



Characteristics Associated with Depression and Suicidal Thoughts Among Medical Residents: Results from the DEPRESS-Ohio Study

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Abstract

Objective This study describes the characteristics that are associated with depression in residents and also examines resident perception of available mental health support.

Methods Residents and their program directors from each of 10 specialties across all academic training institutions in Ohio were electronically surveyed over a 2-month period. Generalized logistic regression was used to test for association between risk factors and depression and, among depressed residents, with suicidal thoughts.

Results Using the PHQ-9, 19% of residents met criteria for at least moderate depression and 31.1% of depressed residents had suicidal thoughts. Over 70% of depressed residents were not receiving treatment, including 70% of depressed residents with suicidal thoughts. Residents who were unaware of wellness programming or did not believe their program director would be supportive of a depressed resident were significantly more likely to be depressed. Residents who believed depression treatment would negatively impact medical licensure were significantly more likely to be depressed. Male program directors and those in their position for fewer than 5 years were significantly more likely to have depressed residents in their program.

Conclusions A substantial proportion of depressed residents have suicidal thoughts, and most are not receiving treatment. Depressed residents may perceive the availability of support from their program director differently than their non-depressed colleagues, and may perceive greater risk to medical licensure if they seek treatment.

Keywords Depression · Residents · Treatment · Licensure · Wellness

Depression among medical residents is a significant health problem [1–4]. A recent meta-analysis examining studies reporting depression in residents which utilized depression inventories with a high specificity identified a depression rate of

20.2% [4]. The risk of suicidal ideation is high among residents [3, 5], and is higher than in population peers [3], especially in females [6]. Moreover, evidence suggests a higher rate of medical errors in residents with depression [7–9]. Thus, recognizing and treating depression in residents are critical not only to resident health, but also to patient safety.

The literature does not provide clear guidance on which characteristics are associated with resident depression. Gender [1, 3, 8–11], post graduate year (PGY) of training [1, 3, 8], and marital and parenthood status [7, 8] have been examined by others with mixed results. Similarly, the number of hours residents work may be associated with depression [9], but others report that amount of call [3] or working hours [11] do not influence the rate of depression.

While some residents with depression seek treatment, many do not [11, 12]. Barriers to seeking treatment have included limited time, a preference to manage problems on their own, inconvenient access, and perceived lack of confidentiality [12]. Many residents do not have a primary care physician

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[13], and self-prescribing is frequent [14, 15]. It has not been evaluated whether suicidal thoughts among depressed residents influence their choice to seek treatment. Training programs, such as the Oregon Health and Science University (OHSU) wellness program [16], have developed programming to encourage confidential mental health assistance to residents; however, it remains unclear to what extent residents elsewhere with depression are aware of the availability of programming, support, and access to care. It is also not known if depressed residents believe that their medical license might be jeopardized if they seek treatment. If so, this could be another perceived barrier to choosing effective treatment.

The DEPRESS-Ohio Study (DEpression in RESidents Survey-Ohio) was designed to explore factors associated with depression and suicidal thoughts among medical residents. We examined whether residents' perceptions of availability of wellness programming, program director support, potential for depression treatment jeopardizing licensure, and access to care were associated with depression and, among depressed residents, with suicidal thoughts. In addition, we examined whether program director characteristics might distinguish those directors with greater odds of having a greater proportion of depressed residents.

Methods

In order to recruit participants for this study, the Graduate Medical Education (GME) office from all seven teaching institutions in Ohio sent recruitment emails to residents and their program directors. Ten specialties, whose residents enter as PGY 1, were selected for participation. All specialties were not offered at each institution, and some programs elected not to participate. The email included a link to the consent form and, if accepted, an automatic link to the survey. The initial link was sent in December 2017 with a follow-up link sent in January 2018. Although it was possible for a participant to complete the survey twice, there was no evidence that this occurred.

All institutions provided IRB review and approval.

Residents were not obligated to answer any question except those designating their specialty, institution, and the Patient Health Questionnaire (PHQ-9). The PHQ-9 [17] is a depression screening tool which, when using a cut-off score of ≥ 10 , is 88% sensitive and 88% specific for major depression. This cut-off score defined moderate depression in our study. The surveys were completed and submitted anonymously. The presence of suicidal thoughts was defined by a score of > 0 on the ninth question of the PHQ-9 asking whether the respondent had any thoughts "that you would be better off dead or of hurting yourself in some way," where 0 was "not at all." Since resident identity was blinded by design, a drop down menu appeared on the survey for those residents who scored ≥ 10 on

the PHQ-9 or who scored > 0 on question 9 advising them of the Employee Assistance Program and Suicide Hotline phone numbers at their institutions and in their communities. Residents provided demographic information and were asked if they were currently in treatment for depression. Residents were also asked about their awareness of, and access to, wellness programming, whether they believed their program director would be supportive of a depressed resident, whether they thought seeking treatment for depression would have negative consequences, whether their program director could be asked for help if depressed, and whether they knew how to access treatment for depression if needed.

Program directors provided demographic information including their age, gender, years as a director, and number of residents in their program. Since program directors specified their specialty and institution, the authors were not blind to their identity. Study data were collected and managed using Research Electronic Data Capture (REDCap) tools hosted at Wright State University [18].

Resident characteristics were summarized as the number and proportion within each level of each variable (see Table 1). These were also summarized by moderate depression status (PHQ-9 total < 10 or ≥ 10) and among depressed residents, by suicidal thoughts (PHQ-9 question no. 9 = 0 or > 0). Generalized logistic regression was used to test associations between resident characteristics (specialty, age, gender, residency year, relationship status, having children, hours worked per week, and debt; Table 2) and perceptions (Table 3) and the odds of having at least moderate depression. Adjusted odds ratios (AOR) and their 95% confidence intervals (CI) were estimated in a single multivariate model after removing cases with missing values on any characteristic. AORs and their 95% CIs were also estimated for each of the six perception questions individually, each adjusted for age, gender, residency year, relationship status, having children, hours worked per week, and debt (Table 3). A finite population correction factor was applied to adjust CIs and hypothesis tests. Clustering by institution was accounted for in the analysis of resident characteristics via a random institution effect. Clustering by program (specialty \times institution) was accounted for in the analysis of perceptions via a random program effect. Specialty was included as a fixed effect in the analysis of characteristics since we wished to test its effect on depression, but was included as part of the clustering variable in the analysis of perceptions.

These analyses were repeated for the odds of suicidal thoughts among depressed residents, although without a finite population correction factor, since the number of depressed residents among those who participate is not known. Also, an AOR for currently in treatment for depression was estimated (Table 3).

Logistic regression with a finite population correction factor was used to test associations between program

Table 1 Resident characteristics, overall, by moderate depression and, among depressed residents, by suicidal thoughts

Characteristic (no. of missing values)	Level	Overall (<i>n</i> = 1015)		All residents				Depressed residents			
				Not depressed (<i>n</i> = 822, 81.0%)		Depressed (<i>n</i> = 193, 19.0%)		Not suicidal (<i>n</i> = 133, 68.9%)		Suicidal (<i>n</i> = 60, 31.1%)	
				<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Specialty (0)	Anesthesiology	76	7.5	65	85.5	11	14.5	9	81.8	2	18.2
	Emergency medicine	71	7.0	62	87.3	9	12.7	4	44.4	5	55.6
	Family medicine	55	5.4	48	87.3	7	12.7	2	28.6	5	71.4
	Internal medicine	232	22.9	181	78.0	51	22.0	35	68.6	16	31.4
	Obstetrics and gynecology	64	6.3	48	75.0	16	25.0	12	75.0	4	25.0
	Pathology	42	4.1	33	78.6	9	21.4	8	88.9	1	11.1
	Pediatrics	139	13.7	118	84.9	21	15.1	14	66.7	7	33.3
	Psychiatry	134	13.2	116	86.6	18	13.4	14	77.8	4	22.2
	Radiology	57	5.6	47	82.5	10	17.5	6	60.0	4	40.0
	Surgery	145	14.3	104	71.7	41	28.3	29	70.7	12	29.3
Age (years) (3)	< 30	570	56.3	455	79.8	115	20.2	78	67.8	37	32.2
	30–34	340	33.6	281	82.6	59	17.4	43	72.9	16	27.1
	35+	102	10.1	84	82.4	18	17.6	12	66.7	6	33.3
Gender (6)	Male	497	49.3	404	81.3	93	18.7	62	66.7	31	33.3
	Female	511	50.7	412	80.6	99	19.4	70	70.7	29	29.3
Residency year (4)	1	290	28.7	235	81.0	55	19.0	37	67.3	18	32.7
	2	264	26.1	202	76.5	62	23.5	43	69.4	19	30.6
	3	256	25.3	218	85.2	38	14.8	23	60.5	15	39.5
	4+	201	19.9	164	81.6	37	18.4	30	81.1	7	18.9
Relationship status (4)	Not living with partner	382	37.8	298	78.0	84	22.0	52	61.9	32	38.1
	Living with partner	629	62.2	521	82.8	108	17.2	81	75.0	27	25.0
Has children (3)	No	793	78.4	631	79.6	162	20.4	112	69.1	50	30.9
	Yes	219	21.6	190	86.8	29	13.2	21	72.4	8	27.6
Hours work per week (0)	< 60	344	33.9	300	87.2	44	12.8	32	72.7	12	27.3
	60+	671	66.1	522	77.8	149	22.2	101	67.8	48	32.2
Debt (6)	< \$1,000	295	29.2	246	83.4	49	16.6	27	55.1	22	44.9
	\$1,000 to < \$200,000	284	28.1	223	78.5	61	21.5	43	70.5	18	29.5
	\$200,000+	430	42.6	348	80.9	82	19.1	62	75.6	20	24.4
Currently in treatment for depression (1)	No	864	85.2	724	83.8	140	16.2	98	70.0	42	30.0
	Yes	150	14.8	97	64.7	53	35.3	35	66.0	18	34.0
Suicidal thoughts (0)	No	939	92.5	806	85.8	133	14.2	133	100.0	0	0.0
	Yes	76	7.5	16	21.1	60	78.9	0	0.0	60	100.0

characteristics (director age, gender, and years as a director, and number of residents in program; Table 4) and whether or not the program median was above the median proportion of depressed residents (17.4%). In the results, the term “significant” refers to the comparison being statistically significant after adjusting for multiple testing.

All tests were two-sided and the Hommel method [19] was used to adjust for multiple testing over all the tests of AORs in Tables 2, 3, and 4 to preserve a family-wise $\alpha = 0.05$ level of significance. R [R Core Team (2018). R: A

language and environment for statistical computing. R Foundation for Statistical Computing. Vienna, Austria. URL <https://www.R-project.org/>] was used to carry out generalized logistic regression using the glmm package [20] and logistic regression using the rms package [21]. SAS PROC MULTTEST [SAS Institute Inc. (2012). SAS Version 9.4. Cary, NC: SAS Institute Inc.] was used to adjust for multiple testing. A secondary, exploratory, chi-square test of association between moderate depression and marital status was carried out in R, and Cramer’s V was used as a measure of effect size [22].

Table 2 Odds of moderate depression vs. resident characteristics; Odds of suicidal thoughts vs. resident characteristics among depressed residents

Characteristic	Level	All residents (<i>n</i> = 990) Outcome = moderate depression		Depressed residents (<i>n</i> = 187) Outcome = suicidal thoughts	
		AOR	95% CI	AOR	95% CI
Specialty	Psychiatry (reference)				
	Anesthesiology	0.93	(0.47, 1.84)	0.70	(0.08, 6.33)
	Emergency Medicine	0.80	(0.40, 1.63)	6.94	(0.67, 71.8)
	Family Medicine	0.70	(0.32, 1.52)	10.7	(1.04, 109)
	Internal Medicine	1.25	(0.73, 2.14)	1.19	(0.20, 7.07)
	Obstetrics and Gynecology	1.51	(0.76, 3.01)	2.71	(0.32, 22.8)
	Pathology	1.92	(0.91, 4.04)	0.46	(0.03, 6.76)
	Pediatrics	0.83	(0.45, 1.52)	2.41	(0.37, 15.7)
	Radiology	1.40	(0.69, 2.84)	2.28	(0.28, 18.7)
Age (years)	Surgery	1.73	(0.97, 3.09)	2.35	(0.37, 14.8)
	< 30 (reference)				
	30–34	0.89	(0.64, 1.22)	0.77	(0.32, 1.86)
Gender	35+	1.05	(0.62, 1.78)	0.94	(0.22, 3.98)
	Male (reference)				
Resident year	Female	1.03	(0.79, 1.35)	0.67	(0.31, 1.43)
	1 (reference)				
Relationship status	2	1.47	(1.05, 2.05)	0.78	(0.31, 1.99)
	3	0.82	(0.56, 1.19)	1.69	(0.59, 4.90)
	4	1.07	(0.69, 1.65)	0.46	(0.13, 1.60)
	Not living with partner (reference)				
Has children	Living with partner	0.85	(0.64, 1.12)	0.53	(0.25, 1.13)
	No (reference)				
Hours worked per week	Yes	0.72	(0.48, 1.07)	1.00	(0.29, 3.44)
	< 60 (reference)				
Debt	60+	1.71	(1.18, 2.46)	0.98	(0.30, 3.20)
	< \$1,000 (reference)				
	\$1,000 to < \$200,000	1.38	(0.98, 1.94)	0.30	(0.12, 0.78)
	\$200,000+	1.32	(0.96, 1.83)	0.26	(0.10, 0.66)

* *p* < 0.05

** *p* < 0.01

*** *p* < 0.001

No associations were significant after adjusting for multiple testing

Results

Of 2490 residents emailed surveys, 1015 submitted completed surveys (40.8%). Of those, 193 (19.0%) were at least moderately depressed (PHQ-9 ≥ 10). Of those at least moderately depressed, 60 (31.1%) had at least some suicidal thoughts (Table 1). An additional 16 residents had thoughts of suicide despite not meeting criteria for at least moderate depression. Results showed that 72.5% of those residents meeting criteria for at least moderate depression were not currently in treatment, nor were 70.0% of those depressed residents expressing some suicidal ideation. Depressed residents with thoughts of suicide were no more likely to be in treatment than their depressed

peers who had no suicidal thoughts. Also, of the 150 residents receiving treatment for depression, 97 (65%) did not meet PHQ-9 criteria for moderate depression. There were no significant differences between specialties in the odds of having at least moderate depression (*p* = 0.179) (Table 2). Among depressed residents, there were no significant differences between specialties in the odds of suicidal thoughts (*p* = 0.122).

Separated residents appeared to have a greater likelihood of depression (five of the eight or 62.5% separated residents were depressed compared with no more than 21.3% among any other marital status group). A secondary exploratory test of association between moderate depression and marital status found a weak association (Cramer's *V* = 0.115, *X*² = 13.393,

Table 3 Odds of moderate depression vs. resident perceptions; Odds of suicidal thoughts vs. currently in treatment and resident perceptions among depressed residents

Question (no. of non-missing values for depression and suicidal thoughts analyses, respectively)	Outcome = moderate depression				Outcome = suicidal thoughts among depressed residents			
	% moderate depression		AOR	95% CI	% suicidal thoughts		AOR	95% CI
	Yes	Not sure/No			Yes	Not sure/No		
Currently in treatment for depression (n = NA, 187)	–	–	–	–	31.4	29.4	1.42	(0.65, 3.10)
Q1. Does your training program educate about wellness? (Yes vs. Not sure/No) (n = 986, 187)	17.1	26.2	0.62	(0.46, 0.85)	**	30.4	29.4	1.16 (0.49, 2.78)
Q2. Do you have access to a wellness program? (Yes vs. Not sure/No) (n = 985, 186)	15.8	27.4	0.53	(0.41, 0.70)	***	25.7	36.5	0.65 (0.31, 1.34)
Q3. Do you believe your training program is/would be supportive if a resident had depression? (Yes vs. Not sure/No) (n = 989, 187)	14.0	29.8	0.40	(0.30, 0.52)	***	22.1	38.0	0.40 (0.19, 0.85) *
Q4. Do you believe seeking treatment for depression has negative consequences for medical licensure? (Yes vs. No) (n = 990, 187)	29.2	17.3	2.00	(1.43, 2.80)	***	34.2	28.9	1.34 (0.56, 3.22)
Q5. Do you feel you can ask your program director for help if you feel depressed? (Yes vs. Not sure/No) (n = 987, 187)	13.9	30.0	0.39	(0.30, 0.51)	***	22.3	37.6	0.44 (0.21, 0.92) *
Q6. Do you know where to ask for help if you feel depressed? (Yes vs. Not sure/No) (n = 987, 187)	14.1	30.3	0.38	(0.29, 0.50)	***	25.5	34.8	0.82 (0.41, 1.62)

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Data in boldface indicates remained significant after adjusting for multiple testing

simulated $p < 0.009$). There were no significant age, gender, or child status differences among depressed and non-depressed residents. Moreover, after adjusting for multiple testing, there were no significant differences by PGY class, hours worked, or debt.

Residents answering “yes” to the questions about awareness of wellness education, access to wellness programming, program director support, program director accessibility, and knowing where to ask for help, were less likely to be depressed than those who answered “no or not sure” (Table 3). All but awareness of wellness education (Question 1) were significantly associated with lower odds of depression ($p < 0.001$). Residents who believed seeking depression treatment would have negative consequences for medical licensure were significantly more likely to be depressed than were those who did not believe there would be negative consequences [AOR = 2.00, 95% CI (1.43, 2.80), $p < 0.001$].

Programs with a male director [AOR = 8.52, 95% CI (3.08, 23.6), $p < 0.001$] or a director who had been training director for less than 5 years [AOR = 7.09, 95% CI (2.68, 18.8), $p < 0.001$] had a much greater odds of having more than the median proportion of depressed residents. Neither program director age nor the number of residents in the program had a significant association with resident depression (Table 4).

Discussion

The 19% of residents found in this study to have at least moderate depression are consistent with other reports [4]. Among those with at least moderate depression, 31.1% appear to think about suicide at least occasionally. This is greater than the rate of 6–21% reported in the literature [3, 5, 23]. Unfortunately, a very low percentage of currently depressed residents were receiving treatment, and this did not differ between those with and without suicidal thoughts. We cannot assume all of these depressed residents would have met DSM 5 criteria for Major Depressive Disorder had they been clinically evaluated. However, given the PHQ-9’s high sensitivity and specificity to Major Depression [17], it is likely that there are many residents with depression who are not receiving treatment. The majority of residents in treatment for depression are not currently depressed, suggesting successful treatment.

Residents who were unaware of wellness programming offered at their institutions were significantly more likely to be depressed. Moreover, those residents who did not believe their program director would be supportive of a depressed resident, or did not believe they could talk with their program director if depressed, were significantly more likely to be

Table 4 Odds of greater than median proportion of moderate depression vs. program director/program characteristics

Predictor	Level	AOR	95% CI	
Age (years) (45+ vs. < 45)		1.43	(0.63, 3.26)	
Gender (male vs. female)		8.52	(3.08, 23.6)	***
Years as PD (< 5 vs. 5+)		7.09	(2.68, 18.8)	***
No. of residents	1–24 (ref)			
	25–49	1.35	(0.59, 3.10)	
	50+	2.26	(0.71, 7.21)	

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Data in boldface indicates remained significant after adjusting for multiple testing

depressed than their colleagues who saw their program director as supportive or accessible, respectively. Depressed residents, like others with depression, may perceive opportunities, experiences, and relationships more negatively than they are in reality. This negative bias may have shaped their perception of programming, and the support or accessibility of their director. For instance, a depressed resident may consider programming to not exist if they find what is offered is not valuable, while non-depressed residents may not consider “value” when responding to this question. Nonetheless, the differences are striking and serve to alert program directors that additional strategies may be necessary to engage and encourage depressed residents to seek help, while protecting these same residents from the stigma associated with such conditions. This may require increased promotion of existing confidential services, like Employee Assistance Programs (EAP), or even the development of new programs like confidential referral agencies within the institution, which are readily accessible to depressed residents and are staffed by clinicians without direct teaching responsibilities with those residents.

Only 70% of residents reported knowing how to access treatment for depression if needed. Those residents who said they did not know where to ask for help if depressed were significantly more likely to be at least moderately depressed. A depressed resident’s negative perceptions may shape awareness of treatment options and how to access confidential treatment. It is crucial, therefore, for programs to consistently and broadly communicate to residents how to access treatment and to assure that confidential access can occur in a timely manner.

Finally, those residents who believed treatment would jeopardize medical licensure were significantly more likely to be depressed. In Ohio, the state Medical Board requires notification only for those physical or mental illnesses that impair the physician’s ability to function professionally. This is not the case in all states, however, as some still require that prior mental health treatment be revealed as part of the licensing

process. Concern about this may alter perceptions of licensure security of depressed residents. The perceived stigma of psychiatric treatment may exist among residents and other physicians discouraging the pursuit of depression treatment when warranted. This may be in part why some residents choose to self-prescribe and/or avoid evaluation despite the need for professional treatment [13–15]. In this regard, the state boards should embrace recommendations from the Federation of State Medical Boards to encourage focus on impairment rather than diagnosis or history of treatment when considering an applicant for licensure.

In this study, male program directors and those who have been in their position for less than 5 years have significantly more residents experiencing depression. The program director analysis was not adjusted for specialty or institution due to sparseness of the data; thus, the apparent associations may reflect specialty or institutional differences. As this is the first report to describe program director characteristics as being associated with depression in their trainees, additional research is necessary to better clarify this possible effect and the potential relationship with specific specialties.

Among residents, no statistically significant relationships were found between depression and specialty, age, gender, residency year, child status, hours worked per week, or debt. While some associations were identified, they failed to reach significance after adjusting for multiple testing. Perhaps with a larger sample size and fewer hypotheses tested, these relationships may be better clarified. While marital status also was not associated with depression, we observed that separated residents had much greater likelihood of depression than their colleagues. Training directors should be aware that this may be a particularly vulnerable subgroup.

While depression appears to be a substantial problem among residents in all specialties, the larger concern is the percentage of such residents apparently not receiving treatment. It seems likely that treatment is effective in this population as a majority of residents currently receiving treatment for depression are no longer depressed (by PHQ-9 criteria). The high prevalence of suicidal thoughts among depressed residents in our study is greater than previously reported, perhaps because others studied populations included medical students [3, 5]. Moreover, all residents in our study were required to complete the PHQ-9, which included the question about suicidal thoughts, while the other studies [3, 5] permitted participants to avoid that question if preferred. Thus, our results are probably more reflective of the actual percentage of residents who have had suicidal thoughts and should alert our training programs to the magnitude of this problem.

There are several limitations to our study. Only 46.5% of residents submitted surveys. To test whether non-response might have influenced our findings, we evaluated the rate of moderate depression among those residents who submitted their survey in December 2017, finding 19.0% met our criteria

while 30.6% had some frequency of suicidal thoughts. We examined the residents who failed to respond in December (and would have been characterized as “non-responders”) but who responded in January 2018, and found 19.2% met our criteria for moderate depression and 33.3% had some frequency of suicidal thoughts. These small differences are consistent with the hypothesis of low non-response bias. Some specialties elected not to participate in some institutions, which could also contribute to selection bias. This study is a self-report survey utilizing closed questions. Therefore, response bias could possibly affect results. One of the major findings identified in this study were the associations between depression and resident perceptions of wellness programming, support, licensure jeopardy, and access to care. It is possible that depressed residents perceived these issues in a manner that biased their response. Social desirability bias and the prevalence of stigma against mental illness in the medical community may have led respondents to either under-report their depressive symptoms or avoid certain questions.

In addition, this preliminary study did not attempt to define for residents the different ways in which wellness programming may exist. Such programs may be perceived differently and impact depression and treatment-seeking behavior.

Perception questions regarding program director support and accessibility were descriptively vague and wording varied slightly between the resident and director surveys. They did not allow for the possibility that some residents may have trusted faculty mentors other than their program director by whom they felt supported and believed were accessible. This may have altered the perception responses of depressed residents.

While this is the first study to examine depression in residents from ten specialties representing all academic institutions in a single state, the results may not be generalizable to all residents across the country. Whether specialties not studied have a different proportion of depressed residents, or residents in treatment, is not known. Also, despite the usefulness and wide utility of the PHQ-9 to identify moderate depression, it is a screening tool and not a substitute for a clinical evaluation. The percentage of clinically validated major depression in residents not in treatment may have been different than the percentage we identified using this screening instrument. Moreover, we defined residents as having suicidal thoughts if they responded to the PHQ-9 question about such thoughts in any way other than “not at all.” Thus, residents who may have had such thoughts very infrequently were included among those with suicidal thoughts. This likely overstated the clinical importance of those with such thoughts who were not currently in treatment.

There are a variety of factors that might inhibit depressed residents from pursuing treatment including stigma, cost-of-care, time-availability to seek treatment, and confidentiality [12]. However, there are strategies that have been described

that reduce depression and suicidal thinking in residents in a cost-effective and confidential fashion [16, 22]. This study suggests that negative perceptions about the availability of wellness programming, program director support, licensure risk, and accessibility to treatment are significantly associated with greater odds of at least moderate depression among residents. However, these findings are exploratory and require replication.

Improved communication between programs and their residents regarding the availability of well-publicized wellness programming, the extent to which depressed residents are supported by faculty, and availability of confidential and effective access to care, is critical to ensuring residents get the treatment they need when depressed. Efforts to combat stigma within the culture of medicine will facilitate those with depression to seek help. It is critical to the health of our future physicians.

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Compliance with Ethical Standards

This study was conducted after acquiring IRB approval at all seven academic training institutions. Surveys were completed after each participant acknowledged informed consent.

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References

1. Mousa OY, Dhamoon MS, Lander S, Dhamoon AS. The MD Blues: under-recognizing depression and anxiety in medical trainees. *PLoS ONE*. 2016. <https://doi.org/10.1371/journal.pone.0156556>.
2. Dyrbye LN, Thomas MR, Shanafelt TD. Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian medical students. *Acad Med*. 2006;81(4):354–73.
3. Goebert D, Thompson D, Takeshita J, Beach C, Bryson P, Ephgrave K, et al. Depressive symptoms in medical students and residents: a multischool study. *Acad Med*. 2009;84(2):236–41.

4. Mata DA, Ramos MA, Bansal N, Khan R, Guille C, Di Angelantonio E, et al. Prevalence of depressive symptoms among resident physicians. *JAMA*. 2015;314(22):2373–83. <https://doi.org/10.1001/jama.2015.15845>.
5. Rotenstein LS, Ramos MA, Torre M, Segal B, Peluso MJ, Guille C, et al. Prevalence of depression, depression symptoms, and suicidal ideation among medical students: a systematic review and meta-analysis. *JAMA*. 2016;316(21):2214–36.
6. Lindeman S, Laara E, Hakko H, Lonnqvist J. A systematic review on gender-specific suicide mortality in medical doctors. *Br J Psychiatry*. 1996;168:274–9.
7. de Oliveira GS, Chang R, Fitzgerald PC, Almeida MD, Castro-Alves LS, Ahmad S, et al. The prevalence of burnout and depression and their association with adherence to safety and practice standards: a survey of United States anesthesiology trainees. *Anesth Analg*. 2013;117(1):182–93.
8. Fahrenkopf AM, Sectish TC, Barger LK, Sharek PJ, Lewin D, Chiang VW, et al. Rates of medication errors among depressed and burned out residents: prospective cohort study. *BMJ*. 2008. <https://doi.org/10.1136/bmj.39469.763218.BE>.
9. Sen S, Kranzler HR, Krystal JH, Speller H, Chan G, Gelernter J, et al. A prospective cohort study investigating factors associated with depression during medical internship. *Arch Gen Psychiatry*. 2010;67(6):557–65.
10. Guille C, Frank E, Zhao Z, Kalbach DA, Nietert PJ, Mata DA, et al. Work-family conflict and the sex difference in depression among training physicians. *JAMA Intern Med*. 2017;177(12):1766–72.
11. Tyssen R, Vaglum P, Gronvold NT, Ekeberg O. The impact of job stress and working conditions on mental health problems among junior house officers. A nationwide Norwegian prospective cohort study. *Med Educ*. 2000;34:374–84.
12. Guille C, Speller H, Laff R, Epperson CN, Sen S. Utilization and barriers to mental health services among depressed medical interns: a prospective multisite study. *JGME*. 2010;2:210–4.
13. Rosen IM, Christie JD, Bellini LM, Asch DA. Health and health care among housestaff in four U.S. internal medicine residency programs. *J Gen Intern Med*. 2000;15:116–21.
14. Montgomery AJ, Bradley C, Rochfort A, Panagopoulou E. A review of self-medication in physicians and medical students. *Occup Med*. 2011;61:490–7.
15. Christie JD, Rosen IM, Bellini LM, Inglesby TV, Lindsay J, Alper A, et al. Prescription drug use and self-prescription among resident physicians. *JAMA*. 1998;280:1253–5.
16. Ey S, Moffit M, Kinzie JM, Brunett PH. Feasibility of a comprehensive wellness and suicide prevention program: a decade of caring for physicians in training and practice. *JGME*. 2016;8(5):747–53.
17. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: Validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16:606–13.
18. Harri PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377–81.
19. Hommel G. A comparison of two modified Bonferroni procedures. *Biometrika*. 1988;75:383–6.
20. Knudson C. glmm: generalized linear mixed models via Monte Carlo likelihood approximation. R Package Version 1.2.3. 2018. <https://CRAN.R-project.org/package=glmm>.
21. Harrell FE Jr. rms: Regression modeling strategies. R package version 5.1-2. <https://CRAN.R-project.org/package=rms>.
22. Kendall MG, Stuart A. The advanced theory of statistics. vol. 2. New York: MacMillan; 1979.
23. Guille C, Zhao Z, Krystal J, Nichols B, Brady K, Sen S. Web-based cognitive behavioral therapy intervention for the prevention of suicidal ideation in medical interns: a randomized clinical trial. *JAMA Psychiat*. 2015. <https://doi.org/10.1001/jamapsychiatry.2015.1880>.

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