Medical Student Suicide Rates: A Systematic Review of the Historical and International Literature

Caren J. Blacker, BMBCh, MA, Charles P. Lewis, MD, Cosima C. Swintak, MD, J. Michael Bostwick, MD, and Sandra J. Rackley, MD, MAEdHD

Abstract

Purpose
Physician suicide rates are reportedly higher than those of the general population, but medical student suicide rates are not well studied. It is difficult to determine whether physician suicide rates can be predicted by medical student risk factors for suicide and difficult to identify those risk factors without knowing medical student suicide rates. The authors systematically reviewed the literature to collate data on medical student suicide rates.

Method
The authors searched the PubMed, Web of Science, and Library of Congress databases for papers published in any language before November 11, 2017. They identified 3,429 papers; after the initial screening process, they assessed 82 full-text articles for eligibility. Twelve ultimately met the full inclusion criteria; meta-analysis was not possible. Data regarding medical student suicide numbers and rates were extracted and compared with contemporaneous general population suicide rates using public epidemiological data, when available.

Results
Medical student suicide rates were infrequently reported in the historical and international literature, and data collection techniques were inconsistent. Generally, U.S. medical student suicide rates were lower than those of the contemporaneous general population. Proportionate mortality of medical students (number of deaths by a particular cause such as suicide divided by total number of deaths) was not reported in the literature.

Conclusions
Gaps exist in knowledge of medical student suicide rates, risk factors, and targets for intervention. Significant barriers have impeded information collection. Yet, more comprehensive data collection is needed to understand suicide risk in this population and to implement and improve effective intervention strategies.

He who has gone, leaving us only his memory to cherish, remains with us, stronger, more present than the living man.
—Antoine de Saint-Exupéry, 
Citadelle

The suicide of a medical colleague is shocking and reverberates throughout the community. It seems especially poignant when it is a medical student, whose life and career are just beginning to unfold. Emeritus professors remember classmates who killed themselves decades earlier, the media dissects the deaths of these elite youth, and training programs scramble to prevent contagion among survivors. However, an event being profoundly awful does not make it common; tragedy may heighten awareness of such a death without constituting epidemiological evidence of a larger issue.

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A 2017 survey of U.S. medical graduates found that the median level of debt was $192,000 (USD), an increase of 1% from the previous year.17

A preliminary literature search revealed no comprehensive descriptions of the current rates of, or risk factors for, medical student suicides. Our goal, then, was to review the historical literature describing medical student suicide rates. We sought to establish whether suicide rates have been quantified and whether they have changed over time. We also aimed to compare suicide rates across geographical regions and ascertain whether the historical literature examined potential contributors to student suicides, including shifting sex ratios, increasing student debt, and changing medical curricula.

**Method**

We systematically reviewed the historical and international literature about medical student suicide up to November 11, 2017, using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria (see Figure 1). We performed a Boolean search of the PubMed, Web of Science, and Library of Congress databases using the following MeSH terms: (med* student OR medical trainee OR intern OR medical school OR student doctor) AND (suicid* OR mortality OR death OR self* murder OR self* inflict*). We collated all identified papers in EndNote X7 (Clarivate Analytics, Philadelphia, Pennsylvania). We included papers published in any language and translated any non-English-language papers ourselves. Our inclusion criteria were reports of numbers and/or rates of suicide in discrete medical student populations (distinct from physicians or students not in medical school).

We identified 3,429 papers during our initial databases search; after removing duplicates, 2,924 papers remained. A review of the title and keywords of each paper demonstrated that 2,661 papers failed to meet our inclusion criteria, and we discarded these. We then assessed the abstracts of the remaining 263 papers for our inclusion criteria, after which 82 papers remained. These papers underwent a full-text review to determine whether the content met the full inclusion criteria; 12 papers remained after this step and were included in our qualitative analysis. A meta-analysis was not possible. We extracted medical student suicide numbers and/or rates from the 12 included papers and compared the reported suicide rates with those of the general population at the time. Contemporaneous general population suicide rates were either reported in each paper, or we obtained population suicide rates from Centers for Disease Control and Prevention records.18

**Results**

Twelve papers recorded quantitative data about medical student suicides19–30 (see Table 1). Eight papers were studies of U.S. medical schools.20–25,27,29 Six papers provided annual medical student suicide rates,20,25–29 reported as suicides/100,000/year. Three papers did not directly provide suicide rates but contained information about suicide numbers and the medical student population.19,23,24 Three provided minimal population data but did offer limited statistical and demographic information.21,22,30 Sources of suicide numbers and/or rates included personal accounts, prospective studies, retrospective surveys, obituaries, police records, and newspaper reports. Data quality varied; one study was part of a prospective evaluation of health risks,23 whereas others were retrospective and/or descriptive. Some papers reported

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**Figure 1** Literature search and article selection process for a systematic review of the historical and international literature on medical student suicide published through November 2017, conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria (http://www.prisma-statement.org/).
### Table 1
Summary of 12 Studies Reporting Medical Student Suicide Numbers and/or Rates Included in a Review of the Historical and International Literature Published Through November 2017

<table>
<thead>
<tr>
<th>First author, year</th>
<th>Country and study design</th>
<th>No. of suicides, deaths, and total medical student population</th>
<th>Date range (no. of years)</th>
<th>Reported annual suicide rate (suicides/100,000/year)</th>
<th>Suicide characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paget, 1869</td>
<td>United Kingdom: Anecdotal record of 1,226 medical students attending a London medical school</td>
<td>2 suicides 41 deaths 1,226 students</td>
<td>1839–1859 (20 years)</td>
<td>Not reported</td>
<td>No description of suicide methods or student demographics</td>
</tr>
<tr>
<td>Simon, 1968</td>
<td>United States/Canada: 50/85 U.S. and Canadian medical schools responded to a written survey</td>
<td>31 suicides 163 deaths Unknown population (3,365–4,980 per academic year)</td>
<td>1947–1967 (20.5 years)</td>
<td>0–100 (based on 0–5 suicides per year)</td>
<td>Suicide was the second most common cause of death after accidents</td>
</tr>
<tr>
<td>Earley, 1969</td>
<td>United States: 90/90 medical schools responded to an AAMC survey on medical student mortality</td>
<td>21 suicides (18 known, 3 probable) 103 deaths Unknown population</td>
<td>1961–1967 (6 years)</td>
<td>Not reported</td>
<td>Suicide was the third most common cause of death after accidents and illness; 8 suicides (40%) occurred in the third year of a 4-year course</td>
</tr>
<tr>
<td>Everson, 1975</td>
<td>United States: Review of U.S. medical school attrition reports to AAMC; authors obtained medical school population from contemporary JAMA statistics but did not report</td>
<td>7 suicides (6 known, 2 probable) 55 deaths (29 had no reported cause) Unknown population</td>
<td>1967–1971 (4 years)</td>
<td>Not reported</td>
<td>Student mortality rate was 3/110,000, which was lower than that among contemporary white males aged 20–24 (mortality rate of 183/100,000); suicide student rate was not calculated</td>
</tr>
<tr>
<td>Thomas, 1976</td>
<td>United States: Johns Hopkins medical students tracked in prospective study</td>
<td>2 suicides 3 deaths 1,337 students</td>
<td>1948–1964 (16 years)</td>
<td>Not reported</td>
<td>One suicide occurred in the first weeks of the first year; the other was in an academically capable student in the third year</td>
</tr>
<tr>
<td>Marvin, 1977</td>
<td>United States: Recorded causes of death of all medical students at the University of Arkansas</td>
<td>6 suicides 21 deaths (3 had no reported cause) 20,947 students</td>
<td>1879–1976 (97 years)</td>
<td>Not reported</td>
<td>No suicides were recorded; 3 causes of death unknown; accidents and infection were the 2 most common causes of death</td>
</tr>
<tr>
<td>Pepitone-Arreola-Rockwell, 1981</td>
<td>United States: 89/116 U.S. medical schools responded to a written survey and included data on suicides</td>
<td>52 suicides Unknown total deaths Unknown population (6,088–7,704 per academic year)</td>
<td>1974–1981 (7.5 years)</td>
<td>Both sexes: 18.4 Men: 15.6 Women: 18.9</td>
<td>Student mortality rate was known in 43 cases (34 men, 9 women); marital status was known in 32 cases (75% single); year was known in 25 cases (60% in year 1 or 2); November–January and June were higher-risk months</td>
</tr>
<tr>
<td>Millan, 1990</td>
<td>Brazil: Death reports from the graduation office of the College of Medicine of São Paulo University</td>
<td>8 suicides 26 deaths Unknown population (known to study authors)</td>
<td>1965–1985 (20 years)</td>
<td>39.6</td>
<td>All suicides occurred in the final 4 years of a 6-year curriculum; 6 victims were men, 2 women</td>
</tr>
<tr>
<td>Hays, 1996</td>
<td>United States: 101/126 U.S. medical schools responded to telephone interviews</td>
<td>15 suicides 57 deaths Unknown population (50,769–51,769 per academic year)</td>
<td>1989–1994 (5 years)</td>
<td>Both sexes (range): 0–11.71 Men (range): 0–16.00 Women (range): 0–5.01</td>
<td>Of suicide victims, 14 were men; 1 woman; 13 were single, 1 married, 1 divorced; 8 were firearm deaths, 6 overdoses, 1 jumping; 9/13 had a psychiatric history (3 had a substance use history)</td>
</tr>
<tr>
<td>Kamski, 2012</td>
<td>Austria: Comparison of Tyrol Police data on local suicides with medical student suicides from the University of Innsbruck</td>
<td>6 suicides Unknown total deaths Unknown population (known to study authors)</td>
<td>2007–2012 (5 years)</td>
<td>36</td>
<td>All suicide victims were 21–35 years of age; none were in a relationship</td>
</tr>
<tr>
<td>Cheng, 2014</td>
<td>United States: 90/113 U.S. medical schools responded to an electronic survey</td>
<td>8 suicides 46 deaths Unknown population (49,690–53,568 per academic year)</td>
<td>2006–2011 (5 years)</td>
<td>Both sexes (mean): 2.3 Men (range): 0–3.8 Women (range): 0–8.0</td>
<td>Of suicide victims, 2 were men; 4 (67%) were in the first 2 academic years; 2 were shooting deaths, 2 hanging, 1 overdose, 1 unknown; 3 left suicide notes</td>
</tr>
<tr>
<td>Pruthi, 2015</td>
<td>India: Online search of Indian newspaper archives for medical student suicide reports</td>
<td>16 suicides Unknown total deaths Unknown population</td>
<td>2010–2014 (4 years)</td>
<td>Not reported</td>
<td>Seven suicides were associated with poor academic performance; none were reported by the press after March 2012</td>
</tr>
</tbody>
</table>

Abbreviations: AAMC indicates Association of American Medical Colleges; JAMA, Journal of the American Medical Association.
on fixed populations (i.e., the total population of medical students during a discrete time period), whereas others examined dynamic populations (i.e., new students entered each year while others left or graduated). In the sections that follow, we describe the medical student suicide data from these studies and the general population comparisons by time period and location.

Nineteenth century
The earliest study was written in 1869 by the English surgeon and warden of St Bartholomew’s medical school, Sir James Paget. He described the outcomes of 1,226 medical students he trained between 1839 and 1859. All-cause mortality was high, with 41 students dying during training, 21 from infectious diseases and 2 by suicide. Paget, as both school warden and local pathologist, was in the unusual position of knowing if his pupils died by suicide during training. Medical school duration, curriculum, student demographics, and contemporaneous general population suicide rates were not available.

United States and Canada, 1947–1967
No subsequent medical student suicide reports were published until a retrospective survey of 65 U.S. and Canadian medical schools (50 of which responded) in 1968. Across all responding medical schools, suicide was the second highest cause of student death during the preceding 20.5 years. Annual suicide rates ranged from 0 to 100, the high end being significantly higher than that of the contemporaneous age-matched U.S. general population, which had suicide rates of 8.5 to 13.0. Suicide rates increased during the time periods 1950–1955 and 1960–1965, but a causal analysis was not performed. Medical students also had higher annual accidental death rates than the general population.

A 1967 U.S. medical school survey by the Association of American Medical Colleges (AAMC) received a 100% response rate from 90 schools. Medical schools reported 18 definite and 3 “probable” suicides between 1961 and 1967. Suicide rates were not calculated, and medical student population numbers were not recorded. Suicides occurred most often in the third (penultimate) year of training. The authors recommended that each medical school institute “more systematic methods of recording and analyzing the morbidity of its students and graduates.” They also noted that, among the “health problems ordinarily excluding applicants from admission,” 50 medical schools declined applicants with “emotional problems … regardless of severity.”

Medical school attrition reports to the AAMC between 1967 and 1971 indicated a significantly lower overall annual mortality rate among medical students (37/100,000) than among contemporaneous white men ages 20–24 (183/100,000), but the authors did not describe suicide rate or total student population. These AAMC reports included 55 medical student deaths, with 7 probable suicides. Half the deaths were unexplained, meaning the number of suicides could have been underreported. Between 1967 and 1971, suicide rates in the general population in the United States ranged from 10.7 to 11.7.

A 1976 report on a prospective study of 1,337 Johns Hopkins medical students over 16 academic years recorded 3 deaths during medical school: 1 malignancy and 2 suicides. No suicide rate was calculated. The contemporaneous general population suicide rates were 9.8 to 13.2. A 1977 review of the causes of death of all University of Arkansas medical students over 97 years (1879–1976) found no recorded suicides in nearly 21,000 students, with only 3 “unknown” causes of death. The authors recorded proportionate mortality (number of deaths by a particular cause divided by total number of deaths), with accidents (39%) and infections (33%) being the two most common causes of death.

In 1974, the Family Educational Rights and Privacy Act (FERPA) was signed into law, preventing U.S. academic institutions from disclosing data about students’ behavior, grades, or health status, including suicides or attempted suicides. This law might have affected responses to a 1981 questionnaire completed by 96 of 116 U.S. medical schools, 88 of which included data on suicides. Responses to this questionnaire were reported in a subsequent study, which examined a dynamic population between 1974 and 1981. The authors reported “54 suicide attempts” not causing death and 52 suicides (34 men, 9 women, 9 unspecified), with a reported mean suicide rate of 18.4. The reported annual suicide rate of male medical students in the United States during that time period (15.6) was lower than that of the same-aged general population (28.4 for 20- to 24-year-old men), but the annual suicide rate of female students (18.9), although not statistically significantly different from that of male students, was two to three times higher than that of the same-aged general population (6.8 for 20- to 24-year-old women). This paper is widely cited as demonstrating an elevated suicide risk among female medical students, but the results have yet to be reproduced. Importantly, during this time period, the number of women enrolled in medical school each year increased from 910 to 2,338, suggesting huge changes in student demographics and culture. Female student suicides peaked in the second year of this time frame (1975) and might have been related to their minority status, demographic shifts, possible discrimination, or other variables specific to the time and environment.

United States, 1989–2011
Two, more recent surveys of U.S. medical schools reported lower suicide rates than earlier studies. Hays et al reported an annual student suicide rate ranging from zero to 11.71 during the period between 1989 and 1994, which was markedly lower than that of the general population (14.9 in 1991). Cheng et al, whose study was published in 2014, based their study design on Hays and colleagues’ work and reported an average student suicide rate of 2.3 (range 0–5.69), which was below the mean suicide rate in the general population (11.9 for 2006–2011). Both studies found a higher mean suicide rate in men than in women. Hays et al also noted that most suicide victims were not in a relationship, a finding mentioned in two other studies as well. Between the data collection of the studies by Hays et al and Cheng et al, the Health Insurance Portability and Accountability Act (HIPAA) of 1996 was signed into law. This law potentially affected the sharing of suicide-related data (e.g., cause of death could no longer be reported in obituaries). This change raises questions about whether the lower suicide rates reported in the more recent literature...
reflect true declines or are artificially depressed because of limitations on data collection.

**International data, 1965–2014**

The mean annual suicide rate between 1965 and 1985 in one Brazilian medical school was 39.6, based on 8 suicides over 20 years. This rate was “four times” that of the local population (6.0–11.8 for 20- to 29-year-olds). Medical training in Brazil is typically 6 years long, compared with 4 years in the United States, thus increasing students’ “at-risk” time for suicide. All reported suicides occurred during the last 4 years of training.

The authors of a 2012 study reported 6 medical student suicides over a five-year period at one medical school in Austria, and they calculated a suicide rate of 36/100,000, stating that the rate was increasing. They did not report the calculations they used to determine this rate, and contemporaneous general population suicide rates were unobtainable for comparison. Besides single relationship status, all other demographic details were pooled with those of local university student suicides, so further information on suicide risk factors specific to medical students was unavailable.

Another group of authors searched newspaper reports in India from 2010 to 2014, and they uncovered 16 medical student suicides, 7 of which were described as being associated with academic performance. They did not find any reports of medical student suicide after 2012, the significance of which is unknown. The mean annual general population suicide rate in India during this period was 17.83 (range 17.70–17.94).

**Discussion**

We found enormous variability in how suicide data are reported. Because of profound differences in data collection, analysis, and reporting, we could not perform a credible meta-analysis on the 12 studies meeting our inclusion criteria. Some papers reported suicide numbers within fixed populations (i.e., the total number of medical students at a given time), which allowed those authors to calculate suicide proportion as a cumulative incidence (suicides/

However, time “at risk” for suicide (i.e., time spent as a medical student) for each student was unknown. The duration of medical school training prior to the reported suicides was not recorded, and comparison with the training duration of peers could only be estimated, preventing us from calculating the incidence density of student suicide or comparing suicide rates across medical schools with different training durations. Other papers reported suicide numbers within dynamic populations, defined as enrollment in medical school at the time of measurement. These papers counted the same medical students multiple times as they progressed through training, yet their time “at risk” for suicide was not reported. Some papers recorded temporal clusters of suicides, but the authors did not perform a cluster analysis, possibly because the overall numbers of suicides were so small.

There are multiple statistical mechanisms that can be used to calculate and compare suicide rates and risks. Total medical student population at a given time must be recorded to permit a comparison with suicide rates in the contemporaneous general population. Dynamic variation as students enter and leave training also needs to be assessed by recording time “at risk” for students who die by suicide during training (i.e., time from entering medical school to suicide) and time “at risk” for students who survive to graduation. Other recommended statistical measures include proportionate mortality in a fixed medical student population, incorporating the conditional probability of suicide occurring during medical school, and case fatality prevalence to assess the probability of suicide during a study period. In addition, medical student suicide rates should be compared with all-cause mortality. For example, deaths certified as accidental may in fact be suicides. High concurrent suicide and accidental death rates in medical students are relevant because accident and suicide deaths may share similar social and psychological traits, such as hypothesized ambivalence toward life.

Suicide is disproportionally represented in the mortality of young people, who already have low mortality rates. Overall, suicide rates among U.S. medical students appear to be lower than those of the general population. The 12 studies meeting our inclusion criteria described disparate populations: different generations, cultures, and ethnicities, with different debt burdens, sex ratios, sociopolitical environments, and medical school curricula. Of note, the early medical student suicide literature described a predominately male population, but over time women became the majority in medical school classes. Compared with men, women in the general population have lower rates of suicide across all ages and lower rates of substance use disorders and accidental deaths, but higher rates of depression, anxiety, and somatic disorders. However, the literature is nearly silent on the extent to which risk profiles in female medical students reflect those of women in the general population and what can be extrapolated from any similarities or differences between these groups.

Standardized reporting of medical student suicide rates is another crucial component of investigating risk factors and assessing the efficacy of prevention and intervention strategies. Without clearer epidemiological data, the effects of specific factors, such as academic year, academic performance, marital status, sex, or age, cannot be evaluated. For example, if women in both the general and medical student populations have a lower suicide rate than men, and medical school populations are becoming predominately female, we would expect overall medical student suicide rates to decrease even though no causal factors have been addressed and male student suicide rates have not changed.

Collecting accurate information about medical student suicides can be difficult. Not all administrators respond to surveys, possibly because of a lack of administrative resources, lack of motivation to respond (e.g., no/few suicides), fear of responding (e.g., anxiety about litigation, concern for the reputation of the school, compliance with federal laws regarding protected information), inadequate record keeping, or concerns for student privacy. The AAMC survey that had a 100% response rate suggests that a centralized body may have more success collecting suicide data than individual researchers, though this may have been because of the AAMC’s perceived authority or because the survey was advertised as a prelude to allocating student resources.
Another issue to consider when surveying U.S. medical schools is the effect of federal laws, such as FERPA and HIPAA, which limit the public availability of data on individual students’ risk profiles, including their mental health, academic status, and suicide attempts or completions. In addition, international research using public records, such as obituaries, police records, and newspaper articles, is limited to data already in the public sphere, and it may miss suicide reports, either because of undetermined causes of death or because of suicides not being disclosed for privacy, legal, or insurance reasons. The underreporting of suicides is a well-known phenomenon in the field of suicidology, potentially complicating the accurate evaluation of medical student suicide rates.

Media reports of medical student and physician suicides have raised awareness of the issue and may have led to the perception of increased suicide rates. Additionally, new literature on trainee and physician suicide is emerging. Consequently, U.S. medical schools have demonstrated a growing interest in preventing suicide, depression, and burnout among their students. However, encouraging medical students to access resources can be challenging. They may be concerned about interventions that could adversely affect their application to residency or postgraduate positions, letters of recommendation, subsequent licensure, or ability to practice. Even when privacy concerns are adequately addressed, many barriers to medical students’ ability to access care remain—educational and clinical responsibilities limit the time students have to seek their own care, medical school insurance plans may have inadequate coverage of psychiatric services including medications and psychotherapy, and mental health professionals often have limited availability.

Conclusions

We found that comprehensive national and international data on medical student suicides are not available. Comparing suicide rates across countries may not be possible because of significant differences in medical training systems and student populations. Training systems and student demographics also shift over time, complicating historical rate comparisons. Nevertheless, accurate suicide data are needed to identify trends, establish predisposing and predictive factors, and identify targets for intervention. Suicides in different populations may have unique characteristics, including risk factors specific to that population; thus, future studies examining medical student suicides in particular may yield knowledge more applicable to intervention efforts in that population than efforts in other populations. Rather than implementing intervention strategies based on general population data, obtaining data specific to medical students would allow medical schools to implement highly targeted interventions and to use rapid quality improvement cycles to determine whether their efforts are effective.

Medical student suicide data might be collected more easily by a centralized educational authority that maintains student and school privacy while complying with national laws. One elementary but practical difficulty lies in how medical schools ascertain that a suicide has occurred. There is no legal obligation for relatives or government authorities to inform medical schools of any death, including suicide, though a student’s unexpected absence usually draws the attention of medical school administrators, who launch their own investigation. Voluntary reporting remains the only mechanism by which schools obtain suicide statistics, hampering the collection of comprehensive data with sufficient epidemiological detail for predictive utility. When faced with serious public health concerns, such as certain infectious diseases, mandated reporting has been accepted as necessary to develop and implement effective intervention strategies. The medical education community may need to petition federal and state governments for similar provisions to allow for the collection of more detailed data on occupation, suicide method, and medical history for students who commit suicide.

The injury prevention literature has highlighted how an understanding of workplace-related risks can lead to effective, large-scale interventions. Applying such principles to a medical student population could first establish whether their unique training or access to medical supplies leads to differences in suicide technique (e.g., by prescription medication overdose), and then it could allow medical schools to consider targeted countermeasures within their curricula, school and hospital environments, and student health programs. Prevention and intervention strategies specific to medical students may include addressing work load, duty hours, and stressful examination processes; access to lethal suicide techniques and specialist knowledge in using them; and students’ increased exposure to death, pain, and psychologically distressing patient issues without adequate counseling or educational space to process these experiences. In providing a safe environment for their students, medical schools could model stigma-free mental health care by encouraging students to use institutional wellness and suicide prevention programs, providing psychiatric services (including student insurance programs that cover mental health care), and demonstrating to students that no professional discrimination will occur if they seek medical help.

Suicides among U.S. medical students seem rarer than those among the general population, but we cannot state this definitively without better data collection and statistical analysis. Data on causes of death among U.S. trainee physicians suggest that the two most common causes of mortality are cancer and suicide, but this has not been investigated in medical students. A well-structured study of causes of death among medical students is desperately needed. If medical educators want to understand and prevent medical student suffering and suicide, we need comprehensive and reliable statistics to guide our interventions and help us assess whether our efforts are making a difference, both for our students now and for the future physicians they will become.

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C.J. Blacker is fellow and instructor, Department of Psychiatry and Psychology, Mayo Clinic, Rochester, Minnesota; ORCID: https://orcid.org/0000-0003-3510-0696.
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