

County characteristics associated with behavioral health emergency medical services calls

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Abstract

A substantial portion of the 20 million calls that emergency medical services (EMS) personnel respond to each year are considered preventable, including more than 1.5 million behavioral health calls. Despite goals of preventing behavioral health crises and reducing the burden on patients and EMS personnel, little is known about how demographic and community characteristics influence behavioral health calls. Using nationwide 2021 EMS call data, we identified counties with high behavioral health calls and examined their demographic and community characteristics. Low-income and racially diverse counties had a higher incidence of behavioral health EMS calls, while politically conservative counties had a lower incidence of behavioral health EMS calls. To better meet the emergency behavioral health needs of communities, policy and decision-makers should consider strategies that increase access to and awareness of alternative behavioral health crisis services (eg, 988 Suicide and Crisis Lifeline).

Key words: behavioral health; emergency medical services; population health; health disparities.

Introduction

Although the provision of emergency medical services (EMS) dates back to the 18th century,¹ the passing of the EMS Systems Act of 1973 marked the formal inception of EMS systems in the US² and an opportunity to improve overall public health through enhanced injury control and disease monitoring.³ However, the rapid expansion in function and utilization of EMS since its formation has resulted in an overburdened and underfunded system.^{4,5} Anywhere from 10% to 50% of the 20 million annual calls that EMS personnel respond to are considered preventable,^{6–9} including more than 1.5 million behavioral health (ie, mental health or substance use-related) EMS calls.¹⁰ People with behavioral health conditions often have limited access to care due to a lack of service availability and/or barriers to receiving existing services,^{11–14} which may contribute to the occurrence of EMS calls for behavioral health crises. Problematically, EMS utilization for behavioral health crises often does not resolve the patient's concern, drains limited resources, delays response to other emergency calls, and incurs unnecessary costs for both the patient and the system.^{6–10}

Previous research has shown that a variety of individual demographics (eg, sex, age, race), social factors (eg, insurance, income), and community characteristics (eg, geographic area, availability of healthcare professionals) are associated with preventable EMS utilization.^{4,7–10} In terms of behavioral health EMS utilization, one nationwide study examining characteristics of patients who utilized EMS for behavioral health concerns found that these patients were more likely to be male, between the ages of 18 to 34, and located in urban

settings.¹⁰ Notably, sex and age were the only patient demographics examined in this study; race was excluded due to high amounts of missing data, and social factors such as insurance coverage and income were not examined.¹⁰ Studies that have examined how other patient demographics and social factors are related to behavioral health EMS utilization have been limited to single communities or states and produced conflicting findings,^{15–17} limiting our awareness of disparities that may exist among specific populations such as racial and ethnic minorities, the uninsured, and low-income groups. Prior literature also suggests that conservative ideologies and stigmatizing attitudes about behavioral health conditions may influence help-seeking behavior.^{18–20} Communities with a higher percentage of political conservatives tend to hold more stigmatizing attitudes^{13,21,22} and are less likely to have mental health treatment facilities that offer suicide prevention and behavioral health crisis intervention services.²³ Yet, little is known about whether or how the political climate of a community may influence behavioral health EMS utilization. Understanding how county-level demographic characteristics are related to health outcomes, such as behavioral health EMS utilization, is a useful approach for identifying disparities in health outcomes.^{24,25} However, to date, no study has examined the relationship between county characteristics and behavioral health EMS calls on a national scale.

The purpose of this study is to examine whether county characteristics are associated with behavioral health EMS calls. Using nationwide EMS call data, we identify counties with high behavioral health EMS calls and describe their

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demographic and community characteristics. As the first nationwide examination of county demographic characteristics associated with behavioral health EMS calls, our study provides valuable insights about community characteristics that may contribute to behavioral health EMS utilization. Additionally, our study is particularly timely given recent policy changes and efforts to transform the nation's behavioral health crisis care system (eg, through the 988 Suicide and Crisis Lifeline). Policy and decision-makers may use this information to allocate behavioral health resources, alleviate the burden of preventable utilization on EMS systems, and, ultimately, improve population health outcomes.

Data and methods

This study uses a cross-sectional design to examine whether county-level demographic and community characteristics are associated with behavioral health EMS calls. Secondary data were obtained from the following data sources: National EMS Information System (NEMSIS),²⁶ County Health Rankings & Roadmaps (CHR&R),²⁷ Presidential Election Returns, and the US Department of Agriculture (USDA).²⁸

Dependent variables

We obtained data on EMS calls from the 2021 NEMSIS dataset.²⁶ NEMSIS is a national system founded by the National Highway Traffic Safety Administration that collects standardized, deidentified data on prehospital EMS calls across the US. The dataset is comprised of individual EMS calls (ie, encounter-level data). The 2021 NEMSIS public use file includes 48 982 990 EMS calls submitted by 13 949 EMS agencies across 53 states and territories. For this analysis, calls that were missing a US county indicator and those with a missing or invalid primary reason for the call were excluded, bringing the final number of EMS calls included in our analyses to $n = 36\,824\,578$. To determine whether each included EMS call was related to a behavioral health condition, we used the primary reason assigned to the patient record. In doing so, we created a binary variable indicating whether the ICD-10 diagnosis code assigned as the primary reason was related to any behavioral health condition (defined as ICD-10 codes F01-F99). In addition, we created dummy variables to measure EMS calls for more specific categories of behavioral health conditions (eg, F01-F09, F10-F19, etc.).

Because we were interested in county-level EMS calls, we aggregated all EMS calls to create a variable indicating the number of behavioral health EMS calls by county. Geographic indicators are not included in the NEMSIS public use file, but masked county indicators are available for limited use. We obtained masked county indicators from the NEMSIS Technical Assistance Center, allowing us to conduct county-level analyses without identifying any individual counties. Counties with no EMS calls in the NEMSIS database ($n = 5$) were excluded, resulting in an aggregated analytic file containing data on 3137 US counties. After we calculated the number of behavioral health EMS calls per county, this count was converted to a measure of behavioral health EMS calls per 100 000 population using 2021 Census Population Estimates obtained from the 2021-2022 Area Health Resource File. To maintain de-identification of counties, this step was performed by the NEMSIS Technical Assistance Team. Based on this measure of behavioral health EMS calls per 100,000, we also created a binary variable

defining “high behavioral health EMS calls” as the top quartile of all counties. As a sensitivity analysis, we created a second binary variable measuring high behavioral health EMS calls as the top decile of all counties.

Independent variables

We compiled county-level characteristics expected to influence behavioral health EMS calls and access to behavioral health services based on prior literature.²³ Given that the availability of earlier intervention and outpatient services is expected to prevent behavioral health concerns from escalating to a crisis situation,¹¹⁻¹⁴ we examined the number of mental health professionals (MHPs) per capita as a measure of behavioral health service availability. In addition, since rural communities tend to have fewer mental health resources than urban counties, we examined county geographic type.²⁹ Importantly, even when behavioral health services are available in a particular community, many other barriers may influence access to care.¹¹⁻¹⁴ Documented barriers to care include ability to pay for services, stigma around behavioral health conditions, and experiences of racial discrimination among racial and ethnic minorities.²³ Similar to previous research,^{23,30} we examined household income levels and insurance status as proxies for ability to pay for services. Since stigma around behavioral health conditions is a well-documented phenomenon that can deter help-seeking behavior,^{13,21} and previous research has shown that political conservatives tend to hold more stigmatizing attitudes than political liberals,^{22,23} we also examined the political conservativeness of the county. Finally, since racism-related stressors may negatively influence mental health and racial discrimination may deter help-seeking behavior among racial and ethnic minorities,^{31,32} we examined racial demographics.

Racial demographics, median household income, percent insured, and the number of MHPs per capita were obtained from the 2021 CHR&R, a program of the University of Wisconsin Population Health Institute.²⁷ To measure racial demographics, we derived 2 variables from the CHR&R indicating (1) the percent of the county population identifying as non-Hispanic white and (2) the percent identifying as a racial or ethnic minority (including African American, Asian, American Indian or Alaska Native, Hispanic, and Native Hawaiian or Pacific Islander). To assess the political conservativeness of the county population, we also measured the percent of individuals who voted Republican in each county using the 2020 Presidential Election Returns. In order to link our independent variables with the NEMSIS database, we shared our compiled dataset with the NEMSIS Technical Assistance Center. Their team created a linked dataset by matching the county FIPS code to the county code for each encounter in the NEMSIS database, and then provided us with a version of the linked dataset containing only masked county indicators. As part of the process, data use agreements associated with the NEMSIS database required us to reduce the precision of these variables prior to merging to prevent the possibility of reverse-identifying any counties using unique values or variable combinations. Thus, each independent variable was recoded into 4 categories based on quartile values prior to merging with the NEMSIS data. Finally, we obtained information on geographic rurality from the USDA's Rural-Urban Continuum Codes.²⁸ Geographic area was categorized as rural, nonmetropolitan, or metropolitan.

Statistical analyses

We used descriptive statistics to describe behavioral health EMS calls and summarize county-level characteristics. Then, we used chi-squares to examine county-level demographic characteristics of counties with high behavioral health EMS calls. Finally, we used negative binomial models to examine multivariable relationships between county characteristics and the number of behavioral health EMS calls per 100 000. We examined unadjusted relationships between individual county-level predictors as well as adjusted relationships controlling for all covariates in a single model. We considered statistical significance at the $P < 0.05$ level. All analyses were performed using Stata Version 18. This study was approved by the Institutional Review Board at [blinded university].

Results

Of the 36 824 578 included EMS calls that occurred in 2021, 2,477,128 EMS calls (6.7%) had a primary reason indicating a behavioral health condition. A detailed breakdown of behavioral health EMS calls by type is presented in Table 1. The most common type of behavioral health EMS calls were those related to mental and behavioral disorders due to a psychoactive substance ($n = 971,133$, 39%). The second and third most common were unspecified mental disorders ($n = 735,940$, 30%) and anxiety, dissociative, stress-related, somatoform, and other nonpsychotic mental disorders ($n = 535,260$, 22%).

On average, counties had 18 MHPs per 10 000 population, a median income of \$57,455, 88% of the population insured, and 65% of the population voting Republican. County populations were predominantly non-Hispanic white (on average, 75% of the population) with a smaller population of racial and ethnic minorities (25%). In bivariate analyses (Table 2), high behavioral health calls were more likely to occur in counties with more MHPs, a higher percent of the population insured, and a larger population of racial and ethnic minorities ($P < 0.001$). In addition, high behavioral health EMS calls were more likely to occur in metropolitan counties ($P < 0.001$) and less likely to occur in counties where a higher percent of the population voted Republican ($P < 0.001$).

In unadjusted negative binomial models examining the relationship between each county-level characteristic and the number of behavioral health EMS calls per 100,000, counties with a higher incidence of behavioral health EMS calls

included counties with the most MHPs (Incident rate ratio: 2.07, $P < 0.001$), counties with the highest percent of insured individuals (IRR: 1.31, $P < 0.001$), and counties with the largest population of racial and ethnic minorities (IRR: 1.51, $P < 0.001$). Counties with a lower incidence of behavioral health EMS calls included counties with a higher percent of the population voting Republican (IRR: 0.43, $P < 0.001$) and rural counties (IRR: 0.68, $P < 0.001$). In multivariable analyses controlling for all county-level characteristics as covariates (Table 3), the incidence of behavioral health EMS calls remained higher in counties with the most MHPs (IRR: 1.53, $P < 0.001$), lower in rural counties (IRR: 0.88, $P = 0.01$), and lower in counties with the highest percent of the population voting Republican (IRR: 0.53, $P < 0.001$). In addition, the incidence of behavioral health EMS calls was lower in counties with the highest median income (IRR: 0.75, $P < 0.001$) when controlling for other covariates.

Discussion

The EMS system plays a crucial role in public health protection, injury control, and disease surveillance through triage, treatment, and transport of patients in emergency situations.^{3,9} While the scope of practice for EMS personnel has grown to encompass more varied types of services over time, not all situations are appropriate for an EMS response.^{8,10} In particular, EMS personnel often have limited training in managing patients with mental and behavioral health conditions.¹⁰ Understanding what types of communities have high behavioral health EMS calls can help inform efforts to alleviate the burden of behavioral health crises on both patients and EMS personnel. We found that behavioral health EMS calls were more likely to occur in low-income, racially diverse, and politically liberal communities. Therefore, efforts are needed to address underlying factors contributing to behavioral health crises and to ensure access to more appropriate, alternative services that can meet the unique needs of patients experiencing a behavioral health crisis in these communities.

Our findings suggest that politically conservative communities have lower behavioral health EMS calls. This finding could be due to a number of reasons. Given that prior research has found similar prevalence of mental health conditions, such as depression, among Republicans and Democrats, and higher reports of unmet behavioral health needs among Republican voters,³³ it is unlikely that this relationship is being driven

Table 1. Behavioral health EMS calls in 2021, by primary impression ($n = 2\,477\,128$).

ICD-10-code	Description	<i>n</i> (%)
F01-F09	Mental disorders due to known physiological conditions	52 939 (2.1%)
F10-F19	Mental and behavioral disorders due to a psychoactive substance	971 133 (39.2%)
F20-F29	Schizophrenia, schizotypal, delusional, and other non-mood psychotic disorder	41 305 (1.7%)
F30-F39	Mood [affective] disorders	36 411 (1.5%)
F40-F48	Anxiety, dissociative, stress-related, somatoform and other nonpsychotic mental disorders	535 260 (21.6%)
F50-F59	Behavioral syndromes associated with physiological disturbances and physical factors	9888 (0.4%)
F60-F69	Disorders of adult personality and behavior	10 416 (0.4%)
F70-F79	Intellectual disabilities	705 (0.03%)
F80-F89	Pervasive and specific developmental disorders	543 (0.02%)
F90-F98	Behavioral and emotional disorders with onset usually occurring in childhood and adolescence	82 588 (3.3%)
F99	Unspecified mental disorder	735 940 (29.7%)

Based on data obtained from the 2021 National Emergency Medical Services Information System (NEMSIS) public use file. For this analysis, we included all EMS activations with a valid ICD-10-code indicating the primary impression and a county indicator ($n = 36\,824\,578$). Overall, behavioral health EMS activations accounted for 6.7% ($n = 2\,477\,128$) of all EMS calls included in this study.

Table 2. Characteristics of counties with high behavioral health EMS calls (*n* = 3137).

County characteristics	High behavioral health EMS utilization			
	Top quartile		Top decile	
	<i>n</i> (%)	<i>P</i>	<i>n</i> (%)	<i>P</i>
Mental health professionals per 10 000 population				
Quartile 1 (<6)	88 (11%)	<0.001	28 (4%)	<0.001
Quartile 2 (6-14)	140 (18%)		40 (5%)	
Quartile 3 (14-23)	185 (24%)		72 (9%)	
Quartile 4 (>23)	370 (47%)		173 (22%)	
Median income				
Quartile 1 (<\$47 825)	178 (23%)	0.175	84 (11%)	0.695
Quartile 2 (\$47,825-55,150)	192 (24%)		75 (10%)	
Quartile 3 (\$55,150-64,039)	197 (25%)		72 (9%)	
Quartile 4 (>\$64 039)	216 (28%)		82 (10%)	
Percent insured				
Quartile 1 (<85%)	125 (16%)	<0.001	54 (7%)	<0.001
Quartile 2 (85%-89%)	190 (24%)		74 (9%)	
Quartile 3 (89%-92%)	209 (27%)		79 (10%)	
Quartile 4 (>92%)	259 (33%)		106 (13%)	
Percent racial and ethnic minorities				
Quartile 1 (<8%)	134 (17%)	<0.001	34 (4%)	<0.001
Quartile 2 (8%-17%)	174 (22%)		50 (6%)	
Quartile 3 (17%-36%)	230 (29%)		91 (12%)	
Quartile 4 (>36%)	245 (31%)		138 (18%)	
Percent non-Hispanic white				
Quartile 1 (<63%)	245 (31%)	<0.001	138 (18%)	<0.001
Quartile 2 (63%-83%)	230 (29%)		91 (12%)	
Quartile 3 (83%-92%)	174 (22%)		50 (6%)	
Quartile 4 (>92%)	134 (17%)		34 (4%)	
Percent voting Republican				
Quartile 1 (<56%)	357 (46%)	<0.001	173 (22%)	<0.001
Quartile 2 (56%-68%)	221 (28%)		90 (11%)	
Quartile 3 (68%-77%)	144 (18%)		37 (5%)	
Quartile 4 (>77%)	61 (8%)		13 (2%)	
Geographic area				
Rural	80 (12%)	<0.001	34 (5%)	<0.001
Nonmetropolitan	326 (25%)		113 (9%)	
Metropolitan	377 (32%)		166 (14%)	

Racial and Ethnic Minorities include African American, Asian, American Indian or Alaska Native, Hispanic, and Native Hawaiian or Pacific Islander. Behavioral health EMS activations were defined based on the ICD-10-code assigned as the primary impression (F01-F99). Five counties were excluded from analyses due to having no EMS activations at all.

by underlying differences in the occurrence of behavioral health conditions. However, prior literature does suggest that more politically conservative communities tend to have fewer behavioral health resources and hold more stigmatizing attitudes about behavioral health.^{13,18,21-23} When communities hold stigmatizing attitudes, such as the erroneous belief that behavioral health conditions are the result of a personal or moral failing rather than a major public health issue, this may deter individuals from disclosing behavioral health symptoms or from seeking care altogether. To the extent that help-seeking behavior is driven by stigma, this presents an opportunity for policy makers and practitioners to implement educational campaigns that address stigma.²⁰

Our findings also suggest that low-income and racially diverse counties are experiencing higher behavioral health EMS calls, indicating potential disparities among these populations. Disparities in health outcomes, as well as disparities in behavioral health services delivery and access, in the US have been well-documented in prior studies.^{15,23,34-37} For example, low-income populations tend to have higher healthcare needs in general,³⁸⁻⁴⁰ and are less likely to have access to alternative behavioral health services for urgent needs.^{23,37} Additionally, racial and ethnic minorities tend to be over-represented in

emergency department settings.³⁵ There are a number of factors that may be driving disparities in behavioral health EMS utilization among racial and ethnic minorities, including racism-related stressors that may negatively influence mental health.⁴¹ Prior studies have also shown that racial and ethnic minorities may wait longer to access mental health services due to a number of barriers (eg, stigma around mental health, concerns about hospitalization, costs, language barriers, and immigration status), which may place individuals at higher risk of experiencing an emergent situation.^{15,34-36} Ensuring access to affordable, culturally competent behavioral health care in underserved communities and implementing interventions that target underlying stressors contributing to behavioral health crises in low-income and racially diverse communities may help reduce behavioral health EMS utilization.

We also found that counties with more MHPs had higher behavioral health EMS calls. One possible explanation for these findings is that MHPs may be more likely to locate in counties with higher behavioral health service utilization (ie, a higher demand for their services)²³ due to availability of training programs and incentives offered in communities that need more MHPs. Given that many communities still

Table 3. Multivariable analyses of county-level demographic characteristics associated with behavioral health EMS calls ($n = 3137$).

County characteristics	High behavioral health EMS utilization			
	Unadjusted IRR	95% CI	Adjusted IRR	95% CI
Mental health professionals per 10 000 population				
Quartile 1 (<6)	Reference	Reference	Reference	Reference
Quartile 2 (6-14)	1.34 ^c	[1.22-1.47]	1.22 ^c	[1.11-1.34]
Quartile 3 (14-23)	1.38 ^c	[1.26-1.51]	1.16 ^b	[1.06-1.27]
Quartile 4 (>23)	2.07 ^c	[1.89-2.27]	1.53 ^c	[1.38-1.69]
Median income				
Quartile 1 (<\$47 825)	Reference	Reference	Reference	Reference
Quartile 2 (\$47,825-55,150)	0.95	[0.86-1.04]	0.91 ^a	[0.83-0.99]
Quartile 3 (\$55,150-64,039)	1.00	[0.91-1.10]	0.87 ^b	[0.79-0.96]
Quartile 4 (>\$64 039)	1.03	[0.94-1.14]	0.75 ^c	[0.67-0.83]
Percent insured				
Quartile 1 (<85%)	Reference	Reference	Reference	Reference
Quartile 2 (85%-89%)	1.03	[0.93-1.13]	0.98	[0.89-1.07]
Quartile 3 (89%-92%)	1.14 ^b	[1.04-1.25]	1.03	[0.93-1.15]
Quartile 4 (>92%)	1.31 ^c	[1.19-1.44]	1.11	[0.98-1.25]
Percent racial and ethnic minorities				
Quartile 1 (<8%)	Reference	Reference	Reference	Reference
Quartile 2 (8%-17%)	1.19 ^c	[1.08-1.31]	1.06	[0.96-1.16]
Quartile 3 (17%-36%)	1.33 ^c	[1.21-1.46]	1.12 ^a	[1.01-1.24]
Quartile 4 (>36%)	1.51 ^c	[1.38-1.66]	1.09	[0.97-1.24]
Percent voting Republican				
Quartile 1 (<56%)	Reference	Reference	Reference	Reference
Quartile 2 (56%-68%)	0.75 ^c	[0.68-0.82]	0.81 ^c	[0.74-0.90]
Quartile 3 (68%-77%)	0.58 ^c	[0.53-0.64]	0.66 ^c	[0.59-0.74]
Quartile 4 (>77%)	0.43 ^c	[0.40-0.48]	0.53 ^c	[0.46-0.60]
Geographic area				
Rural	0.68 ^c	[0.62-0.74]	0.88 ^b	[0.79-0.97]
Nonmetropolitan	0.88 ^c	[0.82-0.95]	1.02	[0.94-1.10]
Metropolitan	Reference	Reference	Reference	Reference

Unadjusted IRRs were calculated by running separate models for each county characteristic. Adjusted IRRs were calculated by fitting a single model controlling for all county characteristics as covariates. Racial and Ethnic Minorities includes African American, Asian, American Indian or Alaska Native, Hispanic, and Native Hawaiian or Pacific Islander. Behavioral health EMS activations were defined based on the ICD-10-code assigned as the primary impression (F01-F99). Five counties were excluded from analyses due to having no EMS activations at all. Percent non-Hispanic white omitted from regression analyses because of perfect collinearity with percent racial and ethnic minorities.

^a $P \leq 0.05$, ^b $P \leq 0.01$, ^c $P \leq 0.001$.

Abbreviation: IRR, incident rate ratios.

face workforce shortages,^{23,42} policies that further promote training programs and reinforce the supply of MHPs may help address underlying behavioral health conditions. Another potential explanation could be poor quality of care, which is difficult to assess given limited quality measures for behavioral health services.^{43,44} To improve quality of care, organizational leaders might consider strategies for implementing and disseminating evidence-based practices among MHPs.⁴⁵⁻⁴⁷

Given that few studies have characterized behavioral health EMS calls nationally, our study provides one of the first examinations of county characteristics associated with behavioral health EMS calls. However, it is important to note that the NEMSIS database is not a complete census and relies on voluntary reporting by EMS agencies. Thus, data presented in this study do not represent all EMS calls nationally. Additionally, our study uses data from 2020 to 2021, covering a period in time shortly after the onset of the COVID-19 pandemic. Considering that the COVID-19 pandemic impacted many subpopulations, it is possible that the pandemic also influenced behavioral health EMS calls during this time. Furthermore, as a cross-sectional ecological study, our findings cannot be used to draw causal inference and should not be used to draw inferences at the individual-level. Finally, we were limited in the number of variables that we could

examine in this study due to disruptions in the availability of public data sources and NEMSIS data use agreements. Future research should examine more detailed indicators of county-level racial composition, political indicators beyond voting, and indicators of other factors that may influence EMS calls such as medical debt and the presence of alternative services (eg, crisis intervention teams, mobile crisis teams, etc.). Future research should also examine longitudinal trends in behavioral health EMS calls to assess the effectiveness of alternative services and policy changes aimed at addressing behavioral health disparities.

Conclusion

Several community characteristics appear to be related to behavioral health EMS calls, including income levels, racial demographics, and voting history. Allocating resources to communities with high behavioral health EMS calls may help alleviate the burden of behavioral health crises on both patients and EMS providers. To improve population health outcomes and prevent behavioral health crises from occurring, policy and decision-makers should consider implementing strategies that address underlying factors contributing to behavioral health crises and ensure access to more appropriate, alternative services that can meet the unique needs of patients

experiencing a behavioral health crisis. More specifically, raising awareness of the 988 Suicide and Crisis Lifeline and ensuring availability of specialty behavioral health crisis services delivered by mental health treatment facilities in low-income and racially diverse communities may help reduce behavioral health EMS calls by providing a more appropriate alternative.

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Supplementary material

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Conflicts of interest

Please see ICMJE form(s) for author conflicts of interest. These have been provided as supplementary materials.

Notes

1. Foex B. Life in the balance: emergency medicine and the quest to reverse sudden death. *Emerg Med J*. 1999;16(6):464-464. <https://doi.org/10.1136/emj.16.6.464-a>
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