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Insights Provided by Depression Screening Regarding Pain, Anxiety, and Substance use in a Veteran Population

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Abstract

Objective: We sought to quantify the extent to which a depression screening instrument commonly used in primary care settings provides additional information regarding pain interference symptoms, anxiety, and substance use. **Methods:** Veterans Aging Cohort Study (VACS) data collected from 2003 through 2015 was used to calculate odds ratios (OR) for associations between positive depression screening result cutoffs and clustering conditions. We assessed the test performance characteristics (likelihood ratio value, positive predictive value, and the percentage of individuals correctly classified) of a positive Patient Health Questionnaire (PHQ-9 & PHQ-2) depression screen for the identification of pain interference symptoms, anxiety, and substance use. **Results:** A total 7731 participants were included in the analyses. The median age was 50 years. The PHQ-9 threshold of ≥20 was strongly associated with pain interference symptoms (OR 21.6, 95% CI 17.5-26.7) and anxiety (OR 72.1, 95% CI 52.8-99.0) and yielded likelihood ratio values of 7.5 for pain interference symptoms and 21.8 for anxiety and positive predictive values (PPV) of 84% and 95%, respectively. A PHQ-9 score of ≥10 still showed significant associations with pain interference symptoms (OR 6.1, 95% CI 5.4-6.9) and symptoms of anxiety (OR 11.3, 95% CI 9.7-13.1) and yet yielded lower likelihood ratio values (4.36 & 8.24, respectively). The PHQ-9 was less strongly associated with various forms of substance use. **Conclusion:** Depression screening provides substantial additional information regarding the likelihood of pain interference symptoms and anxiety and should trigger diagnostic assessments for these other conditions.

Keywords

depression, screening tool, co-occurring, pain, anxiety, veterans

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Introduction

Globally, depression is the most common psychiatric disorder[1] and the most common mental health condition seen in US primary care patients.[2-5] In the US, an estimated 17 million adults have had at least 1 major depressive episode in the past year, representing 7% of all adults.[6] Depression independently impacts physical health conditions and disease prognosis of cancer, stroke, and acute coronary syndrome, as well as medication adherence[7] and increases risk for all-cause mortality.[8-13] Consequently, screening for depression is recommended and commonly performed in primary care.[14]

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It has been well-established that depression co-occurs more frequently than would be expected by chance (ie, "clusters") with other highly prevalent clinical conditions and behaviors (ie, "conditions"), such as pain, anxiety, and substance use.[8-13] Veterans in particular tend to have higher rates of depression anxiety and chronic pain due to combat experiences.[15,16] While current US guidelines recommend screening and treatment for depression, unhealthy alcohol, drug and tobacco use, guidelines do not include independent recommendations to screen for anxiety, pain, or other substance use.[17,18] Screening for all conditions that cluster with depression is unlikely to be feasible given provider-level as well as system-level time and resource constraints,[19] especially since an estimated 50% of adults with major depression still remain undiagnosed[20] despite the US Preventive Service Task Force (USPSTF) recommendation for depression in primary care.[21-23] Anxiety is similarly underdiagnosed.[24] Because depression is strongly correlated with pain,[25] anxiety disorders,[26] and substance use,[27-29] information obtained from depression screening may provide clinically meaningful information that would facilitate identification of individuals at high risk of these conditions and could trigger further diagnostics. A combined diagnostic approach could also lead to a more effective and targeted choice of treatment by increasing awareness of comorbidities.

Depression is often screened for using the 9-item Patient Health Questionnaire-9 (PHQ-9) or its abbreviated version, the 2-item Patient Health Questionnaire-2 (PHQ-2).[30] Brief screeners such as the PHQ-9 and 2 are useful tools for identifying persons at risk for depression, but may also signal the presence of health conditions such as pain, anxiety, and substance use and could serve as a prompt for additional diagnostic testing. Additionally, their screening capabilities may differ in care settings disproportionally impacted by these clustering conditions, such as with HIV patients.[31]

Therefore, this study sought to evaluate whether a common depression screening tool can provide additional information, at no extra cost, regarding the likelihood of conditions that often cluster with depression beyond what would be expected from established correlations alone. We used data from the Veterans Aging Cohort Study (VACS), a cohort of patients receiving primary care in the Veterans Health Administration (VA) healthcare system, to measure associations between depressive symptom severity—measured using the PHQ-9 and PHQ-2—and pain interference symptoms, anxiety, as well as tobacco, alcohol, marijuana, illicit opioid, stimulant, and injection heroin use.

Methods

Sample and Data Sources

The VACS survey sample includes US veterans receiving healthcare in 8 VA centers: Atlanta, Baltimore, Dallas, Houston, Los Angeles, New York (Manhattan, Brooklyn, and the Bronx), Pittsburgh, and Washington, D.C. The VACS sampling frame is primary care and is composed of approximately equal numbers of patients with HIV and without HIV in primary care practices who are matched by age, race, gender, and VA center of care.[32] Study enrollment began in 2002. The VACS includes clinical, administrative, and survey data on all study participants. Institutional review boards at each participating VA medical center and affiliated academic institutions approved all study activities. We used data from 8 annual surveys that administered the PHQ-9 and PHQ-2. These surveys were administered from 2003 to 2015 in Atlanta, the Bronx, Houston, Los Angeles, Manhattan/Brooklyn, and Pittsburgh and from 2004 to 2015 in Baltimore and Washington DC. Analyses were performed using data starting in survey period 2003 to 2004 after all study sites had begun recruiting participants.

Measures

The current analysis considers severity of depressive symptoms, indicated by specific ranges of scores on the PHQ-9 and PHQ-2, as well as symptoms of pain interference, anxiety, and substance use. All instruments and thresholds used in our analyses are described below.

Depression. Depressive symptoms were measured using the PHQ-9 and PHQ-2. The PHQ-9 is a 9-item screening instrument that assesses the frequency of experiencing depression-related symptoms in the prior 2 weeks (eg, "little interest or pleasure in doing things," "feeling down, depressed, or hopeless") using response options rated on a 4-point scale ranging from 0 "not at all" to 3 "nearly every day" and a total score ranging from 0 to 27.[30] Following Kroenke,[33] we used a PHQ-9 score of $\geq$10 to indicate current depressive symptoms, $\geq$15 to indicate moderate depressive symptoms, and $\geq$20 to indicate severe depressive symptoms.[34] The PHQ-2 measures the frequency of depressed mood and anhedonia over the past 2 weeks using the first 2 items of the PHQ-9 with a total score ranging from 0 to 6. A cut-off of $\geq$3 was selected as being suggestive of current depression.[35] Missing values were replaced with the mean value of the remaining items if the number of missing items was below 20%. If the number of missing items in the scale exceeded 20%, the sum score was not computed and counted as missing.[36,37]

Pain interference and anxiety symptoms. Pain interference symptoms were assessed using 1 question from the Health Survey Short-Form 12 (SF-12) that states: "During the last month, how much has pain interfered with your normal work (including work outside and inside the home)?"[38] Potential responses were "not at all," "a little bit," "moderately," "quite a bit," or "extremely." Responses of

"moderately," "quite a bit," or "extremely" were coded as positive for pain interference symptoms.[39,40] Anxiety symptoms were assessed by a single survey item, which asked if the participant had "felt nervous or anxious" in the 4 weeks before the survey and, if applicable, the degree to which they were bothered by these feelings on a 4-point Likert scale (ranging from 0 [not at all] to 3 [severely]).[41,42] We coded a dichotomous variable indicating any presence of the symptom with a positive anxiety coded if the individual stated the symptom at least "bothers me a little."

Unhealthy alcohol use. Alcohol use was measured using the Alcohol Use Disorder Identification Test (AUDIT). The AUDIT is a 10-item questionnaire that was designed to detect unhealthy alcohol use[43] across various settings and subgroups.[44-46] The AUDIT assesses 3 domains of alcohol use and related variables: past-year consumption based on frequency, quantity, and heavy drinking; past year dependence symptoms including impaired control, increased salience of drinking, and morning drinking; and consequences of use (eg, guilt, blackouts, alcohol-related injury, and others' concern about one's use). Each item is scored from 0 to 4 for a maximum score of 40. Based on World Health Organization (WHO) guidelines,[47] we used an AUDIT score of ≥ 8 as a cut-off for unhealthy alcohol use. Missing AUDIT score data were characterized using available AUDIT items as previous analyses.[48]

Other substance use. Separately, we examined current tobacco use ($\geq$10 cigarettes a day) and past-year use of marijuana, crack/cocaine, other stimulants other than crack/cocaine (eg, amphetamine), injection drug use, and illicit opioids including heroin and/or non-medical use of prescription opioids "such as Oxycontin, Vicodin, Percocet." Prescription opioids were assessed differently during the 2005 to 2007 survey wave and were therefore excluded. Other substance use was analyzed as binary variables (ie, positive if an individual reported substance use in the past year, negative otherwise).

Statistical Analyses

All analyses were conducted using R Version 3.6.1. Bivariable analyses were conducted to describe across-time levels of depressive symptom severity and clustering condition symptoms. We calculated odds ratios (OR) and 95% confidence intervals (CIs) for associations between categories of depressive symptom severity and clustering condition symptoms using random effects to account for within-individual clustering across follow-ups.[49-52] The VACS cohort consists of approximately 50% HIV positive patients and HIV patients often have increased rates of mental health conditions and substance use.[31] Therefore, we included an interaction term, depressive symptom severity by HIV status, to test for significant differences in the relationship between PHQ-9/PHQ-2 category and clustering condition symptoms by HIV status.

We assessed the test performance of the PHQ-9/PHQ-2 as screening tools for identifying clustering condition symptoms and evaluated these tools when using different thresholds (10, 15, and 20) to define a "positive" test. Specifically, we calculated the sensitivity, specificity, likelihood ratio (sensitivity/1-specificity), positive predictive value (PPV), and the percentage of individuals correctly classified when using positive depression screening result to identify pain interference symptoms, anxiety, unhealthy alcohol use, and other substance use.

Results

A total of 8706 participants were enrolled and completed a baseline survey. A total of 7731 (88%) completed 1 or more follow-up surveys, when the PHQ was administered, and were therefore included in the current analyses. The mean PHQ-9 score was 5.7 (range: 0-27, inter-quartile range: 0-9). The median age was 50 years, with ages ranging from 21 to 86 years (inter-quartile range: 44-55 years). Approximately 95% of individuals were male, 66% were African American, 23% were white, and 9% were Hispanic. Missing PHQ data was imputed for 19.6% of participants.

Based on the PHQ-9, 73% had a score less than 10, 9% had a score between 10 and 14, 5% had a score between 15 and 19, and 5% had a score of 20 or more (Table 1). Based on the PHQ-2, 78% had a score of more than 3. On average over the follow-up period, 39.1% had pain interference symptoms, 40% had anxiety symptoms and nearly half (44%) of the sample had past-year tobacco use, 10.6% had past-year unhealthy alcohol use, 20.2% reported past-year marijuana use, 13% reported past-year crack/cocaine use, and 18.9% reported past-year illicit opioid use. A minority of the sample reported past-year stimulant use other than crack/cocaine (3%) and injection drug use (3%). Depression, pain interference symptoms, anxiety, and substance use levels tended to vary over time (Table 1). Population characteristics did not vary significantly by HIV status (Table S1, S3).

Depression Severity and Clustering Conditions

PHQ-9 scores of 10 to 14, 15 to 19, and $\geq$20 versus the referent $\leq$9 were associated with greater odds for pain interference symptoms, with estimates ranging from 6.1 (95% CI; 5.4-6.9) to 21.6 (95% CI; 17.5-26.7). Similarly, scores of $>$10 were associated with $>$10 times the odds of anxiety symptoms, with point estimates and confidence intervals ranging from 11.3 (95% CI; 9.7-13.1) to 72.1 (95% CI; 52.5-98.9) (Table 2). The association between

Table 1. Across-time Prevalence of Depression Severity, Pain interference symptoms, anxiety, and Alcohol and other Substance Use among Veterans Aging Cohort Study Participants (2003-2015).

	2003-04 n = 2833 (%)	2004-05 n = 3997 (%)	2005-07 n = 4112 (%)	2008-09 n = 4252 (%)	2009-11 n = 3764 (%)	2011-12 n = 3515 (%)	2012-14 n = 3826 (%)	2015 n = 1296 (%)	Overall (%)
PHQ-9 scores									
<10	71.4%	73.6%	71.1%	75.6%	75.4%	74.0%	72.2%	70.7%	73.3%
10-14	8.2%	10.4%	11.0%	8.7%	9.4%	8.5%	8.0%	8.1%	9.2%
15-19	4.9%	5.5%	6.2%	5.0%	4.9%	6.2%	5.0%	3.6%	5.3%
≥20	4.4%	6.0%	6.6%	4.8%	4.6%	5.0%	3.7%	4.4%	5.0%
PHQ-2 ≥3	77.4%	78.6%	76.2%	79.6%	80.3%	77.5%	77.8%	79.0%	78.3%
Anxiety	42.2%	45.8%	45.1%	45.6%	------[a]	41.7%	54.1%	53.2%	40.0%
Pain interference	38.7%	39.8%	39.4%	37.5%	38.9%	37.4%	41.6%	40.3%	39%
AUDIT ≥8	11.7%	13.1%	15.3%	13.8%	12.0%	11.3%	------[a]	------[a]	10.6%
Current smoker	40.1%	45.3%	45.8%	43.3%	43.5%	41.5%	44.6%	41.8%	43.5%
Current heavy smoker	------[a]	28.3%	------[a]	26.7%	24.1%	23.8%	18.3%	14.4%	17.7%
Marijuana	19.4%	20.7%	19.85	18.1%	19.0%	19.0%	24.0%	24.5%	20.2%
Illicit opioids[b]	18.3%	17.3%	12.8%	21.1%	19.7%	20.0%	22.5%	21.5%	18.9%
IDU	2.0%	2.8%	2.9%	2.8%	2.6%	2.7%	3.9%	2.9%	2.8%
Crack/Cocaine	10.1%	15.8%	15.0%	13.0%	12.5%	10.5%	15.2%	14.0%	13.4%
Other stimulants[c]	2.0%	3.0%	2.4%	2.0%	1.8%	1.7%	3.8%	3.6%	2.5%

[a]Data not assessed at this survey wave.
[b]Includes non-medical use of prescription opioids "such as Oxycontin, Vicodin, Percocet" or heroin use (note: prescription opioids were not assessed during the 2005-07 survey wave).
[c]Other stimulants defined as "amphetamines, uppers, speed, crank, crystal meth, bam."

Table 2. Associations between Depression Severity and Pain interference symptoms, anxiety, and Alcohol and Substance Use among Veterans Aging Cohort Study Participants: PHQ-9 versus PHQ-2.

	Odds Ratios (95% Confidence Intervals)					
	PHQ-9 Score				PHQ-2 Score	
	<10	10-14	15-19	≥20	<3	≥3
Anxiety	Referent	11.28 (9.74-13.07)	30.35 (24.12-38.19)	72.06 (52.53-98.85)	Referent	11.59 (10.44-12.86)
Pain interference	Referent	6.11 (5.39-6.93)	10.95 (9.22-13.00)	21.63 (17.50-26.74)	Referent	6.86 (6.17-7.62)
AUDIT ≥8	Referent	2.24 (1.78-2.82)	2.96 (2.23-3.94)	3.56 (2.59-4.90)	Referent	2.2 (1.82-2.64)
Current smoker	Referent	1.58 (1.32-1.89)	2.00 (1.58-2.53)	2.44 (1.85-3.20)	Referent	1.78 (1.56-2.02)
Current heavy smoker	Referent	1.41 (1.11-1.80)	1.41 (1.02-1.94)	2.66 (1.87-3.77)	Referent	1.56 (1.27-1.91)
Marijuana	Referent	2.06 (1.69-2.52)	2.24 (1.74-2.90)	2.12 (1.57-2.86)	Referent	1.91 (1.62-2.61)
Illicit opioids[a]	Referent	2.67 (2.19-3.26)	2.75 (2.14-3.53)	3.09 (2.33-4.10)	Referent	2.22 (1.89-1.95)
IDU	Referent	2.51 (1.67-3.78)	2.77 (1.71-4.49)	2.88 (1.60-5.18)	Referent	2.36 (1.68-3.3)
Crack/Cocaine	Referent	2.55 (2.07-3.14)	2.90 (2.21-3.80)	3.72 (2.75-5.03)	Referent	2.33 (1.95-2.77)
Other stimulants[b]	Referent	2.85 (1.93-4.22)	2.74 (1.68-4.45)	2.74 (1.53-4.91)	Referent	2.56 (1.83-3.59)

[a]Includes non-medical use of prescription opioids "such as Oxycontin, Vicodin, Percocet" or heroin use (note: prescription opioids were not assessed during the 2005-07 survey wave).
[b]Other stimulants defined as "amphetamines, uppers, speed, crank, crystal meth, bam."

PHQ-9 score and substance use was weaker than for pain interference and anxiety symptoms, with the highest category (≥20) increasing the odds marijuana use by 2.1 (95% CI; 1.6-2.9) and 3.7 (95% CI; 2.8-5.0) for crack/cocaine use. Except when using a cutoff score of 10 to 14, the odds ratios were larger when depression was assessed using the PHQ-9 versus the PHQ-2. Associations did not vary significantly by HIV status (Table S2, S4), hence findings are presented for the full sample.

Test Performance of Depression Screening for Identification of Clustering Condition Symptoms

Identification of pain interference and anxiety symptoms. A PHQ-9 score of ≥10 yielded likelihood ratios of 4.4 and 8.2, sensitivity levels of 40% and 40%, specificity levels of 91% and 95%, and PPVs of 74% and 88% for identifying pain interference and anxiety symptoms, respectively (Table 3). A PHQ-9 score of ≥20 yielded likelihood ratios

Table 3. Test Performance of Depression Screening Tools for Identification of Pain interference symptoms, anxiety, and Substance Use among Veterans Aging Cohort Study Participants.

	PHQ-9			PHQ-2
	PHQ9≥10	PHQ9≥15	PHQ9≥20	PHQ2 ≥3
Anxiety				
Sensitivity	40%	22%	11%	36%
Specificity	95%	98%	100%	94%
Positive predictive value	88%	93%	95%	85%
Likelihood ratio	8.24	14.11	21.57	6.29
% Correctly classified	69%	62%	57%	67%
Moderate/High pain interference				
Sensitivity	40%	22%	11%	36%
Specificity	91%	96%	99%	91%
Positive predictive value	74%	79%	84%	71%
Likelihood ratio	4.36	5.85	7.84	3.83
% Correctly classified	71%	67%	64%	69%
Alcohol use (AUDIT ≥ 8)				
Sensitivity	34%	18%	9%	30%
Specificity	80%	91%	96%	82%
Positive predictive value	16%	17%	19%	16%
Likelihood ratio	1.72	1.87	2.02	1.64
% Correctly classified	76%	83%	87%	76%
Current smoker				
Sensitivity	25%	14%	6%	24%
Specificity	82%	91%	96%	83%
Positive predictive value	52%	53%	53%	52%
Likelihood ratio	1.39	1.43	1.45	1.39
% Correctly classified	57%	57%	57%	57%
Current heavy smoker				
Sensitivity	26%	14%	7%	24%
Specificity	81%	90%	96%	82%
Positive predictive value	31%	31%	32%	30%
Likelihood ratio	1.40	1.41	1.47	1.34
% Correctly classified	68%	72%	74%	68%
Marijuana				
Sensitivity	26%	13%	6%	24%
Specificity	80%	89%	95%	81%
Positive predictive value	26%	25%	23%	25%
Likelihood ratio	1.34	1.25	1.15	1.28
% Correctly classified	69%	74%	76%	69%
Illicit opioid use[a]				
Sensitivity	31%	17%	8%	28%
Specificity	83%	91%	96%	83%
Positive predictive value	54%	54%	54%	52%
Likelihood ratio	1.84	1.79	1.79	1.68
% Correctly classified	63%	62%	61%	62%
Injection drug use				
Sensitivity	38%	21%	8%	32%
Specificity	78%	88%	94%	79%
Positive predictive value	8%	8%	7%	7%
Likelihood ratio	1.73	1.75	1.53	1.54
% Correctly classified	76%	85%	91%	77%

(continued)

Table 3. (continued)

	PHQ-9			PHQ-2
	PHQ9≥10	PHQ9≥15	PHQ9≥20	PHQ2 ≥3
Crack/Cocaine use				
Sensitivity	31%	17%	8%	28%
Specificity	81%	90%	95%	81%
Positive predictive value	21%	21%	21%	20%
Likelihood ratio	1.59	1.62	1.60	1.48
% Correctly classified	74%	79%	83%	74%
Other stimulants[b]				
Sensitivity	38%	20%	8%	34%
Specificity	79%	89%	95%	81%
Positive predictive value	5%	5%	4%	5%
Likelihood ratio	1.87	1.87	1.63	1.75
% Correctly classified	78%	87%	93%	79%

[a]Includes non-medical use of prescription opioids "such as Oxycontin, Vicodin, Percocet" or heroin use (note: prescription opioids were not assessed during the 2005-07 survey wave).
[b]Other stimulants defined as "amphetamines, uppers, speed, crank, crystal meth, bam."

of 7.84 and 21.57, sensitivity levels of 11% and 11%, specificity levels of 99% and 100%, and PPVs of 84% and 95% for pain interference and anxiety symptoms, respectively.

Identification of unhealthy alcohol use and other substance use. All PHQ-9 and PHQ-2 score cutoffs yielded lower likelihood ratios, sensitivity and specificity levels, and PPVs when used to identify unhealthy alcohol use and other substance use compared to anxiety and pain interference symptoms. PHQ-9 scores of ≥10 yielded likelihood ratios ranging from 1.34 (marijuana use) to 1.87 (other stimulant use) (Table 3) and sensitivity levels of 25% to 38% and specificities of 78% to 83% for each substance use outcome. PPVs were greatest for tobacco use (52%), illicit opioid use (54%), and marijuana (23%) and were much lower for unhealthy alcohol use (19%), injection drug use (7%), and other stimulant use (4%).

Discussion

This study, to our knowledge, is the first to specifically assess the value of using the PHQ-9 and PHQ-2 screening tools to identify conditions that commonly cluster together with depression. Our results indicate that the use of the PHQ-9 and PHQ-2 to screen for depression in primary care may contain enough incidental information about the likelihood of certain clustering conditions to influence diagnostic assessment decisions for pain interference symptoms and anxiety, but is unlikely to provide additional information to identify substance use. For example, a PHQ-9 score ≥20 yielded likelihood ratio values of 7.84 for pain interference symptoms and 21.57 for anxiety, potentially outperforming the Generalized Anxiety Disorder 7-item (GAD-7) for identifying anxiety (likelihood ratio 5.1).[53] Given that depression is commonly screened for, while pain and anxiety are not, the high PPV (84% and 95%) of PHQ-9 for these conditions provides an important opportunity to identify and treat otherwise undiagnosed pain and anxiety.

Our results provide further empirical data to support current USPSTF guidelines, which recommend that all positive depression screening results should lead to additional assessment of comorbid psychological factors such as anxiety.[21] Anxiety disorders remain underdiagnosed in primary care, in part due to the potential presentation of anxiety with symptoms not readily identified with brief anxiety screeners.[24] The use of a positive depression screening result to trigger more thorough anxiety diagnostics, therefore could lead to greater identification of those with anxiety not picked up by the brief screeners often used in primary care.

It may be argued that there is little clinical utility to diagnosing anxiety when depression is already suspected, as these 2 conditions are known to co-occur, are often treated using the same therapies, and indeed may be viewed as different manifestations on a psychiatric disorder spectrum.[54] However, depression with anxiety is more often accompanied by alcohol use disorder than depression alone,[26,55] may respond best to specific treatments,[56] and therefore awareness of the patient's commodities would very likely influence subsequent clinical decisions.

Our results also support activities beyond current USPSTF guidelines, particularly screening for pain if a positive depression screen is identified. Pain is often unreported due to stigma, fear of repercussions, or other reasons, particularly in certain populations.[57-62] Using a positive depression screening to trigger pain screening may serve to identify

patients with unreported pain. Due to the bidirectional nature of the relationship between pain and depression,[63-65] treating both concurrently may lead to a greater improvement of the outcomes of both conditions more than if each were treated alone. This relationship is particularly important in light of the current opioid epidemic, because individuals with mental health disorders are often overprescribed opioid medication[66] and screening for and treating depression and pain concurrently has the potential to guide clinical decisions toward alternate non-opiate treatments that can address not only pain, but also co-occurring conditions.[67]

The low-to-moderate sensitivity for detecting pain interference symptoms and anxiety, however, indicate that PHQ-9 and PHQ-2 screeners would not be sufficient in themselves to diagnose these conditions. Their moderate- to high-likelihood ratio values and PPVs, however, show they may convey substantial information regarding the likely presence of these conditions, potentially helping to guide decisions regarding further diagnostic assessment of patients. Additionally, the PHQ-9 performed similarly in both an HIV+ and HIV- sample, emphasizing the importance of depression screening in specialty care in addition to in primary care.

While current USPSTF guidelines recommend that positive depression screening results should lead to assessment of substance use, the results of the current study suggests depression screeners, however, may be unlikely to provide sufficient information to guide more extensive assessment of alcohol and other substance use in this population. This emphasizes the importance of the development of guidelines for illicit substance use-specific screening.[18] With few exceptions, the full PHQ-9 demonstrated better overall screening test performance indicated by greater sensitivity, likelihood ratio values, and slightly higher percentages correctly classified compared with the PHQ-2. Therefore, the value added of implementing the better performing but the longer PHQ-9 should be evaluated.

In a prior study, we examined the test performance of the AUDIT for identification of clustering conditions. Taken together, we observed that the PHQ-9 performs better than the AUDIT for identifying anxiety symptoms and pain interference symptoms but worse than the AUDIT for identifying substance use.[48] With the exception of crack/cocaine use, anxiety, and pain interference symptoms, however, the PHQ-9 consistently had a higher sensitivity, but lower specificity than the AUDIT for the detection of all clustering conditions. Further research is warranted for the potential for other conditions or behaviors commonly assessed in clinical practice (eg, tobacco use) to improve case finding of other health concerns.

This study has several limitations. First, the presence of clustering conditions was assessed using brief screening tools (ie, AUDIT) or self-report (eg, pain interference symptoms, anxiety, substance use) rather than clinical diagnoses. It is possible clinically diagnosed conditions would have different correlations with the PHQ-9 and would therefore impact our findings. Second, levels of depressive and anxiety symptoms, tobacco, crack/cocaine, injection drug use, and illicit opioid use appeared to peak in 2004 to 2007 and then decrease over the course of follow-up. These findings may be due to differential dropout from death or loss to follow-up. Similarly, these analyses did not account for the potential treatment of the clustering conditions over time, which may impact condition associations. Third, the variable measures studied for their inter-relationships and predictive power often had different time references. This shortcoming would tend to decrease sensitivity of the research design. Finally, our study included veterans receiving care at the VA, an older, racially diverse, lower socioeconomic status population compared to the general US population and a population with guaranteed access to health care. Our findings may not be generalizable to women, younger individuals or populations that are not racially diverse, of higher socioeconomic status, or without guaranteed access to health care. Additional studies are needed to examine the degree to which depression screening is useful for identification of clustering conditions across populations.

Conclusion

Our findings underscore the potential for depression screening to provide an additional benefit of identifying patients with high risk for other clinical conditions, particularly pain interference symptoms and anxiety. Using information from a positive depression screening result to trigger assessment of conditions expected to cluster together appears to be a promising way to improve case finding, and, by extension, treatment of anxiety and pain.

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Author Contributions

None.

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