

**Association between Depressive Symptoms and Vitamin D Deficiency
among Recently Admitted Nursing Home Patients**

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The prevalence of depression or depressive symptoms at the time of nursing home admission has been reported up to 80%.¹ Depressive symptoms have been shown to be associated with multiple negative health outcomes.² A possible risk factor for depression is vitamin D deficiency. A recently published meta-analysis showed that lower vitamin D levels were significantly associated with higher risk of depression among non-institutionalized populations.³

Vitamin D deficiency has been observed in 40% or more of community dwelling elders⁴ and up to 100% of nursing home residents in some studies.⁵ Although nursing home residents are at high risk for both depression and vitamin D deficiency, to our knowledge, there has been only one study investigating the association of vitamin D and depression in the nursing home with marginal findings.⁶

This study examines the association of prevalent depressive symptoms with vitamin D deficiency among recently admitted nursing home residents.

METHODS

This cross-sectional study involved male veterans admitted between 2011 and 2012 to the Veterans Affairs Pacific Islands Health Care System Community Living Center for rehabilitation, skilled-nursing, intermediate, and respite care and was approved by the Institutional Review Board. The 15-item GDS⁷ was used to assess depressive symptoms. Patients with GDS ≥ 5 were considered to have prevalent depressive symptoms. Total serum 25-hydroxyvitamin D (25(OH)D) levels were measured. Vitamin D deficiency was defined as 25(OH)D level < 20 ng/mL.⁴ Demographic data collected included age, ethnicity, body mass index (BMI), reasons for

admission, setting prior to admission, smoking, alcohol use, vitamin D supplementation and antidepressant use.

The cohort was divided into vitamin D deficient and the non-deficient groups and compared in demographic variables, GDS, and prevalent depressive symptoms using t-tests and chi-square tests for continuous and categorical variables, respectively. We used univariate and multivariate logistic regression models to calculate odds ratios (OR) with 95% confidence intervals (CI) of prevalent depressive symptoms for vitamin D deficiency and vitamin D levels, adjusted for covariates.

RESULTS

Of 302 male veterans admitted, those without 25(OH)D levels (n=61) or GDS (n=123) and on antidepressants (n=27) or vitamin D supplementation (n=27) were excluded, the latter two to control for potential effects on psychological and vitamin D status, leaving 64. (21.2%).

Mean 25(OH)D level was 20.9 ng/ml and the prevalence of vitamin D deficiency was 51.6%.

Mean age was 67.8 years and mean BMI was 27.3. Half of the cohort was White (50.0%) and Asian/ Pacific Islander was 42.2%. Mean GDS score was 3.1, and 23.4% had ≥ 5 points. Patients with vitamin D deficiency were significantly likelier to be younger and have higher BMI.

Vitamin D deficiency and 25(OH)D were used in multivariate logistic regression models as independent variables in two models, respectively, both adjusted for age, BMI, and ethnicity.

While 25(OH)D was not associated with prevalent depressive symptoms, vitamin D deficiency was significantly and independently associated with prevalent depressive symptoms (OR=9.05,

95%CI=1.61-50.71, p=0.01) (**Table 1**).

DISCUSSION

Our findings support an association between depressive symptoms and vitamin D deficiency in nursing home residents. Vitamin D deficiency was independently and significantly associated with prevalent depressive symptoms in the multivariate logistic regression model among 64 veterans at the time of nursing home admission.

Enigmatically, in our study, BMI appears to have a complex confounding effect that may be unique to the elderly and merit further investigation. Although obesity is associated with higher mortality in general populations, higher BMI has been shown to have a survival benefit in older adults known as obesity paradox.⁸ In our cohort, higher BMI was associated with both higher levels of vitamin D deficiency and less depressive whereas in the literature obesity is known to be a risk factor for both vitamin D deficiency⁹ and depression¹⁰ in younger adults.

The obesity-vitamin D deficiency link has been attributed to excess adipose tissues acting as storage of fat soluble vitamin D leading to lower bioavailability or lower exposure to sunlight due to impaired mobility or disability.⁹ In elderly residing in nursing homes, malnutrition and weight loss can be highly prevalent, and low BMI can be associated with depression. In the elderly, low BMI may thus be a surrogate marker of poor overall health status leading possibly to depressed symptoms.

Potential limitations of this study include cross-sectional study design; small subject size; cohort

of male veterans; inherent sampling bias with the exclusion of veterans as described above; and although validated to be a reliable screening tool use of GDS scores as opposed to psychiatric interviews.

In this study, Vitamin D deficiency was significantly associated with prevalent depressive symptoms among recently admitted nursing home residents after adjusting for covariates. This important association merits further investigation and clarification.

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Author Contributions

Study concept and design: GK, MT, KM, GWR, AT, and HP. Acquisition of data: GK and AT. Analysis and interpretation of data: GK, MT, KM, GWR, AT, HP, GG, and DF. Drafting the article: GK. Revising the article critically for important intellectual content: GK, MT, KM, GWR, AT, HP, GG, and DF. Final approval of the version to be published: GK, MT, KM, GWR, AT, HP, GG, and DF.

Sponsor's Role

None.

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Table 1. Odds ratios of prevalent depressive symptoms* for vitamin D status using multivariate logistic regression models.

Factors	Model 1 [†]		Model 2 [†]	
	Odds Ratio		Odds Ratio	
	(95%CI [‡])	p value	(95%CI)	p value
vitamin D deficiency [§]	9.05 (1.61-50.71)	0.01	-	-
vitamin D level	-	-	0.94 (0.86-1.01)	0.11
age	1.06 (0.98-1.14)	0.15	1.04 (0.97-1.11)	0.24
body mass index	0.84 (0.72-0.97)	0.02	0.85 (0.74-0.98)	0.03
White	ref	-	ref	-
Asian/Pacific islander	0.47 (0.10-2.15)	0.33	0.39 (0.09-1.68)	0.20
Black	0.51 (0.03-7.47)	0.62	0.76 (0.06-10.19)	0.84

* Prevalent depressive symptoms: Defined as Geriatric Depression Scale score of five or more.

[†] Model 1: Outcome variable is vitamin D deficiency defined as serum 25-hydroxyvitamin D level <20ng/mL. Model 2: Outcome variable is serum 25-hydroxyvitamin D level. Both adjusted for age, body mass index, and ethnicity.

[‡] CI: Confidence interval.

[§] Vitamin D deficiency: Defined as serum 25-hydroxyvitamin D level <20ng/mL.