gaps.

2.2. Study Design and Sampling

Data were obtained from the global health survey "Tunisian Health Examination Survey-2016 (THES)," a cross-sectional nationally representative survey carried out between 09 March 2016 and 08 June 2016. The survey involved a sample of 9,209 individuals aged 15 and older and was carried out by the National Institute of Health, with support from the Ministry of Health and the WHO [12]. THES 2016 is among the first surveys to explore a range of health domains within a nationally representative sample of the Tunisian population. It was carried out among 5,250 households spread over the Tunisian territory (750 households per region) [20]. The sampling

design was elaborated in collaboration with the National Institute of Statistics (INS). The sampling frame was based on the 2014 national census of population and housing. To ensure the findings were representative of the Tunisian population, we employed a complex survey design analysis. Sampling weights were applied to each observation to account for the unequal probability of selection across different strata and to align the sample distribution with the 2014 national census data. Furthermore, we adjusted for cluster effects at the primary sampling unit level (districts) by using robust standard errors.

The study received approval from the National Council of Statistics, which grants authorization only when strict scientific and methodological standards are met. A stratified, three-stage cluster random sampling procedure was implemented across the seven major regions of Tunisia (Tunis District, North-West, North-East, Center-West, Center-East, South-West, and South-East). At the first stage, 50 districts were randomly selected in each region, with selection proportional to the number of households. Each district represented a geographic area including approximately 70 households. At the second stage, 15 households were randomly selected within each chosen district. At the third stage, in households with more than one adult, one man and one woman were randomly selected; in households with only one man and/or one woman, both were included. This design ensured the representativeness of the Tunisian adult population while accounting for regional and household-level variability.

2.3. Inclusion and Exclusion Criteria

The study population consisted of a nationally representative sample of 9,209 individuals. To be eligible for inclusion, participants had to be aged 15 years or older and reside in one of the 5,250 households selected across the seven major regions of Tunisia. The selection followed a stratified, three-stage cluster random sampling procedure based on the 2014 national census. Within selected households, if more than one adult was present, one man and one woman were randomly selected for inclusion; in households with only one man or woman, both were included.

The study achieved a high national response rate of 97%, ensuring the validity of the sampling and the representativeness of the findings across the Tunisian territory.

2.4. Data Collection

Two questionnaires were included in this study: a household questionnaire and an individual questionnaire for people aged 15 years and over. The questionnaire was adapted into the Tunisian dialect to ensure cultural appropriateness, clarity, and ease of understanding for participants from diverse educational backgrounds. The definitions used in the estimation of the parameters in the THES study are detailed as follows: Socio-economic parameters were defined as sex, age (adolescents 15-19 years old, young people 15-29 years old, adults 30-64 years old, and elderly subjects 65 and over), marital status, academic level, and geographical characteristics. The Standard of Living proxy was defined in Quintile of Wellbeing: a proxy for the household's standard of living was constructed from information on the features of the accommodation as well as household capital goods through a principal component analysis, and households were classified into quintiles to define 5 sub-classes of homogeneous individuals from the most disadvantaged to the most advantaged [21]. Regarding occupation, and according to the International Classification of Types of Occupations by the International Labour Office [22], we divided our population into: Senior Executive, Intermediate Executive, Elementary Occupation, Others, Retired, and Without Profession/Never Worked. The other parameters of the household and individual questionnaire of the THES survey, whose results are not presented in this article, are summarized in the section procedure.

In the present study, self-reported depression as diagnosed by a physician was used as a proxy measure for depression. An individual was considered to have had 'depression' if he or she answered "yes" to the question: "Have you ever been diagnosed with depression by a physician?" The term depression may commonly cover a wide range of entities related to mood disorders, from some depressive symptoms to a full-fledged depressive disorder [23, 24].

Data on two medical conditions: rheumatoid arthritis and diabetes, as well as on menopause, were collected and their relationship to depressive symptoms was studied. Substance use was investigated through questions related to tobacco consumption (with smoke: cigarettes and narghile, and smoke-free: electronic cigarettes and chewing tobacco) and alcohol consumption. These were analyzed among individuals as daily/occasional, previous, or absence of consumption. We investigated their relation with depression.

Data entry was performed *via* tablet throughout the interview. The Android version of the CSPRO software was used for data entry. Most of the checks for inconsistent and missing values were built into the system.

Data collection utilized the Computer Assisted Personal Interviewing (CAPI) method, with investigators inputting responses directly into tablets using the Android-based CSPro software. To ensure high data integrity, automated validation checks for missing or inconsistent values were integrated into the digital interface. Before fieldwork, the research team, including coordinators and supervisors, underwent intensive six-day training. This program, led by experts from the National Institute of Health and the WHO, combined theoretical presentations with hands-on practical exercises.

2.5. Data Analysis

The data were analyzed using R 3.3.2 software. Quantitative variables were represented by mean ± standard error. Qualitative variables were described as percentages and 95% confidence intervals and were compared using the Chi-squared test. Statistical

associations were searched for with a significance level set at a p-value of 0.05. To identify the factors independently associated with the depression reportedly diagnosed, we conducted a multivariate logistic regression analysis. The multivariate analysis was used to calculate adjusted odds ratios with a 95% confidence interval, measuring the independent association strength with each factor in the model.

2.6. Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki [17] and approved by the Tunisian Ministry of Health, the WHO, the National Statistics Council (Visa No. 09-2015), and the National Authority for the Protection of Personal Data (Authorization No. 185-01/16). Appropriate informed verbal consent was obtained from all participants or their legal guardians before enrollment.

3. RESULTS

3.1. Description of the Survey Population

The survey population was divided into 4360 men (49.2%) and 4849 women (51.8%). The sex ratio (M/F) was equal to 0.94. The average age of the participants was 41.4 ± 17.4 years, with extremes ranging from 15 to 101 years. Table 1 summarizes the sociodemographic characteristics of the population.

3.2. Prevalence of Self-reported Diagnosed Depression

The prevalence of self-reported diagnosed depression in the general population, aged 15 years or older, was 4.7% (95% CI: 4.3%–5.1%). Details regarding the prevalence are presented in Table 2.

Table 1. Description of the study sample.

	N	Percentage (%)
Sex	-	-
Men	4360	49.2
Women	4849	51.8
Age (years)	-	-
15-29	2735	29.7
30-64	5450	59.2
> 65	1024	11.1
Residence Area	-	-
Urban	6271	68.1
Rural	2938	31.9
Educational level	-	-
Illiterate	1566	17
Primary	2578	28
High school	3499	38
University	1566	17
Marital status	-	-
Single	2763	30
Married	5858	63.5
Divorced	138	1.5
Widowed	460	5

Table 2. Prevalence of self-reported depression according to socio- demographic and clinical factors.

Prevalence of Self-reported Depression	Male 4.0%	p	Female 5.4%	p	Total 4.7%	p	N
Age	-	-	-	-	-	-	-
15-29	3.7	0.09	3.7	0.02	3.7	0.06	1475
30-64	3.8	-	6.3	-	5.1	-	6182
≥ 65	6.1	-	4.8	-	5.5	-	1552
Marital status	-	-	-	-	-	-	-
Single	3.6	0.65	5.7	0.35	4.5	0.06	1664
Married	4.1	-	5.0	-	4.6	-	6782
Divorced	4.9	-	8.0	-	7.2	-	133
Widow	11.5	-	6.6	-	7.0	-	630
Residence location	-	-	-	-	-	-	-

Prevalence of Self-reported Depression	Male 4.0%	p	Female 5.4%	p	Total 4.7%	p	N
Urban	3.9	0.87	5.7	0.03	4.8	0.07	5930
Rural	4.4	-	4.8	-	4.6	-	3279
Region characteristics	-	-	-	-	-	-	-
Greater Tunis	5.2	$<10^{-3}$	5.4	$<10^{-3}$	5.3	$<10^{-3}$	1245
North East	5.8	-	7.8	-	6.8	-	1324
North West	3.0	-	3.7	-	3.3	-	1358
Central East	4.2	-	6.3	-	5.3	-	1312
Central West	2.3	-	5.1	-	3.7	-	1348
South East	2.8	-	3.4	-	3.1	-	1295
South West	1.2	-	2.9	-	2.1	-	1327
Economic status	-	-	-	-	-	-	-
Most disadvantaged	5.3	0.57	3.7	0.01	4.5	0.52	1752
2nd class	4.6	-	4.8	-	4.7	-	1834
3rd class	3.3	-	4.5	-	3.9	-	1861
4th class	4.1	-	6.6	-	5.4	-	1888
Most advantaged	3.3	-	6.7	-	5.0	-	1874
Education level	-	-	-	-	-	-	-
Illiterate	6.9	0.28	4.5	0.24	5.2	0.93	2266
Primary school	3.6	-	5.2	-	4.4	-	2852
High school	3.9	-	6.0	-	4.8	-	2915
University	3.4	-	5.6	-	4.5	-	1176
Profession	-	-	-	-	-	-	-
Senior Executive	1.7	0.83	6.7	0.01	3.8	0.70	640
Intermediate Executive	4.9	-	5.7	-	5.2	-	465
Elementary Profession	3.8	-	8.1	-	4.9	-	2418
Others	5.6	-	1.9	-	4.6	-	874
Retired	4.0	-	5.9	-	4.3	-	764
Without profession	3.9	-	5.0	-	4.8	-	4048
Habits	-	-	-	-	-	-	-
Smoking	-	-	-	-	-	-	-
Never smoked	3.0	0.31	5.3	0.06	4.6	0.78	6602
Weaned smoking	4.2	-	0.0	-	4.1	-	540
Currently smoking	4.9	-	8.0	-	5.1	-	2041
Refuse to answer	0.0	-	3.5	-	1.2	-	26
Alcohol	-	-	-	-	-	-	-
Consumed at least once	5.2	0.11	10.2	0.24	5.2	0.60	745
Never consumed	3.9	-	5.4	-	4.7	-	8381
Refuse to answer	0.0	-	4.3	-	0.5	-	83
Somatic conditions	-	-	-	-	-	-	-
Diabetes	-	-	-	-	-	-	-
Yes	6.8	0.14	6.4	0.14	6.6	0.03	952
No	3.8	-	5.3	-	4.5	-	8257
Rheumatic disease	-	-	-	-	-	-	-
Yes	8.2	$<10^{-3}$	8.8	$<10^{-3}$	8.6	$<10^{-3}$	1803
No	3.5	-	4.4	-	3.9	-	7406
Menopause (females only)	-	-	-	-	-	-	-
Yes	–	–	5.2	1.0	–	–	2158
No	–	–	5.4	-	–	–	2691

The prevalence of self-reported diagnosed depression was 5.4% (95% CI: 4.8%–6.0%) among women and 4.0% (95% CI: 3.4%–4.6%) among men in the population aged 15 years and older.

The prevalence of self-reported diagnosed depression varied across demographic, socioeconomic, and occupational factors. Among adolescents (15–19 years), the prevalence of self-reported diagnosed depression was 2.5% (95% CI: 1.8%–3.2%), with 3.0% (95% CI: 2.1%–3.9%) in girls and 2.1% (95% CI: 1.3%–2.9%) in boys.

Among men, prevalence was 6.1% (95% CI: 4.4%–7.8%) in those aged ≥65 years, with no significant differences across age groups, marital status, residence, or economic class. In contrast, women showed significant differences across age groups (p=0.02), with prevalence ranging from 3.7% (95% CI: 2.8%–4.6%) in young women (15–29 years) to 6.3% (95% CI: 5.4%–7.2%) in those aged 30–64 years, and across economic classes (p=0.01), ranging from 3.7% in the most disadvantaged class to 6.7% (95% CI: 5.3%-8.1%) in the most advantaged. Urban women had a higher prevalence (5.7%) (95% CI: 4.9%–6.5%) compared to rural women (4.8%) (95% CI: 3.8%–5.8%), while no urban–rural difference was observed among men. Regionally, prevalence ranged from 2.1% (95% CI: 1.1%–3.1%) in the Southwest to 6.8% (95% CI: 5.5%–8.1%) in the Northeast (p<0.001). Education level was not significantly associated with depression in either gender, whereas female laborers had the highest prevalence (8.1%) (95% CI: 5.9%–10.3%). As for behavioural habits, no association was found between the prevalence of depression and tobacco and/or alcohol consumption.

The prevalence of depression was significantly higher among individuals with rheumatoid arthritis or diabetes. However, this difference was only observed separately for men and women concerning a history of rheumatoid arthritis. In the female population, the prevalence of depression was 5.2% (95% CI: 4.2%–6.2%) among postmenopausal women and 5.4% (95% CI: 4.4%–6.4%) among premenopausal women.

Additional details are provided in Table 2.

3.3. Factors Associated with the Presence of Diagnosed Depression

After adjusting for sociodemographic and economic factors, the prevalence of self-reported diagnosed depression was associated with female sex and the 30–64 and 65+ age groups. Conversely, marriage, originating from the Northwest or Southwest regions, and the absence of rheumatoid arthritis were identified as protective factors, independent of other variables (Table 3).

Table 3. Factors associated with the presence of diagnosed depression.

Factors	Odds Ratio	[CI95%	(OR)]	p
Sexe ratio F/M	**1.53**	1.11	2.10	**0.009**
Marital Status (reference: single)	-	-	-	-
Married	**0.59**	0.42	0.84	**0.003**
Divorced	0.81	0.38	1.74	0.585
Widow	0.72	0.43	1.20	0.208
Academic level (reference: illiterate)	-	-	-	-
Primary school	1.09	0.80	1.50	0.575
High school	1.21	0.84	1.73	0.305
University	1.40	0.87	2.26	0.16
Age group (reference:15-29)	-	-	-	-
30-64	**1.81**	1.20	2.73	**0.005**
≥ 65	**1.82**	1.06	3.14	**0.03**
Rural/ Urban	0.96	0.75	1.23	0.727
Region (reference: Greater Tunis area)	-	-	-	-
North-East	1.17	0.85	1.62	0.328
North-West	**0.61**	0.41	0.90	**0.013**
Center-East	0.90	0.64	1.26	0.548
Center-West	0.69	0.47	1.02	0.061
South-East	0.72	0.49	1.06	0.097
South-West	**0.39**	0.25	0.60	**<10-3**
Economic Class (reference: most disadvantaged class)	-	-	-	-
2nd class	1.02	0.73	1.42	0.921
3rd class	1.07	0.76	1.49	0.71
4th class	1.00	0.70	1.41	0.98
Most advantaged class	1.06	0.73	1.55	0.754
Profession (reference: senior executive)	-	-	-	-

Factors	Odds Ratio	[CI95%	(OR)]	p
Intermediate executive	1.18	0.67	2.10	0.568
Elementary profession	1.33	0.80	2.19	0.269
Others	1.01	0.57	1.80	0.972
Retired	0.98	0.53	1.78	0.935
Without profession / never worked	1.08	0.65	1.79	0.76
Rheumatoid arthritis No/Yes	**0.48**	0.38	0.60	**<10-3**
Diabetes No/Yes	0.78	0.58	1.06	0.11
Alcohol consumption (reference: Yes)	-	-	-	-
Never	0.87	0.59	1.30	0.498
Refuses to answer	0.43	0.09	1.97	0.276
Smoking (reference: never) Weaned subject	1.03	0.61	1.73	0.911
Smoker	1.31	0.95	1.81	0.101
Refuses to answer	1.70	0.20	14.31	0.625

4. DISCUSSION

In this study, the prevalence of self-reported, lifetime depression in the adult Tunisian population was 4.7%, with higher rates observed among women. Among women, prevalence varied significantly across age groups (p=0.02), ranging from 3.7% in those aged 15–29 years to 6.3% in those aged 30–64 years. Marriage (OR=0.59, 95% CI: 0.42–0.84) and absence of rheumatoid arthritis (OR=0.48, 95% CI: 0.38–0.60) were identified as protective factors, whereas being aged 30–64 years (OR=1.81, 95% CI: 1.20–1.73) or ≥65 years (OR=1.82, 95% CI: 1.06–3.14) increased the risk of depression.

4.1. Prevalence of Depression

The prevalence of self-reported depression in our study was 4.7%. According to the WHO's Global Burden of Disease study, depression affected over 300 million people worldwide in 2015, corresponding to a prevalence of 4.4% of the global population [2]. In our study, the prevalence of self-reported diagnosed depression (lifetime) was slightly higher in women (5.4%) than in men (4.0%), with a female-male adjusted OR of 1.53. This aligns with the DSM- 5, which estimates depression to be 1.3 to 3 times more prevalent in women than in men [25-27]. Recent psychiatric research suggests that the higher prevalence in women is due to a combination of biological, psychological, environmental, and societal factors [28]. Genetic research has also identified genes potentially associated with depression, with their expression influenced by environmental factors and personality traits [28-30].

4.2. Factors Associated with Depression

Our study confirmed age-related variations in depression prevalence. Among adolescents aged 15–19, the prevalence was 2.5%, higher in girls (3%) than boys (2.1%), making it the lowest among all age groups. This may result from underdiagnosis due to variable symptomatology in adolescents, such as irritability replacing sadness [26]. Similar rates were reported in Turkey (2.4%) [31] and Pakistan (4.4%) [32], though slightly higher rates were found in Lebanon (6.7%) [33]. Adolescents consistently show lower depression rates than adults, as noted in Ferrari *et al.*'s meta-analysis [9].

For adults aged ≥65, the prevalence was 5.5%, with males showing higher rates (6.1%). Multivariate analysis identified age ≥65 as a risk factor (ORa=1.82). These rates are lower than in industrialized countries (16.5%) [34, 35], but as Tunisia ages, national rates may converge with global trends. Depression in older adults increases mortality risks, whether suicidal or non- suicidal, and elevates healthcare costs [36-38]. With the aging global population projected to reach 22% by 2050, systematic screening in high-risk groups is crucial [39-41].

Marriage emerged as a protective factor against depression (OR=0.59). In LMICs, single individuals have depression rates comparable to those of married individuals, differing from trends in HICs [7].

Regarding geographical residence, depression prevalence differed by gender. Women in urban areas had higher rates than those in rural areas (p=0.03), while no significant difference was observed for men. Literature on urban-rural differences is inconsistent, though urbanization is linked to mood disorders in some studies [42].

Western Tunisia differs from the eastern coastal regions, which are more economically developed. In contrast, western Tunisia is more remote, socially conservative, and characterized by stronger family cohesion. These stronger family bonds are likely to explain the observed protective effect.

Socioeconomic status significantly influenced depression prevalence. Among men, depression was higher in disadvantaged groups (5.3%) compared to advantaged ones (3.3%), aligning with findings from Domènech-Abella *et al.* [43] and Bromet *et al.* [8]. In women, however, depression was more prevalent in advantaged groups, potentially due to better access to care.

Unemployment was associated with higher depression prevalence, particularly in men, consistent with existing studies [44-48]. Among women, depression was more common in those holding leadership positions, likely

reflecting the dual burden of professional and domestic responsibilities in Tunisia.

While the observed prevalence aligns with Middle Eastern and North African (MENA) regional trends, the variation across Tunisian strata suggests a complex interplay of sociocultural factors. The elevated prevalence among urban women may reflect the 'double burden' of transitioning societal roles, where traditional familial expectations intersect with modern professional demands. However, these interpretations regarding family cohesion and social responsibility remain hypothesis-generating. In the Tunisian healthcare context, the disparity between regions may also be exacerbated by the centralization of psychiatric services in the Northeast, potentially leading to higher diagnosis rates compared to the underserved Southwest.

While no significant association was found between smoking, alcohol use, and depression, both behaviors were linked to higher depression prevalence in our population. This aligns with global findings linking smoking to depressive episodes [49].

In chronic disease contexts, depression prevalence was 6.6% among individuals with diabetes (p=0.03), though multivariate analysis showed no significant association. Literature suggests depression rates are twice as high in those with diabetes, particularly women [50-52]. For rheumatoid arthritis, depression prevalence was 8.6% (p<0.001), and the absence of such conditions was protective (OR=0.48). This aligns with studies showing a 16.8% prevalence of major depression in rheumatoid arthritis patients [53, 54] and a twofold increased risk of depression in individuals with osteoarthritis [41]. These associations are likely influenced by pain, fatigue, and reduced mobility [55-57].

The prevalence of depression in postmenopausal women in our study was 5.2%, comparable to that in non-menopausal women (5.4%), indicating no statistically significant association between menopause and depression in this population. Literature findings on this topic are mixed. Some studies align with our results, reporting no menopause-depression relationship [58, 59]. Others suggest that pre-menopause may be linked to depressive symptoms, with post- menopause associated with anxiety [46]. Additionally, perimenopause has been identified as a higher-risk phase for depression [59-62].

The selection of rheumatoid arthritis, diabetes, and menopause for association with depressive symptoms was grounded in established scientific evidence and the specific objectives of the THES 2016 study. A substantial body of literature demonstrates that chronic inflammatory conditions, such as rheumatic diseases, and metabolic disorders, such as diabetes, are significantly linked to a higher prevalence of depression [52-55]. Similarly, hormonal fluctuations during menopause are widely recognized as a risk factor for mood disorders [60]. Given that this specific relationship had not been previously investigated in the Tunisian context, our study aimed to fill this knowledge gap by leveraging the data from the THES 2016 study, where these conditions were primary variables of interest [20].

During the survey, only one-third of participants (31.8% of men and 33% of women) reported being followed by a medical practitioner for diagnosed depression. Most of these individuals consulted a specialist (80.4% of men and 86.8% of women). However, two-thirds of diagnosed individuals did not pursue further therapy or management. This low follow-up rate can be attributed to several factors, including the scarcity of psychiatrists, particularly in Tunisia's public sector and underserved regions [62], and the limited role of primary care in depression treatment, where specialist referral predominates [63]. Financial constraints, such as inadequate social coverage, along with psychological barriers like stigma and the perception of mental health issues as taboo, further hinder comprehensive care [64, 65].

Based on these findings, we recommend the integration of standardized mental health screening tools into primary healthcare facilities to facilitate early detection, particularly in rural and disadvantaged regions. Furthermore, public health initiatives should develop gender-specific community interventions that address the unique psychosocial stressors faced by women. Future longitudinal research is required to further investigate the causal pathways of depression within the Tunisian socioeconomic transition.

5. STRENGTHS AND LIMITATIONS OF THE STUDY

Our study had several strengths. It involved a large, representative sample of the Tunisian population aged 15 and older. Furthermore, the THES 2016 survey, which covers the overall health of the Tunisian population, allowed us to explore the association of depressive symptoms with factors related to physical health and habits. Also, our survey is the most recent national survey on mental health in Tunisia. However, this study also had limitations. The THES questionnaire was not based on a validated screening tool for depression in Tunisia. The term “depression” encompasses a wide range of mood disorders [66], from isolated symptoms to dysthymia or major depressive disorder as defined by the DSM-5 [67]. This diversity means the prevalence of depression can vary depending on the tool used. The THES 2016 survey relies on self-reported medical history, asking respondents about depression diagnoses from doctors or psychotherapists within the last 12 months or lifetime, a method used in surveys in other countries such as the United States [68] and Germany [69]. The cross-sectional nature of this study precludes the establishment of temporal or causal relationships between the identified correlates and depression. Additionally, our reliance on self-reported, physician-diagnosed lifetime depression as a proxy measure is subject to significant reporting biases. Specifically, participants may have experienced recall bias regarding past medical history or social desirability bias, potentially underreporting symptoms or diagnoses due to the persistent social stigma surrounding mental health in

the Tunisian context. These factors may lead to an underestimation of the true prevalence of the disorder [70-72].

CONCLUSION

Depression represents a major public health challenge in Tunisia, aligning with its status as a leading cause of disability worldwide. As the most recent nationally representative survey since the 2011 Revolution, these findings provide a critical epidemiological baseline for updating Tunisia's national mental health strategy and underscore the urgent need for integrated depression screening within primary care, particularly for aging populations and those with physical comorbidities. Furthermore, without robust information systems or psychiatric registries, there is an urgent call for specialized studies to better understand community-specific determinants and to implement effective, evidence-based mental health strategies across the country.

To optimize early detection, future research should explore the integration of machine learning algorithms into primary care workflows. According to the latest 2025 clinical guidelines [], AI-assisted screening tools can analyze PHQ-9 results alongside demographic data to identify high-risk individuals with greater precision, provided that ethical safeguards for data privacy are strictly maintained [73-75].

AUTHORS' CONTRIBUTIONS

The authors confirm their contributions to the paper as follows: H.A.S, N.Z.: Study conception and design; M.B.: Data collection; M.Z., M.B., F.C., N.Z., U.O: Analysis and interpretation of results; M.Z., M.B., F.C.: Draft manuscript. All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

CAPI	=	Computer-Assisted Personal Interviewing
CI 95%	=	95% Confidence Interval
DSM-5	=	Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
GBD	=	Global Burden of Disease
HIC	=	High-Income Countries
INS	=	National Institute of Statistics
LMIC	=	Low- and Middle-Income Countries
OR	=	Odds Ratio
ORa	=	Adjusted Odds Ratio
THES	=	Tunisian Health Examination Survey
WHO	=	World Health Organization
YLDs	=	Years Lived with Disability

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The research received preliminary approval from the Tunisian Ministry of Health and the World Health Organization. The study was formally approved by the Tunisian National Council of Statistics (Visa no. 09-2015, November 10, 2015) and the National Authority for the Protection of Personal Data (Authorization No. 185-01/16, May 6, 2016).

HUMAN AND ANIMAL RIGHTS

All procedures involving human participants were conducted in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was systematically obtained from every participant or their legal representative before their participation in the survey.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

Data may be made available from the National Institute of Health, Tunisia upon reasonable request for research purposes. Requests can be directed to the NIH *via* their official email: insp@rns.tn

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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