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# COMORBIDITY OF DEPRESSION WITH CHRONIC DISEASES: A POPULATION-BASED STUDY IN ALEPPO, SYRIA*

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## Abstract

**Objective—**To assess the comorbidity and correlates of depression in chronic diseases in the community in Aleppo, Syria. This has never been previously investigated in an Arab country.

**Method—**We conducted a cross-sectional, population-based study in Aleppo on adults aged 18−65 (*N* = 2038). We collected data utilizing a structured interview questionnaire. Socio-demographics, general health information, and self-report of physician-diagnosed depression and chronic diseases active in the past year were obtained. We used logistic regression to estimate the odds of depression in chronic diseases and socio-demographic correlates of depression comorbid with chronic diseases.

**Results—**Mean age (*SD*) was 35.3 (12.1) years, 55% were female. In women, predictors of depression were heart disease (OR = 3.95, 95% CI: 1.50−10.40), hypertension (OR = 2.92, 95% CI: 1.53−5.55), and kidney disease (OR = 2.96, 95% CI: 1.64−5.32). Depression comorbidity with any chronic disease decreased in higher socio-economic status (middle vs. low: OR = 0.28, 95% CI: 0.12 −0.65; high vs. low: OR = 0.20, 95% CI: 0.05−0.81). In men, predictors of depression were rheumatism (OR = 7.10, 95% CI: 2.58−19.60) and respiratory disease (OR = 3.77, 95% CI: 1.23 −11.60). Depression comorbidity decreased in residence in formal zones (OR = 0.22, 95% CI: 0.06 −0.80).

**Conclusion—**Depression is associated with many chronic diseases in the community in Aleppo, a finding consistent with reports from other cultures. Potential gender-related risk factors were identified. Findings inform public mental health planning and support the delivery of depression treatment in primary care settings.

### Keywords

depression; chronic disease; comorbidity; epidemiologic studies; Arab world

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## INTRODUCTION

Depression is commonly associated with chronic diseases [1]. Individuals diagnosed with common chronic diseases such as cancer, heart disease, arthritis, and chronic lung disease are at increased risk for developing depression [2]. This association is very important since it can lead to increased morbidity and mortality [3,4] and higher cost [5], and treating depression may ameliorate these negative outcomes [6,7]. The prevalence of depression in chronic disease increases from community to clinical samples [1]. Community samples reveal higher rates of depression in individuals with compared to those without common chronic diseases such as heart disease, hypertension, stroke, diabetes, and chronic lung disease [8,9]. Proper assessment of the association between depression and chronic diseases, for public health care planning and policy, requires population-based studies. Data on depression from population-based samples in the Arab world are very limited. An international study found the rate of lifetime major depression at 19% in adults in Beirut, Lebanon, the highest of all countries included in the study [10]. In a more recent investigation from the United Arab Emirates, rates of lifetime depression were reported at 2.8% and 10.3% in males and females, respectively [11]. We were unable to find any data through a Medline search on the comorbidity of depression with chronic diseases from community samples in Arab countries. In Syria, mental health resources are limited and information on the prevalence and treatment of depression is not available. Additionally, there is no health insurance system and access to care is available through private pay clinics or a network of publicly-funded primary care clinics. The latter are accessible to those who cannot afford the private clinics. In this study, we report on the rates and socio-demographic correlates of depression co-occurring with common chronic diseases from a cross-sectional epidemiologic community sample in Aleppo, Syria. To our knowledge this is the first such report from an Arab country.

## METHODS

### Participants/Sampling

Data are from the first Aleppo Household Survey (AHS) that was conducted by our center, the Syrian Center for Tobacco Studies (SCTS), in 2004. The AHS is a population-based health survey of a representative sample of households in Aleppo, the second largest city in Syria (population 2,500,000). Methodology, sampling, and survey development are discussed in detail elsewhere [12,13]. Briefly, two-stage, stratified, cluster sampling was used with target population divided into two strata—formal and informal (built without approval from municipal authorities) zones—according to Aleppo municipality's registry. The latter zone reflects disadvantaged status [12]. The target population was adults 18−65 years of age, who could understand study procedures and provide informed consent. Response rate was 86%, achieving a sample size of 2038 (921 male, 1117 female).

### Procedures

We used an interviewer-administered survey which involved six, two-person, mixed gender teams of surveyors equipped with notebook computers programmed to record questionnaire responses and measurements using a custom data entry program (Delphi programming language and SQL server DBMS). The questionnaire included sections on socio-demographics, general health and disability, smoking, chronic diseases, and depression. The questionnaire included a question that reflects access to health care in our setting by asking participants whether they had routine medical or laboratory check-ups in the past year. Socio-demographics included age, gender, marital status, ethnicity, religion, level of education, work-status (student, employed, unemployed), and family income. Work-status, number of people working for money within household, household income, education level, item ownership, and household density (number of individuals living in the household divided by the number of

rooms) were combined in a score for socio-economic status (SES) [14]. SES scores range from 0−12 with higher values indicating better SES. All study participants underwent a thorough structured interview. We obtained detailed information on cigarette smoking pattern. We determined height using a sliding wall meter (Seca, Germany), and body weight using digital scales (Camry, China). The protocol and informed consent were approved by the Institutional Review Boards at the University of Memphis and the SCTS, and all participants provided informed consent.

### Outcome Measures

Depression was deemed present if, based on interview questionnaire, the subject reported ever having had a physician-diagnosed depression and endorsed having suffered from depression in the past year. Similar criteria were used for the diagnosis of the following chronic physical diseases: heart disease, stroke, diabetes, chronic respiratory diseases (asthma, chronic bronchitis, and chronic obstructive pulmonary disease), rheumatism, peptic ulcer disease, kidney disease, and liver disease. Henceforth, all references to depression and chronic diseases indicate their presence as physician-diagnosed conditions in the past year. For obesity we used the WHO criterion of a Body Mass Index (BMI) $\geq 30$. Comorbid depression was defined as the presence of depression with any of the above mentioned chronic diseases, including obesity.

### Statistical Analysis

Descriptive statistics were calculated for main study outcomes (disease and depression prevalence). $Chi^2$ test was used to assess bivariate relation between depression and other chronic diseases (Table 2) and $p \leq 0.05$ was considered as significant. We used logistic regression models to assess the association of depression (dependent variable) with chronic diseases (independent variables) (Table 3), adjusting for socio-demographic factors. We calculated unadjusted and adjusted (models 1, 2) odds ratio (OR) and 95% confidence interval (CI). In model 1, we adjusted for the following factors: age, residence, education, occupation, socio-economic status, marital status, religion, ethnicity, access to health care, and daily cigarette smoking. Since we relied on physician-diagnosed depression and co-morbidities, differential access to health care might influence these outcomes and thus we adjusted for this factor in the analysis. Adjustment for gender was added for total sample. In model 2 we adjusted for the same variables in model 1 plus all other chronic diseases (Table 3). Similarly, we used logistic regression models to assess the socio-demographic predictors (independent variables) of depression comorbid with any chronic disease (dependent variable) (Table 4). Subjects with at least one chronic disease plus depression were compared to individuals with at least one chronic disease without depression. Socio-demographic factors, access to health care, and daily cigarette smoking were entered in the model. SES score was stratified into three tertiles and educational level was divided into three categories (illiterate (did not attend school), ≤ 9 grade, > 9 grade). We adjusted for daily smoking in all logistic regression models, since smoking has been associated with several of the chronic diseases such as heart disease and chronic respiratory diseases, as well as depression [15,16]. All statistical analysis was performed using SPSS statistical program (version 13.0 for Windows; SPSS. Inc).

## RESULTS

We conducted analyses on the total sample of 2038 subjects. Mean age (*SD*) was 35.3 (12.1) years. Males represented 45% and females 55% of the sample, with mean ages (*SD*) of 36.4 (12.1) and 34.3 (11.9) years, respectively. Socio-demographic characteristics are detailed in Table 1. Overall, 4.5% of participants had depression. Women were more likely to have depression than men (6.1% and 2.6% respectively, $p < 0.001$).

Table 2 depicts the prevalence rates of chronic diseases and of depression in individuals with vs. without chronic diseases. Rates of stroke (1.1%), liver disease (1.1%), diabetes (4.4%), and heart disease (4.7%) were low, whereas obesity (38.2%) was high. Depression rates were significantly higher in all diseases except for diabetes, liver disease, and obesity.

In Table 3 we present unadjusted and adjusted odds ratio and 95% confidence interval for depression in the various chronic diseases (i.e., presence vs. absence of each disease) for the total sample and by gender. Adjusted models 1 and 2 are detailed in the statistical analysis section. Predictors of depression in the fully adjusted model (2) were hypertension (OR = 2.63), chronic respiratory disease (OR = 1.96), peptic ulcer disease (OR = 1.77), and kidney disease (OR = 2.38). Of note, heart disease predicted depression in women (OR = 3.95) but not men (OR = 0.32). In contrast, diabetes predicted depression in men (OR = 4.46) but not women (OR = 0.12).

Finally, we examined the socio-demographic predictors of comorbidity of depression (vs. no depression) with any chronic disease (Table 4). We present odds ratio and 95% confidence interval for the total sample and by gender. In the total sample, depression comorbidity increased in middle education level (≤ 9th grade) vs. illiterate (OR = 2.61) and Arab ethnicity (OR = 2.52). Meanwhile, it decreased in middle (vs. low) socio-economic status (OR = 0.41) and residence in formal zones (OR = 0.44). In females, comorbidity increased in middle education level (OR = 2.38), and decreased in middle and higher SES (OR = 0.28 and 0.20, respectively). In males, comorbidity decreased only in residence in formal zones (OR = 0.22). Age, marital status, religion, and occupation did not affect comorbidity.

## DISCUSSION

This report represents the first epidemiologic study on the comorbidity of depression with chronic medical diseases in the Middle East. Similar to Western societies, we found depression to be associated with many common chronic diseases in the community. Disadvantaged socioeconomic status predicted depression comorbidity in individuals with chronic disease.

Our data are consistent with epidemiologic studies from Western societies showing an increased association between depression and chronic respiratory diseases [17,18], hypertension [19,20], and peptic ulcer disease [21,22]. We also extend the finding of higher depression risk in renal disease [23] from clinical to population samples. Higher depression risk is reported in epidemiologic studies in heart disease [24,25] and in clinical studies in chronic arthritic disease [26,27]. Such an association was present in our unadjusted and partially adjusted models. However, it was not present in our fully adjusted model, after controlling for all other chronic diseases. After controlling for all other chronic diseases, there was no association between depression and respiratory and peptic ulcer diseases in women, nor in hypertension, diabetes, and peptic ulcer disease in men. These findings indicate that co-existing common chronic diseases, a prevalent circumstance, may confound the association between depression and a given chronic disease. We suggest epidemiologic studies should control for other common co-existing chronic diseases in their assessment of such an association. We did not observe associations reported in epidemiologic studies with obesity [28,29], diabetes [30], or stroke [31,32]. In obesity, studies have ranged from observing a small increase in depression (OR = 1.2, 95% CI: 1.09−1.35) by Simon et al. [29] to an increase only in women [33] in the United States, no association in Australia [34], and a decrease in depressive symptoms in China [35]. A review by Faith et al. [36] concludes that meta-analytic studies do not find a statistically significant relationship between the two disorders and suggests a complex relationship between them with moderating (e.g., SES, gender) and mediating (e.g., negative comments) factors. Combining these cultural variations and complexity factors, we speculate that cultural attitudes about obesity may represent a mediating factor. Specifically,

stigma and discrimination against obese individuals in some cultures may mediate depression. We did not detect such an association in Syria, where obesity is more accepted than Western cultures. In diabetes, there are conflicting reports of no association [34,37,38] and association with major depressive disorder [39]. Finally, the association with stroke approached significance, even though our sample's age limit (≤ 65 years) engenders a lower rate of stroke. We should note the gender differences in our data. In men, rheumatism and chronic respiratory disease, whereas in women heart disease and hypertension, were the primary diseases associated with depression. We speculate that this differential association may reflect the impact of the chronic disease on gender-specific roles. For example, men may be unable to work due to rheumatism-related pain and respiratory problems. As the primary wage earners, this disrupts their major role and leads to financial hardship. Additionally, we observed an unexpected decrease in depression in women with diabetes after adjusting for all other chronic diseases. Our data does not provide a clear explanation for this finding, but we speculate the presence of unmeasured characteristic(s) in diabetic women that leads to either a decreased risk or reporting of depression.

Examination of socio-demographic factors associated with depression co-occurring with chronic disease revealed interesting findings. Comorbid depression increased in women with lower SES and men residing in informal zones. As these disadvantaged groups are unlikely to receive more medical care, we suspect our result reflects an actual increase in depression risk rather than ascertainment bias from better access to medical services and subsequent diagnosis of depression. Elevated rates of depression in disadvantaged segments of society are consistent findings worldwide [40-43]. We see a similar trend in depression co-occurring with chronic diseases. Ethnic and racial influences on the expression and diagnosis of depression have been reported in other societies [44-46]. In a previous study of a limited non-representative sample, we did not find differences in psychiatric morbidity between Arab and non-Arab women in Aleppo [47]. There is no available epidemiologic data on depression in Arab vs. other ethnicities in the Middle East. In our current total sample, Arab ethnicity increased the risk of depression comorbidity, but the association did not persist when we examined it by gender indicating the association is not robust.

Another finding relates to education. We detected a significant increase in depression comorbidity among those with middle education (1−9 years) relative to illiterate. While this finding appears contrary to reports of lower depression in educated individuals [43,48,49], it is consistent with Kessler et al. [42] findings of lower lifetime depression (OR = 0.8) in lower educational status (≤ 11 years education). Alternatively, our result may actually reflect ascertainment bias, whereby educated individuals would be more likely to seek medical care and consequently become diagnosed with depression and with chronic disease.

Gender difference emerged here as well. The association with SES was present only in females, whereas with residence only in males. This supports the recurrent finding of women's higher vulnerability to the adverse mental health effects of lower SES [50]. Public health policy can benefit from understanding gender differences to better address the mental health needs of the community. Further, we would like to highlight that women did not have a higher rate of comorbid depression. In general, higher depression rates are observed in women in epidemiologic studies from the United States [41,42], Germany [51], the Netherlands [49], various European countries [48], and countries in Asia and the Middle East [10]. We previously reported high rates of psychiatric morbidity in women in Aleppo [47]. Indeed, even in this sample, women had a higher rate of depression than men. Our result is not inconsistent with these findings, since we are examining only depression co-occurring with chronic disease. Therefore, risk factors for comorbid depression may differ from those for depression in general. Some factors such as disadvantaged status are shared, while others such as gender are not shared.

Finally, our findings have important implications for public mental health planning and policy development. For example, the increased risk for depression in individuals with chronic diseases makes primary care clinics an excellent locale for treating depression. This is particularly important in Syria, where prominent stigma and lack of specialty mental health providers are major barriers to mental illness treatment, and delivering care in such a setting would address such barriers. As a result, affording primary care providers with training and support to treat depression would be a more effective and efficient way of resource utilization. We suspect this may be applicable to many Arab countries.

The rates of common chronic diseases in Aleppo we presented are novel, and no such previous reports exist. Such data informs public health authorities and establishes a stepping stone into further research on disease prevalence in Syria. We submit few observations in this area. We suspect the low rate of diabetes to be an underestimate, since people in Syria do not undergo routine exams and laboratory tests to detect it. In a different epidemiologic study we conducted in Aleppo, we found about 15% of subjects to have diabetes, a third of whom were newly detected via our laboratory testing (unpublished data). The public health consequences of undiagnosed diabetes due to lack of routine exams are dire and this is a major area to address in public health planning. The low rate of stroke probably reflects the young age and the upper age limit of 65 years in our sample.

Study limitations include the use of self-report of physician-diagnosed depression and of chronic diseases. This may lead to ascertainment bias as those with chronic diseases are more likely to seek medical care and thus more likely to receive the diagnosis of depression. We addressed this bias by controlling for access to health care in our regression modeling. Nevertheless, direct assessment of depression by the interviewer would have generated more precision and allowed for the evaluation of depression symptom severity, but this was not feasible. Since seeking assessment for depression in Syria is infrequent due to prominent stigma, lack of awareness, and the poor availability of resources, our method may have underestimated the rate of depression. The use of self-report of physician-diagnosed chronic diseases may yield prevalence rates that differ from those based on direct assessment. Nevertheless, this standard is accepted practice in epidemiologic studies for feasibility purposes. Another area of limitation is the small number of subjects with stroke or liver disease, thereby not allowing for risk assessment in these disorders. Finally, findings from this study may not generalize to other countries in the Arab world, or even to other parts of Syria.

## CONCLUSION

This epidemiologic study of depression in chronic diseases in Syria represents the first such report from the Arab world. Similar to Western societies, we found individuals with chronic diseases to have higher rates of depression. The study supports delivering treatment for depression in primary care settings especially since stigma and access to specialty mental health services are very limited. Indicators of disadvantaged status, especially in women, may represent risk factor for depression comorbidity with chronic diseases. Future epidemiologic studies in the Arab world should consider the use of direct assessment of depression which would allow for the examination of the relationship between active depressive symptoms and chronic diseases.

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**Table 1**

Sample Characteristics of Study Participants ($N$ = 2038)

| | Men *N* (%) | Women *N* (%) | Total *N* (%) |
|---|---|---|---|
| Age group | | | |
| 18−29 | 305 (33.1) | 431 (38.6) | 736 (36.1) |
| 30−45 | 398 (43.2) | 476 (42.6) | 874 (42.9) |
| 46−65 | 218 (23.7) | 210 (18.8) | 428 (21.0) |
| Residence | | | |
| Formal | 451 (49.0) | 566 (50.7) | 1017 (49.9) |
| Informal | 470 (51.0) | 551 (49.3) | 1021 (50.1) |
| Ethnicity | | | |
| Arab | 730 (79.3) | 895 (80.3) | 1625 (79.9) |
| Non-Arab | 190 (20.7) | 219 (19.7) | 409 (20.1) |
| Religion | | | |
| Muslim | 884 (96.3) | 1054 (94.5) | 1938 (95.3) |
| Non-Muslim | 34 (3.7) | 61 (5.5) | 95 (4.7) |
| Education | | | |
| Illiterate | 128 (13.9) | 297 (26.6) | 425 (20.9) |
| Years of education 1−9 | 546 (59.3) | 585 (52.4) | 1131 (55.5) |
| Years of education > 9 | 247 (26.8) | 235 (21.0) | 482 (23.7) |
| Occupation | | | |
| Student | 62 (6.7) | 57 (5.1) | 119 (5.8) |
| Employed | 792 (86.0) | 146 (13.1) | 938 (46.0) |
| Unemployed | 67 (7.3) | 914 (81.8) | 981 (48.1) |
| Marital status | | | |
| Married | 710 (77.1) | 834 (74.7) | 1544 (75.8) |
| Unmarried | 211 (22.9) | 283 (25.3) | 494 (24.2) |
| Socio-economic status | | | |
| (0−3) | 180 (19.5) | 611 (54.7) | 791 (38.8) |
| (4−5) | 390 (42.3) | 320 (28.6) | 710 (34.8) |
| (6−12) | 351 (38.1) | 186 (16.7) | 537 (26.3) |

**Table 2**

Prevalence of Self-Reported Physician-Diagnosed Chronic Diseases and Depression in Individuals With and Without Chronic Diseases

| Physician-diagnosed diseases | Chronic disease *N* (%) | Depressed | | $p^a$ |
|---|---|---|---|---|
| | | No chronic disease *N* (%) | With chronic disease *N* (%) | |
| Chronic respiratory disease | 257 (12.6) | 69 (3.9) | 23 (8.9) | < 0.001 |
| Heart disease | 96 (4.7) | 81 (4.2) | 11 (11.5) | 0.001 |
| Hypertension | 259 (12.7) | 62 (3.5) | 30 (11.6) | < 0.001 |
| Stroke | 22 (1.1) | 89 (4.4) | 3 (13.6) | 0.038 |
| Diabetes | 89 (4.4) | 86 (4.4) | 6 (6.7) | 0.301 |
| Rheumatism | 304 (14.9) | 64 (3.7) | 28 (9.2) | < 0.001 |
| Peptic ulcer | 239 (11.7) | 70 (3.9) | 22 (9.2) | < 0.001 |
| Kidney disease | 261 (12.8) | 65 (3.7) | 27 (10.3) | < 0.001 |
| Hepatic disease | 23 (1.1) | 92 (4.6) | 0 (0) | 0.62 |
| Obesity (BMI ≥ 30)[b] | 778 (38.2) | 51 (4.1) | 41 (5.3) | 0.20 |

[a] $\chi^2$ test for depression in individuals without vs. with chronic disease.

[b] BMI = Body Mass Index

## Table 3

Depression Odds in Individuals With vs. Without Chronic Diseases

| Chronic disease | Male OR[a] (95% CI[b]) | Female OR[a] (95% CI[b]) | Total OR[a] (95% CI[b]) |
|---|---|---|---|
| Heart disease | | | |
| Unadjusted | 0.79 (0.10−5.95) | 4.59 (2.18−9.66) | 2.97 (1.53−5.79) |
| Model 1[c] | 0.43 (1.30−5.87) | 4.33 (1.84−10.2) | 2.76 (1.20−5.87) |
| Model 2[d] | 0.32 (0.03−3.34) | 3.95 (1.50−10.4) | 1.81 (0.79−4.15) |
| Hypertension | | | |
| Unadjusted | 3.31 (1.20−9.16) | 3.16 (1.88−5.32) | 3.63 (2.30−5.73) |
| Model 1[c] | 3.11 (1.01−9.56) | 3.37 (1.83−6.22) | 3.20 (1.89−5.42) |
| Model 2[d] | 2.30 (0.58−9.09) | 2.92 (1.53−5.55) | 2.63 (1.51−4.61) |
| Stroke | | | |
| Unadjusted | | 5.33 (1.41−20.2) | 3.42 (0.99−11.8) |
| Model 1[c] | NC[e] | 3.93 (0.96−16.1) | 2.45 (0.66−9.00) |
| Model 2[d] | | 1.55 (0.29−8.13) | 1.06 (0.25−4.50) |
| Diabetes | | | |
| Unadjusted | 5.41 (1.75−16.7) | 0.59 (0.14−2.49) | 1.57 (0.67−3.69) |
| Model 1[c] | 5.24 (1.35−20.3) | 0.36 (0.08−1.65) | 1.10 (0.42−2.85) |
| Model 2[d] | 4.46 (0.91−21.9) | 0.12 (0.02−0.69) | 0.58 (0.20−1.69) |
| Rheumatism | | | |
| Unadjusted | 7.72 (3.32−18.0) | 1.53 (0.87−2.68) | 2.65 (1.67−4.20) |
| Model 1[c] | 8.77 (3.41−22.5) | 1.40 (0.76−2.58) | 2.14 (1.29−3.53) |
| Model 2[d] | 7.10 (2.58−19.6) | 1.03 (0.53−1.99) | 1.67 (0.89−2.85) |
| Peptic ulcer | | | |
| Unadjusted | 2.95 (1.14−7.63) | 2.25 (1.25−4.07) | 2.50 (1.52−4.13) |
| Model 1[c] | 2.96 (1.06−8.26) | 2.16 (1.16−4.02) | 2.25 (1.33−3.81) |
| Model 2[d] | 1.97 (0.60−6.48) | 1.70 (0.86−3.34) | 1.77 (1.01−3.10) |
| Kidney disease | | | |
| Unadjusted | 1.99 (0.66−5.96) | 3.02 (1.77−5.13) | 3.04 (1.90−4.86) |
| Model 1[c] | 1.94 (0.60−6.22) | 2.86 (1.64−4.98) | 2.57 (1.57−4.21) |
| Model 2[d] | 1.33 (0.33−5.36) | 2.96 (1.64−5.32) | 2.38 (1.42−4.00) |
| Hepatic disease | NC[e] | NC[e] | NC[e] |
| Chronic respiratory disease | | | |
| Unadjusted | 3.17 (1.29−7.84) | 2.16 (1.20−3.89) | 2.44 (1.49−3.99) |
| Model 1[c] | 3.65 (1.38−9.69) | 1.80 (0.97−3.34) | 2.21 (1.32−3.71) |
| Model 2[d] | 3.77 (1.23−11.6) | 1.68 (0.86−3.31) | 1.96 (1.14−3.38) |
| Obesity | | | |
| Unadjusted | 0.84 (0.33−2.13) | 1.25 (0.76−2.04) | 1.32 (0.86−2.01) |
| Model 1[c] | 0.72 (0.26−2.01) | 1.05 (0.59−1.87) | 0.95 (0.59−1.55) |
| Model 2[d] | 0.84 (0.28−2.52) | 1.00 (0.54−1.87) | 0.86 (0.51−1.43) |

[a] OR = odds ratio

[b] CI = confidence interval

[c] Model 1 adjusted for: age, residence, education, occupation, socio-economic status, marital status, religion, ethnicity, access to health care, and daily cigarette smoking. Adjustment for gender added for total sample.

[d] Model 2 adjusted for the same variables in model 1 plus all other chronic diseases

[e] Indicates number cannot be calculated due to zero in a category.

**Table 4**

Socio-Demographic Predictors of Comorbid Depression (vs. No Depression) in Individuals With Any Chronic Diseases

| Socio-demographic factor | Male OR[a] (95% CI[b]) | Female OR[a] (95% CI[b]) | Total OR[a] (95% CI[b]) |
|---|---|---|---|
| Age | 1.00 (0.96−1.05) | 1.00 (0.98−1.03) | 1.01 (0.99−1.03) |
| Gender | | | |
| Male | — | — | 1.0 |
| Female | | | 1.64 (0.69−3.91) |
| Religion | | | |
| Non-Muslim | 1.0 | NC[e] | 1.0 |
| Muslim | 0.23 (0.02−2.56) | | 1.72 (0.21−13.8) |
| Ethnicity | | | |
| Non-Arab | 1.0 | 1.0 | 1.0 |
| Arab | 1.59 (0.31−8.01) | 2.57 (0.89−7.40) | 2.52 (1.04−6.09) |
| Marital status | | | |
| Single, divorced, widowed | 1.0 | 1.0 | 1.0 |
| Married | 0.42 (0.08−2.10) | 0.68 (0.34−1.38) | 0.55 (0.30−1.02) |
| Residence | | | |
| Non-formal | 1.0 | 1.0 | 1.0 |
| Formal | 0.22 (0.06−0.80) | 0.55 (0.30−1.01) | 0.44 (0.26−0.76) |
| Education | | | |
| Illiterate | 1.0 | 1.0 | 1.0 |
| Years of education ≤ 9 | 4.80 (0.54−42.35) | 2.38 (1.20−4.73) | 2.61 (1.38−4.94) |
| Years of education > 9 | 2.73 (0.21−34.6) | 1.53 (0.41−5.78) | 1.89 (0.67−5.32) |
| Socio-economic status | | | |
| Low | 1.0 | 1.0 | 1.0 |
| Middle | 0.57 (0.16−2.09) | 0.28 (0.12−0.65) | 0.41 (0.22−0.78) |
| High | 1.16 (0.26−5.07) | 0.20 (0.05−0.81) | 0.52 (0.22−1.26) |
| Occupation | | | |
| Student | NC[c] | 1.0 | 1.0 |
| Employed | | 0.89 (0.12−6.63) | 0.75 (0.13−4.33) |
| Unemployed | | 0.32 (0.04−2.51) | 1.12 (0.18−6.83) |

[a] OR = odds ratio

[b] CI = confidence interval

[c] Indicates number cannot be calculated due to zero in a category.