

Prevalence and persistence of depression among undergraduate medical students: a longitudinal study at one UK medical school

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ABSTRACT

Objectives: To determine the prevalence of depression among male and female medical students, its change over time and whether depression persists for affected students.

Design: Longitudinal study comprising annual questionnaire surveys which included the depression subscale of the Hospital Anxiety and Depression Scale (HADS-D).

Participants: Between 2007 and 2010 all 1112 students entering the Core Science component (Year 1) and all 542 students entering the Clinical component (Year 4) of the Cambridge (UK) medical course were followed-up annually.

Methods: We analysed, separately for men and women, mean HADS-D scores, the proportions whose scores indicated depression at different time-points and for students maintaining participation, the number of occasions on which their HADS-D scores indicated depression.

Results: 725 Core Science and 364 Clinical students participated. Mean HADS-D scores ranged between 3.34 and 3.49 among all Core Science students and between 2.16 and 2.91 among all Clinical students. There was no difference between men and women in median HADS-D scores. Prevalence of depression ranged between 5.7% and 10.6% among all Core Science students and between 2.7% and 8.2% among all Clinical students.

Over time Core Science students displayed no increase in mean HADS-D score. Among Clinical students only men displayed a small increase (time coefficient 0.33 (95% CI 0.11 to 0.55)). Prevalence did not increase over time. 220 Core Science and 150 Clinical students participated throughout the study. Of these, 18.2% and 10.6%, respectively, recorded HADS-D scores indicating depression on at least one occasion. Of 56 students recording depression at some point, 37 did so only once.

Conclusions: Prevalence of depression among participants was similar to that reported for comparable groups. Among men approaching the end of clinical studies depression scores increased. In all years a minority of students displayed depression; for some this persisted. Mechanisms are needed to identify and support students suffering from depression, particularly when persistent.

ARTICLE SUMMARY

Article focus

- What is the prevalence of depression among male and female medical students?
- Does prevalence of depression increase or decrease during the course?
- For those affected, is depression persistent?

Key messages

- Although prevalence of depression among medical students was not higher than that found comparable groups a significant minority of students displayed depression, the majority of these did so only on one occasion.
- Prevalence was not found to increase over time.
- Although the majority of students who demonstrated depression did so only on one occasion, mechanisms are needed to identify and support depressed students.

Strengths and limitations of this study

- Data obtained from students in all 6 years of medical undergraduate training.
- Use of a validated survey instrument allowing comparison with comparable groups.
- Results of missing value analysis together with response rates indicate the generalisability of study results to the institution in which the study was conducted.
- Study undertaken in one UK medical school undertaking a traditional medical course limits generalisability.
- Course structure results in only half of students in the Core Science component being able to transfer to Clinical component so limiting longitudinal nature of study.
- Attrition of response rate.
- Use of a single simple self-report instrument.

INTRODUCTION

Psychological well-being is important for medical students, for the patients they meet and for their future medical practice.^{1–4} Medical students with depression more commonly consider dropping out of their course.⁵

Among newly qualified physicians, associations have been found between depressive symptoms and increasing cynicism, self-perceived medical errors and lower levels of self-rated health.^{6–8} As their careers progress, physicians have elevated rates of suicide compared to the general population.^{9–12} Patient care is affected by psychological distress among physicians: poor communication, diminished quality of care and medical errors have been found to be associated with physician stress.^{13 14}

Physicians are more likely to experience depression compared to the general population.^{9–12} However, the prevalence of depression among medical students varies, depending on age, stage of training, methods of measurement and location.¹⁵ The use of different study instruments limits the extent to which medical students can be compared directly with similarly aged populations. Even where valid comparisons have been made, evidence remains conflicting.^{16–20}

Gender differences in depression have been found in both practicing and newly qualified physicians, which mirror epidemiological studies indicating that depression is more common among women than men.²¹ A study of US residents found that 45% of women compared with 32% of men reported 4 or 5 depressive symptoms.⁶ Most, but not all, studies conducted among medical students, using various instruments, show a similar pattern.^{15 20 22 23}

The prevailing view is that depression rises during undergraduate medical education and that this rise is more pronounced among women.^{15 20 24} However, this pattern is not universally reported: studies among some medical student populations show levels of depression fall between years 1 and 2 and between preclinical and clinical stages of training.^{22 23} Longitudinal studies in the UK and Sweden suggest that some students repeatedly experience psychological distress during medical training,^{25 26} but few studies have examined whether depression for an individual student is persistent.

The School of Clinical Medicine at the University of Cambridge is engaged in a study of factors in undergraduate education that may influence the quality of patient care provided by students in their subsequent medical practice. We regard student depression as one such factor. In October 2007, we began a longitudinal study involving all students coming to Cambridge to study medicine. This paper reports the findings with respect to three questions concerning male and female medical students.

1. What is the prevalence of depression?
2. Does prevalence of depression increase or decrease during the course?
3. For those affected, is depression persistent?

METHODS

Participants

The medical course at Cambridge comprises a Core Science component (Years 1–3) during which students

learn core medical science with a small element of clinical experience leading to a primary BA degree, and a Clinical component (Years 4–6). Around 280 students, typically aged 18–19 years, enter Year 1. At the end of Year 3, approximately half continue into the Clinical component in Cambridge. All 1112 students entering the Core Science component (Year 1) and all 542 students entering the Clinical component (Year 4) between 2007 and 2010 were followed up annually. Students were invited to participate in a longitudinal study comprising annual questionnaire surveys. Students entering the Clinical component in 2010 comprised those students who had entered the Core Science component in 2007 and who remained in Cambridge.

Outcome measure

We measured depression using the depression subscale of the Hospital Anxiety and Depression Scale (HADS-D).²⁷ HADS is a self-report instrument initially developed to evaluate the presence and severity of anxiety and depression in general medical populations. It is regarded as a useful tool for identifying those with emotional distress and has good psychometric properties.^{28 29} HADS-D has been widely used in the UK among members of the general population,³⁰ among young adults within the general population,³¹ with undergraduates,^{32 33} medical students^{16 34 35} and medical practitioners.^{36 37}

HADS-D comprises seven items expressed both positively and negatively, giving a maximum score of 21. It has widely recognised norms relating to depression: scores of 0–7 are regarded as ‘normal’, scores of 8–10 indicate ‘possible’ depression and scores of 11 and over indicate ‘probable’ depression. The HADS-D norm of ≥ 8 has been shown to have a sensitivity of 0.82 (95% CI 0.73 to 0.89) and a specificity of 0.74 (95% CI 0.60 to 0.84).²⁹ A study of UK undergraduates comparing results for HADS-D with interview data concluded that the HADS-D scale was a reasonably accurate indicator of depressive conditions in university students at the recommended cut-offs.³⁸

Procedures

Students in years 1–5 received questionnaires during the first week of each new academic year (September/October). Students in Year 6 received questionnaires in January of their final year, prior to final examinations in June. We used a paper-based questionnaire for all students in 2007 and 2008 and for Clinical students in 2009. We used an online questionnaire for Core Science students in 2009 and for all students in 2010 (table 1). Participation was voluntary. Questionnaires were labelled by study number only. A study data manager (who had no access to results) sent one reminder to students after 2 weeks. A small prize was awarded annually by lottery to a small number of participants. The study received approval from the University of Cambridge Psychology Ethics Committee.

Table 1 Number of participating students providing depression scores at each year for each component of the course

	Participating students in each year of course (% of year group) (% of female)			
	Core Science component			
	Total number of entrants	Year of component		
Year 1		Year 2	Year 3	
Students entering 2007	266 (52.2)	182 (68.4) (51.1)	142 (53.4) (52.8)	121 (45.5) (53.7)
Students entering 2008	283 (45.8)	139 (49.1) (58.3)	87 (30.7) (60.9)	78 (27.6) (60.2)
Students entering 2009	281 (48.9)	156 (55.5) (53.2)	94 (33.4) (53.2)	84 (29.9) (57.1)
Students entering 2010	282 (46.3)	188 (67.0) (50.5)	107 (37.9) (50.5)	
Total	1112 (48.0)	665 (59.8) (52.9)	430 (38.7) (53.9)	283 (25.4) (56.5)
	Clinical component			
	Total number of entrants	Year of component		
		Year 4	Year 5	Year 6
Students entering 2007	135 (61.1)	102 (75.6) (62.7)	82 (60.7) (67.1)	76 (56.3) (67.1)
Students entering 2008	135 (44.3)	97 (71.9) (54.6)	70 (51.9) (58.6)	57 (42.2) (63.2)
Students entering 2009	135 (49.6)	70 (51.9) (46.4)	47 (34.8) (45.7)	49 (36.3) (45.8)
Students entering 2010	137 (53.3)	68 (49.6) (50.0)	63 (46.0) (55.6)	
Total	542 (52.0)	337 (62.2) (54.3)	262 (48.3) (58.0)	182 (33.6) (59.9)

Analysis

Overall approach

We took an HADS-D of ≥ 8 to indicate depression. We set statistical significance at the 5% level ($p < 0.05$) for all analyses. Only about half of the Core Science students present in Years 1–3 remained in Cambridge for Years 4–6, yielding small numbers for analysis across all 6 years (table 1). For this reason, we analysed data separately for students from the Core Science and Clinical components.

For study questions 1 and 2 (prevalence of depression) we included all students completing questionnaires between 2007 and 2011. For study question 3 (persistence of depression) we included students entering either the Core Science or the Clinical component in 2007, 2008 and 2009, who maintained their participation for all years of their respective course.

Response bias

For study questions 1 and 2 (prevalence of depression), we undertook missing value analyses for men and women separately, using logistic regression to determine whether HADS-D on entry predicted subsequent study participation. Outcome variables were missing values (yes or no) for HADS-D at Years 2 and 3 for students entering year 1 and Years 5 and 6 for students entering year 4. The explanatory variable was HADS-D at Year 1 for Core Science students and Year 4 for Clinical students. We included 'year of course entry' as an explanatory factor to adjust for student cohort. Students entering in 2010 were considered to have missing subsequent participation if they did not respond in Year 2/Year 5. We calculated ORs corresponding to the increased risk of non-response for every 1 unit increase in HADS-D at course entry, with 95% CIs for ORs and p values.

For study question 3 (persistence of depression) within each component we undertook separate t tests to

examine whether there was any difference in the mean scores of those who maintained their participation and those who did not.

Detailed analyses

For study question 1 (prevalence of depression) we measured separately for men and women, at each point in the course, mean HADS-D and the proportion with HADS-D scores ≥ 8 indicating depression. We compared median HADS-D among men and women using non-parametric tests (Mann-Whitney U tests) and the proportions of men and women whose HADS-D indicated depression (χ^2 tests).

For study question 2 (prevalence of depression over time) we undertook regression analyses separately for men and women, using a 'Generalised Estimating Equations' (GEE) method. We chose the GEE method because many students had repeated data, the HADS-D scores were skewed and we did not want to make any full distributional assumptions. The model assumed a general (unstructured) correlation structure. In order to adjust for the effect of student year of entry, we included this as an explanatory factor variable. To test the robustness of our model we applied a sensitivity analysis to the outcome variables, removing outliers more than 3 SD away from the mean.

For study question 3 (persistence of depression) we examined separately for men and women the number of occasions in which individual students' HADS-D score indicated depression. Within each component we examined whether the proportions of men and women whose score indicated depression differed (1) on any occasion, (2) on only one occasion or (3) on more than one occasion. Given the small sample size we used Newcombe's method³⁹ with R software⁴⁰ to calculate differences in independent (ie, unpaired) proportions together with 95% CIs.

Table 2 Missing value analysis: logistic regression results presented as ORs, 95% CIs and p values for relationship between HADS-D on entry and subsequent study participation, adjusting for student cohort

Depression (HADS-D)	Men	Women
Core Science component students		
OR (95% CI)	1.05 (0.95 to 1.16)	1.08 (0.99 to 1.18)
p Values	0.35	0.08
Clinical component students		
OR (95% CI)	1.07 (0.91 to 1.25)	0.95 (0.79 to 1.15)
p Values	0.43	0.62

HADS-D, depression subscale of the Hospital Anxiety and Depression Scale

RESULTS

Participants

In total 725 Core Science and 364 Clinical students participated in the study. Table 1 shows the number of entrants to the Core Science and Clinical components for each year of entry (2007–2010) and those participating each year and providing depression data.

Response bias

Table 2 shows the results of the missing value analysis for study questions 1 and 2. For students in both components of the course, there was no significant relationship between HADS-D on entry and subsequent study participation. For study question 3, no statistically significant difference in mean HADS-D was found between students who maintained their participation and those who did not (analyses not shown).

Prevalence of depression among men and women (study question 1)

Table 3 shows, at each point in the course, mean HADS-D and the proportion of students whose HADS-D indicated depression.

Core Science component

Mean HADS-D ranged between 3.34 and 3.49. The proportion of students whose HADS-D scores indicated depression ranged between 5.7% (5.8% among men and 5.7% among women) and 10.6% (14.8% among men and 7.5% among women).

Clinical component

Mean HADS-D ranged between 2.16 and 2.91. The proportion of students whose HADS-D scores indicated depression ranged between 2.7% (3.2% among men and 2.2% among women) and 8.2% (5.6% among men and 10% among women).

Table 3 shows comparisons, at each point in the medical course, between median HADS-D among men and women (Mann-Whitney U tests). There were no significant gender differences in either course component.

Table 3 also shows the proportions of men and women whose HADS-D indicated depression (χ^2 tests). Among Core Science component students, significantly more men than women in year 3 recorded HADS-D scores indicating depression, but there were no differences in other years. There were no significant differences between men and women in the Clinical component.

Table 3 Mean HADS-D (SD) and percentages of participants whose HADS-D indicated depression by gender for each year of course within each component. Non-parametric gender comparison of means and χ^2 gender comparisons of percentages

	Mean scores (SD)			Mann-Whitney U test (p value)
	All	Men	Women	
Core Science component students				
Year 1 (n=665/313/352)	3.34 (2.36)	3.22 (2.24)	3.44 (2.47)	0.339
Year 2 (n=429/197/232)	3.49 (2.75)	3.29 (2.77)	3.66 (2.76)	0.120
Year 3 (n=282/122/160)	3.35 (2.85)	3.77 (3.16)	3.04 (2.56)	0.062
Clinical component students				
Year 4 (n=337/157/180)	2.16 (2.08)	2.23 (2.06)	2.10 (2.11)	0.474
Year 5 (n=260/109/151)	2.65 (2.51)	2.82 (2.66)	2.52 (2.40)	0.398
Year 6 (n=182/72/110)	2.91(2.92)	3.08 (2.88)	2.79 (2.96)	0.311
	Prevalence Depression (%) (≥ 8)			χ^2
Core Science component students				
Year 1 (n=665/313/352)	5.7	5.8%	5.7%	0.969*
Year 2 (n=429/197/232)	8.4	7.1%	9.5%	0.376*
Year 3 (n=282/122/160)	10.6	14.8%	7.5%	0.050*
Clinical component students				
Year 4 (n=337/157/180)	2.7	3.2%	2.2%	0.585*
Year 5 (n=260/109/151)	5.8	6.4%	5.3%	0.701*
Year 6 (n=182/72/110)	8.2	5.6%	10.0%	0.286*

*Comparison of men and women in respect of normal HADS-D (score ≤ 7) and HADS-D indicating depression (score ≥ 8). HADS-D, depression subscale of the Hospital Anxiety and Depression Scale.

Table 4 Linear time coefficients resulting from Generalised Estimating Equations regression analyses on the outcome variable HADS-D, adjusting for student year of entry, presented with 95% CIs

	Men	Women
Core Science component students		
Depression (HADS-D)		
Time coefficients	0.20	-0.11
(95% CI)	(-0.03 to 0.43)	(-0.31 to 0.08)
Clinical component students		
Depression (HADS-D)		
Time coefficients	0.33	0.17
(95% CI)	(0.11 to 0.55)	(-0.04 to 0.39)

All results were similar after removal of outliers more than three SD from the mean.
HADS-D, depression subscale of the Hospital Anxiety and Depression Scale.

Prevalence of depression among men and women over time (study question 2)

Table 4 shows the results of the GEE models used in this analysis. These are supported by the finding reported above that missing values were not significantly dependent on initial depression levels (table 2). The time coefficient resulting from a GEE model should be interpreted as representing a population-averaged effect rather than an individual student-level effect.

Core Science component

The results indicate no significant difference, among either men or women, in HADS-D scores over time. Sensitivity analysis (removal of outliers) produced similar results.

Clinical component

A very small but statistically significant increase in HADS-D over time was found among men. No significant difference over time was found among women. Sensitivity analysis (removal of outliers) produced similar results.

Persistence of depression among men and women (study question 3)

Table 5 shows the prevalence of depression recorded by students who maintained their participation throughout the 3 years of each course component.

Core Science component

Among the 96 men and 124 women who maintained their participation, 40 students (17 men and 23 women) recorded at least one HADS-D score indicating depression. Of these, 29 (9 men and 20 women) did so on only one occasion; 9 (6 men and 3 women) did so on two occasions. Two men recorded scores indicating 'possible' depression throughout the Core Science course component.

Clinical component

Among the 59 men and 91 women who maintained their participation, 16 students (5 men and 11 women) recorded at least one HADS-D score indicating depression. Of these, 8 (3 men and 5 women) did so on one occasion; 6 (all women) did so on two occasions. Two men recorded scores indicating 'possible' depression throughout the Clinical course component.

Table 5 also shows the results of comparisons between men and women with respect to transitory or persistent depression. There were no-significant gender differences in either course component.

DISCUSSION

Among groups of male and female medical students in Cambridge, the prevalence of depression varied from 2.2% to 14.8%. No significant changes in mean depression scores were observed among Core Science component students or among women in the Clinical component. A statistically significant increase in mean depression scores was found for men during the Clinical component. However, this increase was extremely small when considered against the 21 points of the HADS-D scale. Most students who demonstrated depression

Table 5 Prevalence of depression recorded by repeat participants

	All	Men	Women	Differences in proportion women-men (95% CI)
Core Science component students				
	n=220 (% of participants)	n=96 (% of participants)	n=124 (% of participants)	
On any occasion	40 (18.2)	17 (17.7)	23 (18.5)	0.008 (-0.10 to 0.11)
On only one occasion	29 (13.2)	9 (9.4)	20 (16.1)	0.07 (-0.03 to 0.15)
On more than one occasion	11 (5.0)	8 (8.3)	3 (2.4)	-0.06 (-0.13 to 0.001)
Clinical component students				
	n=150 (% of participants)	n=59 (% of participants)	n=91 (% of participants)	
On any occasion	16 (10.6)	5 (8.5)	11 (12.1)	0.04 (-0.08 to 0.13)
On only one occasion	8 (5.3)	3 (5.1)	5 (5.5)	0.004 (-0.09 to 0.08)
On more than one occasion	8 (5.3)	2 (3.4)	6 (6.6)	0.03 (-0.06 to 0.11)

during the Core Science component did so only on one occasion. In the Clinical component, although few students experienced depression, half did so on more than one occasion. We found no evidence that women were more likely than men to experience depression, either on one occasion or persistently.

Our study obtained data on depression from students in all 6 years of medical training. In the Core Science component, for each year of the course between 25.4% and 59.8% of those eligible participated. Comparable figures for the Clinical component were 33.6–62.2%. Almost 27% of Core Science students and 37% of Clinical students entering between 2007 and 2009 participated on all occasions during their respective course components, allowing longitudinal observations to be made. These participation rates, allied with missing data analyses indicating that initial scores did not predict later non-response, support the generalisability of our results to the population of medical students at the University of Cambridge. Where possible, these results are related to the existing literature using HADS-D in order to allow direct comparison.

Mean HADS-D scores recorded by students in our study ranged from 2.16 (SD 2.08) for Clinical students in year 4 of the course to 3.49 (SD 2.75) for Core Science students in year 2. These are roughly similar to mean scores reported for comparable groups: scores from 2.68 to 7.5 for medical students elsewhere,^{17 19 34} and from 2.33 to 5.2 for non-medical undergraduate populations.^{41–43}

Mean scores may not reflect the prevalence of significant depression. Using the HADS-D score of ≥ 8 , we found that the prevalence of depression ranged from 2.7% for Clinical students in year 4 of the course to 10.6% for Core Science students in year 3. Prevalence of depression using a similar cut-off score among comparable groups has been found to vary from 9.5% to 29% for medical students,^{16 17 19} and from 3.8% to 18% for non-medical undergraduates.^{38 41} Studies in the general population in Norway and the UK have reported a prevalence of 8% and 12%, respectively,^{30 44} while a study of people aged 18–25 reported a prevalence of 12% among men and 18% among women.³¹ Our results suggest that Cambridge medical students do not have a higher prevalence of depression than students in general or comparable non-student members of the general population. Other work, investigating the suicide rate among students at the University of Cambridge over the period 1970–1996 also found that rates were similar to comparable age groups in the general population.⁴⁵

Although studies involving similarly aged members of the general population have reported a higher prevalence of depression among women compared to men,^{31 44} we found no significant gender differences in either mean HADS-D or prevalence of depression in any year of the course. This replicates previous findings using the HADS with other undergraduates including medical and dental students.^{46 47}

Turning to the question of whether psychological well-being deteriorates during university medical education a UK study of non-medical undergraduates found a significant increase in the proportion recording depression between the period immediately prior to the start of the course and the middle of the second academic year.³³ Few studies have examined the persistence of depression within individual students over time. In our study, regression analyses indicated no significant change for either men or women throughout the equivalent Core Science component of the course. Analysis of students in the Clinical component indicated a very small increase in mean scores for depression for men but not for women. These minor increases in mean depression scores may be related to the approach of finals examinations, or they may presage the known increase in depression seen among practising doctors.

For many students, the experience of depression was transient. Among repeat participants, 40 Core Science and 16 Clinical students recorded HADS-D scores indicating depression at some point. Of these 56 students, 37 did so on only one occasion. Nevertheless, 19 students (11 Core Science and 8 Clinical) showed evidence of repeated depression, with four men (2 in each component of the course) doing so in all 3 years of their respective course component. We found no significant difference in transient or persistent raised levels of depression between men and women.

The authors are not aware of any other studies using HADS-D of medical students against which to set these particular findings. However, their key implication is that while the overall persistence of depression is low, there exists a small, important minority of students for whom depression is an ongoing experience. It is vital for medical schools to recognise and support all students experiencing depression, but in particular to consider how best to encourage this especially vulnerable group to seek help, given the evidence that suggests their reluctance to do so.^{1 26 48 49}

The HADS-D is a well-validated and widely used self-report instrument. The procedures for administering the survey were created to ensure anonymity and confidentiality.⁵⁰ This study is limited by being based on one UK university, providing a 'traditional' course with a collegiate pastoral support structure. There may have been a systematic difference between those participating and those not participating (ie, a non response bias) which may have affected our results. However, the missing value analysis supports the view that those continuing to participate could be considered representative of all student entrants in their year group and that continued participation was not influenced by scores for HADS-D recorded at the beginning of participation. We cannot exclude the possibility of an association between an unobserved change in depression and the missing values.

We tested for a linear relationship between year of course and depression which rests on the assumption that depression increases or decreases gradually over

time. In reality this may not have been the case: mean scores could rise during 1 year and then decline during the next year. Unfortunately, our sample size was too small and number of time points too few to test for quadratic or other polynomial relationships between individual course years and depression, but future studies may like to consider this.

Future work should investigate the generalisability of these results to other medical schools in the UK and, in order to extend the relevance of findings to future patient care, the relationship between depression during undergraduate medical education and 'burnout' after qualification. Further work is needed on identifying both transient and repeated experiences of depression among medical students and understanding possible causes related to course design and students' experience of it. For example, studies of students have found depressive symptoms to be related to prior mental health problems,⁴⁹ personality aspects such as maladaptive perfectionism⁵¹ and strong feelings of altruism and empathy.⁵²

CONCLUSIONS

Overall, only a small proportion of the student body experienced depression. These findings do not support the view that medical students exhibit a higher prevalence of depression than other comparable groups or that differences in mean depression score or prevalence exist between men and women. Nevertheless, depression may start to become more prevalent as medical qualification approaches and a small number of students who experience depression do not recover from one year to the next. It is important that mechanisms should be in place to identify and support all students suffering from depression, but particularly the very few with persistent low mood. As part of this process, it remains important to challenge the stigma of mood disorder among health professionals to encourage students experiencing difficulty to seek and receive appropriate help.

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Competing interests All authors have completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work.

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