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Unrecognised self-injury mortality (SIM) trends among racial/ethnic minorities and women in the USA

Ian R H Rockett ,[1,2,3] Eric D Caine,[2] Hilary S Connery,[4,5] Kurt B Nolte,[6] Paul S Nestadt,[7] Lewis S Nelson,[8] Haomiao Jia[9,10]

For numbered affiliations see end of article.

Correspondence to
Dr Ian R H Rockett, Epidemiology, West Virginia University, Morgantown, WV 26506, USA; irockett@hsc.wvu.edu

Received 26 June 2019
Revised 22 August 2019
Accepted 24 August 2019
Published Online First 24 September 2019

ABSTRACT

Aim To assess whether an enhanced category combining suicides with nonsuicide drug self-intoxication fatalities more effectively captures the burden of self-injury mortality (SIM) in the USA among US non-Hispanic black and Hispanic populations and women irrespective of race/ethnicity.

Methods This observational study used deidentified national mortality data for 2008–2017 from the CDC's *Web-based Injury Statistics Query and Reporting System*. SIM comprised suicides by any method and age at death plus estimated nonsuicide drug self-intoxication deaths at age ≥15 years. Measures were crude SIM and suicide rates; SIM-to-suicide rate ratios; and indices of premature mortality.

Results While the suicide rate increased by 29% for blacks, 36% for Hispanics and 25% for non-Hispanic whites between 2008 and 2017, corresponding SIM rate increases were larger at 109%, 69% and 55% ($p<0.0001$). SIM:suicide rate ratio gaps were widest among blacks but similar for the other two groups. Gaps were wider for females than males, especially black females whose ratios measured ≥3.71 across the observation period versus <3.00 for white and Hispanic counterparts. Total lost years of life for Hispanic, white and black SIM decedents in 2017 were projected to be 42.6, 37.1 and 32.4, respectively.

Conclusion Application of SIM exposed substantial excess burdens from substance poisoning relative to suicide for minorities, particularly non-Hispanic blacks and for women generally. Results underscored the need to define, develop, implement and evaluate comprehensive strategies to address common antecedents of self-injurious behaviours.

INTRODUCTION

Actively killing oneself—that is, self-injury mortality (SIM)—involves more than suicide. Suicide—as codified by medical examiners and coroners (ME/Cs) and the US CDC—is an 'intentional' manner of death (MOD) as is homicide. It often is viewed as a sentinel event indicative of distressed individuals and distressed communities.[1] However, suicide alone as a MOD fails to capture adequately the toll of lives where persons' actions lead directly to their death. For example, a national, multivariable study found that official suicide rates for non-Hispanic blacks and Hispanics during 2003–2005 were approximately two-fifths of the rates for the majority non-Hispanic white population.[2] However, when suicides were pooled with deaths of undetermined intent—the MOD category most susceptible to suicide misclassification[3]—blacks and Hispanics, respectively, had 2.38 and 1.17 higher odds than whites of being assigned an undetermined classification, despite evidence reflecting immediate (proximal) actions causing their demise.[2] A subsequent multilevel (individual and county), multivariable study, which used the enriched restricted access database of the National Violent Death Reporting System (NVDRS), attested to the importance of an authenticated suicide note and psychiatric/psychological history in distinguishing ME/C cases as suicides versus undetermined deaths.[4] That study further demonstrated the paucity of such corroborative evidence, a data deficit appearing most consequential for the (mis-)classification of drug and other poisoning suicides, as compared with suicides by gunshot or hanging. However, its authors noted that non-drug poisoning suicides, for example, such as those implicating gases, pesticides and household cleaners, were much rarer than drug poisoning suicides and also that non-drug poisoning tends to be less ambiguous than drug poisoning as a suicide method for ME/Cs. This category also included alcohol poisoning suicides, which could justifiably have been placed in the drug poisoning category.

While suicides have been conventionally used as the sole representative of fatal self-injury, there has been a growing argument that a broader, behaviourally based, working category of SIM would facilitate injury research, prevention and treatment.[5 6] SIM has been operationalised as a combination of:

1. Registered suicides by all methods at all ages.
2. Estimated drug-associated self-intoxication deaths, where instrumental behaviours of the decedents had proved lethal on the day of death (eg, dying from a fentanyl overdose in the course of using injectable opioids) among persons aged ≥15 years.

SIM arose to address health data disparities in recognition that: (1) suicides are undercounted non-randomly by demographic characteristics, such as sex and race/ethnicity, and method or injury mechanism[2 4]; (2) psychological autopsies or in-depth investigations of decedent histories of psychiatric disorders or distress are rarely used to inform MOD determination in cases of equivocal intent[7–9]; (3) regional medicolegal and epidemiological paradigms possess different functions and

To cite: Rockett IRH, Caine ED, Connery HS, *et al*. *Inj Prev* 2020;**26**:439–447.

priorities, with differing implications for suicide and other injury mortality surveillance, aetiological understanding, prevention and treatment[10]; (4) standards for ME/Cs assigning suicide as the MOD are much more stringent than those governing homicide[11] and would require unaffordable investigative resources (as outlined in (2) above); (5) burdens placed on overstressed and under-resourced emergency healthcare[12 13] and medicolegal death investigation systems[14 15] in affirming drug intoxication suicides, in particular,[16] have likely been exacerbated by the Great Recession of 2008[17] and the opioid and suicide epidemics[18–20]; (6) ME/Cs use 'accident' as a default MOD assignment in the absence of affirmative criteria; (7) governmental coding of the great majority of drug-intoxication deaths as 'accidents' mischaracterises what is known regarding the association between recurring drug misuse and drug use disorders with increased rates of suicidal ideation, planning and attempts[21–23]; and (8) mandated by nationwide statutes, 'accident', as a formal MOD category, is unlikely to be modified in the foreseeable future to account for evidentiary, behaviourally based 'non-suicide' self-injury deaths.

Prior reports on SIM rate trends and patterns in the US highlighted comparisons with other leading causes of death.[5 6 24] Suicide remains the 10th ranked cause of death. However, the SIM rate in 2016 surpassed the mortality rate for diabetes, the seventh leading cause, reflecting the continuing rise in suicide since 2000 and the rapid acceleration of drug-related fatalities.[6] In 2014, SIM accounted for an estimated 32 and 37 years of life lost by the male and female decedents, respectively, compared with 16 and 17 years from diabetes.[5] Suicide is likely relatively more undercounted for women than men because women tend disproportionately to employ less violent, less forensically obvious methods (eg, drugs vs gunshot or hanging),[25] which provides important justification for investigating sex differentials in SIM rates relative to suicide rates.

Buttressing the need for racial/ethnic research on SIM, psychiatric and psychological evidence for suicide corroboration is plausibly rarer for blacks and Hispanics than for whites.[26] Consistent with differential healthcare access and suicide accounting, an NVDRS analysis conducted by CDC found that black and Hispanic suicide decedents had fewer reported mental health conditions than white counterparts.[27] Their suicides also were accompanied by a lower prevalence of evidentiary suicide notes.[4 28] An unanticipated consequence, disparities in access to healthcare and pain management may have decreased overall exposure among black and Hispanic populations to high potency prescription opioids during the early years of the opioid epidemic,[29 30] thus attenuating their risk for fatal drug intoxication with prescription opioids. However, as individuals using highly purified heroin and fentanyl analogues have emerged as the primary overdose fatalities, black and Hispanic men and women have experienced increasing related mortality.[31]

We evaluated two research questions in this national study of racial/ethnic trends and patterns in SIM during the decade 2008–2017. While non-Hispanic white men have been identified as the highest profile risk group for 'deaths of despair',[32 33] including mortality from suicide, drug intoxication and alcohol-related diseases, does SIM capture relatively more 'accidental' and undetermined drug intoxication deaths among non-Hispanic blacks and Hispanics than non-Hispanic whites of both sexes? Is the impact of SIM more pronounced among females than males across all three of the major racial/ethnic groups?

METHODS

This cross-sectional, observational study used deidentified manner and underlying cause-of-death data and associated population data from CDC's *Web-based Injury Statistics Query and Reporting System* (WISQARS).[34] Distinguishing the sexes, and also age for comparing SIM patterns, the study population was confined to non-Hispanic blacks, Hispanics and non-Hispanic whites, who constituted 93% of the US population in 2017. Persons of Asian and Pacific Islander heritage and American Indians and Native Alaskans were excluded from this study due to heterogeneity and instability with small numbers. Following previous practice, SIM was operationalised as a composite of all suicides (International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) UO3, X60-84, Y 87.0), by any method at any age at death, and 80% of 'accidental' ('unintentional' under CDC nomenclature) drug deaths (X40-44) and 90% of undetermined drug deaths (Y10-14) among persons aged >15 years.[5 6] The 'accidental' drug death component was at least sevenfold higher than the undetermined component throughout the observation period, 2008–2017, in each of the racial/ethnic groups under scrutiny. Our SIM formula estimated and removed the small proportion of drug poisoning deaths not attributable to repetitive self-harm behaviours most commonly associated with drug use disorders. The age cutoff ≥15 years for the nonsuicide drug component assumed that purposive self-harm behaviours were rare among preteen and younger teens.

We examined SIM-to-suicide rate ratios to compare the changing relative contributions of suicides and drug intoxication deaths to the overall burden of self-injury fatalities. We also tested and described linear trends in crude SIM and suicide rates by race/ethnicity and sex over the observation period, modelling time as a continuous variable. In order to compare patterns as well as changes in SIM across groups, we then computed age-specific and sex-specific rates for the years 2008 and 2017. Two measures were employed to assess the premature mortality burdens attributable to SIM: cumulative percentage of SIM under age 55 years, and projected years of life lost by SIM decedents (derived from a double decrement life table procedure) based on our predetermined age groups.[35 36]

This study did not meet the criteria for human research established by the West Virginia University Office of Research Integrity and Compliance, as the mortality and population data were deidentified and obtained from a publicly accessible, secondary database. Thus, no protocol approval was necessary.

RESULTS

A linear test for trend ($p<0.0001$) showed rising crude SIM and suicide rates across all three racial/ethnic groups between 2008 and 2017, independent of sex (table 1). Due to the large number of deaths annually, the SEs of the rate estimates were small (0.1–0.2 deaths per 100 000 population). SIM rates for whites were almost triple those of Hispanics and more than double those of Blacks throughout most of the observation period, with rate increases accelerating towards the end. Comparing 2017 with 2008, the SIM rate increased 109% for blacks, 69% for Hispanics and 55% for whites. These rate changes generally were similar for both sexes across the three groups. Suicide rates also rose universally, though less for men than women—29% for blacks, 36% for Hispanics and 25% for whites. These increases were markedly smaller than the growth of SIM rates overall, indicating greater contributions from drug fatalities.

Table 1 Self-Injury mortality (SIM)* and suicide rates per 100 000 population and SIM-to-suicide rate ratios for three racial/ethnic groups by sex, USA, 2008–2017

Race/ethnicity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	% change 2008/2017
Both sexes	**SIM rate**										
White (non-Hispanic)	27.9	28 3	29.5	31.0	31.2	32.4	34.1	36.6	40.5	43.3	55.1
Black (non-Hispanic)	12.9	12.7	12.6	13.3	13.7	14.6	15.5	17.3	22.8	26.9	109.1
Hispanic	9.7	9.9	9.8	10.4	10.5	10.9	11.6	12.6	14.8	16.3	68.8
Male											
White (non-Hispanic)	40.6	41.0	42.4	44.5	44.7	46.1	48.5	52.1	58.3	62.7	54.5
Black (non-Hispanic)	19.6	18.9	18.6	19.7	20.2	21.8	22.8	26.0	34.3	41.2	109.6
Hispanic	15.1	15.3	14.8	15.7	15.8	16.4	17.5	19.0	22.8	25.4	68.1
Female											
White (non-Hispanic)	15.7	16.1	16.9	18.0	18.1	19.1	20.1	21.4	23.2	24.4	55.8
Black (non-Hispanic)	6.7	7.0	7.2	7.5	7.7	8.0	8.8	9.3	12.3	13.9	106.2
Hispanic	4.0	4.4	4.7	5.0	5.1	5.3	5.6	6.0	6.6	7.0	75.1
Both sexes	**Suicide rate**										
White (non-Hispanic)	15.2	15.4	16.0	16.5	16.8	17.1	17.6	18.1	18.2	18.9	24.9
Black (non-Hispanic)	5.3	5.2	5.3	5.5	5.7	5.6	5.6	5.8	6.3	6.9	29.2
Hispanic	4.9	5.2	5.3	5.2	5.3	5.3	5.9	5.8	6.3	6.7	36.0
Male											
White (non-Hispanic)	24.3	24.7	25.6	26.2	26.7	26.9	27.7	28.3	28.3	29.9	23.3
Black (non-Hispanic)	9.3	8.8	9.1	9.4	9.6	9.5	9.5	9.8	10.6	11.4	21.9
Hispanic	8.0	8.5	8.5	8.5	8.5	8.3	9.2	9.1	10.1	10.7	32.6
Female											
White (non-Hispanic)	6.3	6.5	6.7	7.0	7.2	7.5	7.9	8.3	8.3	8.2	29.8
Black (non-Hispanic)	1.7	1.9	1.8	1.9	2.1	2.1	2.1	2.1	2.4	2.8	64.0
Hispanic	1.7	1.8	2.0	1.9	2.1	2.2	2.4	2.6	2.5	2.6	56.4
Both sexes	**SIM: suicide rate ratio**										
White (non-Hispanic)	1.84	1.84	1.84	1.88	1.86	1.90	1.93	2.02	2.23	2.28	23.9
Black (non-Hispanic)	2.41	2.44	2.39	2.43	2.41	2.61	2.75	2.99	3.60	3.91	62.2
Hispanic	1.97	1.90	1.86	1.99	1.96	2.06	1.98	2.15	2.33	2.44	23.9
Male											
White (non-Hispanic)	1.67	1.66	1.65	1.70	1.68	1.71	1.75	1.84	2.06	2.09	25.1
Black (non-Hispanic)	2.10	2.14	2.04	2.11	2.10	2.30	2.40	2.66	3.24	3.62	72.4
Hispanic	1.88	1.80	1.75	1.85	1.85	1.97	1.90	2.09	2.26	2.39	27.1
Female											
White (non-Hispanic)	2.47	2.49	2.55	2.56	2.50	2.55	2.56	2.60	2.81	2.96	19.8
Black (non-Hispanic)	3.98	3.72	3.94	3.88	3.71	3.88	4.18	4.38	5.01	5.00	25.6
Hispanic	2.40	2.41	2.35	2.60	2.44	2.41	2.33	2.35	2.60	2.68	11.7

*Self-injury mortality (SIM) is a composite of all registered suicides, and estimated nonsuicide deaths from drug self-intoxication at ages 15 years and older.

Reflecting the drug-related deaths whose manner was assigned by ME/Cs as 'accident' or undetermined, examination of SIM-to-suicide rate ratios revealed widening gaps between the respective magnitude of the SIM rate and the suicide rate for all three racial/ethnic groups, as a whole and by sex. This widening was especially pronounced for Blacks. The ratios for black females measured 3.71 or higher across the observation period, while those for white and Hispanic females remained under 3.00. The ratios for black males invariably surpassed those of their white and Hispanic counterparts and exceeded 3.00 during 2016 and 2017.

Figure 1 relates respective SIM-to-suicide rate ratios for blacks and Hispanics to the white ratios for the total groups and by sex. Black-to-white ratios steadily increased from 1.29 in 2011 to a high of 1.70 by 2017. By contrast, Hispanic-to-white ratios generally approached parity, ranging from a low of 1.01 in 2010 to a high of 1.09 in 2013. Although patterns of Black-to-white SIM-to-suicide rate ratios for men and women both mirrored the pattern for the combined sexes, ratios were more concentrated and typically higher for women. Hispanic-to-white ratios remained marginally above parity for men throughout the observation period, and marginally below for women 2011 aside. Figure 2 provides direct comparisons between the sexes in the respective magnitude of their SIM-to-suicide rate ratios across race/ethnicity. Black female-to-male SIM-to-suicide rate ratios exceeded those for whites and Hispanics, except in 2017 when approximating the ratio for whites. Ratios trended downwards across all three racial/ethnic groups.

Table 2 presents comparative age-specific and sex-specific SIM rates for 2008 and 2017. Rates were higher in the middle of the age spectrum than at the extremes. They also were substantially higher in 2017. While whites continued to manifest the highest SIM rates, blacks exhibited the largest cross-period changes overall, with increases approaching or exceeding twofold. Age-specific SIM-to-suicide rate ratios were typically larger in 2017 than in 2008 for all racial/ethnic groups. In 2017, SIM rates

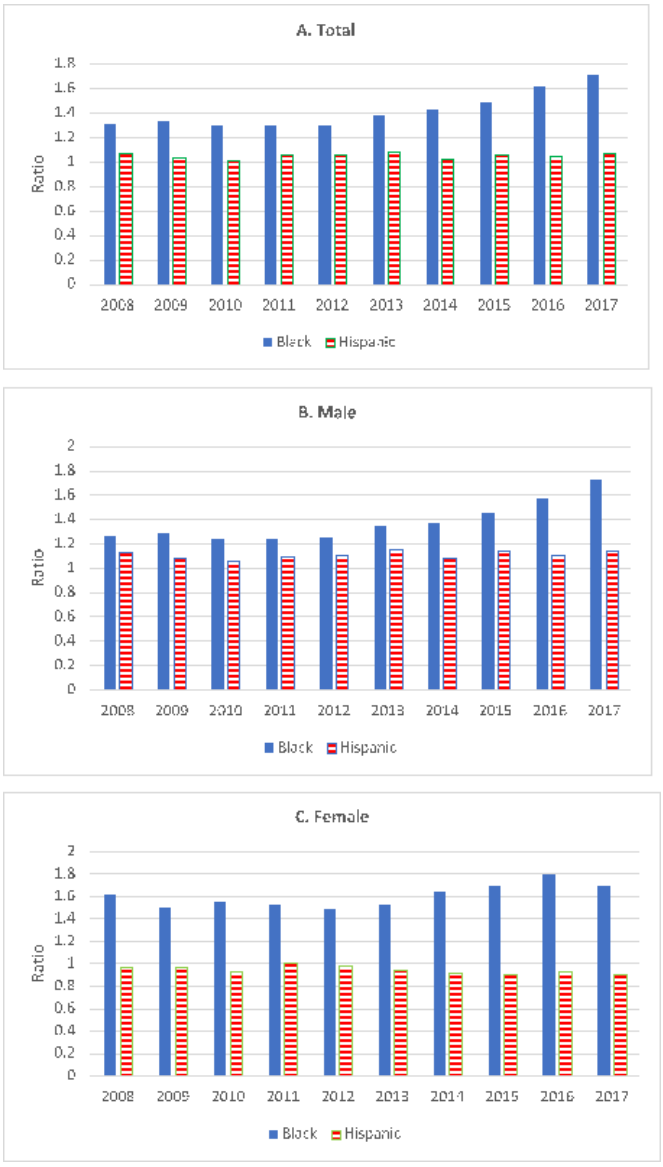

Figure 1 Ratio of minority racial/ethnic group-to-white self-injury mortality-to-suicide rates by sex, USA, 2008–2017.

for blacks were sevenfold, ninefold and fourfold higher than corresponding suicide rates at ages 45–54 years, 55–64 years and 35–44 years, respectively. They were threefold higher for blacks at ages 25–34 years, Hispanics at ages 35–64 years and whites at ages 25–44 years. Reference to the cumulative percentages of SIM deaths showed appreciable transfer of the burden to older middle-age among blacks between 2008 and 2017. In 2008 and 2017, respectively, 85% and 86% of Hispanic SIM deaths occurred within the population 54 years and younger, our first indicator of the premature mortality burden. Corresponding percentages for blacks and whites were lower and showed marked declines.

Separation of the sexes revealed much higher age-specific SIM rates for men than women irrespective of race/ethnicity (table 3). Rate increases between 2008 and 2017 were much greater across most of the age spectrum for blacks than for Hispanics and whites. They also tended to be greater for Hispanic men and women than for white counterparts, especially at the younger ages. Sex-specific and age-specific SIM-to-suicide rate ratios commonly expanded across the observation period, with female

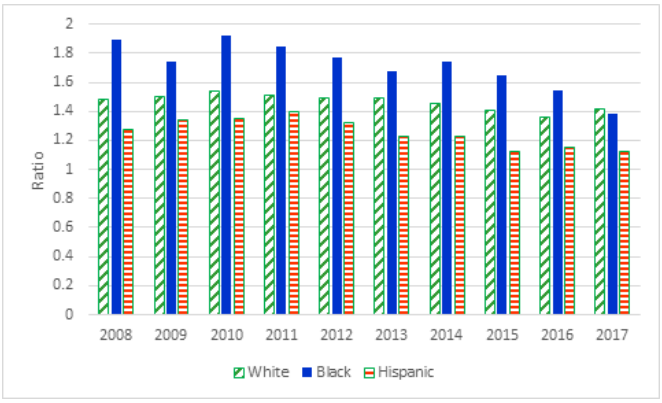

Figure 2 Female-to-male ratio of self-injury mortality-to-suicide rates by race/ethnicity, USA, 2008–2017.

ratios generally exceeding male ratios in 2008 and 2017. Blacks were a high outlier regardless of sex. The second indicator of premature mortality was estimated years of life lost by the individuals who died from self-injury. Greater in 2017 than in 2008, total respective lost years of life (based on exact age zero) for Hispanics, whites and blacks in 2008 and 2017 were projected to be 37.0 and 42.6, 35.7 and 37.1 and 32.2 and 32.4.

DISCUSSION

SIM rates escalated rapidly in all three of the major racial/ethnic groups in the USA over the observation period. Non-Hispanic blacks recorded greater relative increases than non-Hispanic whites, the group with by far the highest rates. Examination of SIM-to-suicide rate ratios exposed health data disparities, which profoundly affected blacks, and women more than men independent of race/ethnicity. Beyond the issue of disparities emanating from differential suicide undercounting, the current approach of recording most drug-related fatalities as an 'accident' or 'unintentional' dampens the urgent public health need to develop effective upstream preventive interventions for recurring self-injurious behaviours—interventions with the potential to address common risks for the full range of self-injury fatalities.[1] This need speaks to the inadequacy of many clinical care systems and state regulations that separate the treatment of persons with substance-related disorders from those with mental health problems in the face of substantial comorbidity and common social determinants of antecedent life turmoil and subsequent negative outcomes.

Inclusion of the great preponderance of 'accidental' and undetermined drug intoxication deaths into our estimation of SIM revealed evidence of convergence in trends between black and white rates for both sexes that in suicide trends manifested in women but not men. Some convergence was also apparent between Hispanics and whites, but the SIM rate trajectory for Hispanics was appreciably lower than those for the other two groups. Black and Hispanic suicide rates were similar throughout the observation period, while black SIM rates rose much more sharply than Hispanic as well as white rates. However, the group with the lowest SIM rates, Hispanics, incurred the largest relative burden of SIM-attributable premature mortality for either sex. Application of SIM showed relatively greater capture of the nonsuicide drug component among women, irrespective of race/ethnicity—consistent with the observation that their suicides may be under-reported relatively more often than those of males because drug ingestion is their leading method of suicide[25] and suicide attempts.[37]

Table 2 Patterns and change in self-injury mortality (SIM) by race/ethnicity and age, USA, 2008 versus 2017

	White (non-Hispanic)						Black (non-Hispanic)						Hispanic					
	No. of deaths	Cumulative deaths, %	Rate*	Period change, %	SIM: SRR†	YLL‡	No. of deaths	Cumulative deaths, %	Rate*	Period change, %	SIM: SRR†	YLL‡	No. of deaths	Cumulative deaths, %	Rate*	Period change, %	SIM: SRR†	YLL‡
Age, years	**2008**																	
0–14	148	0.3	0.4	NA	1.00	35.7	30	0.6	0.3	NA	1.00	32.2	22	0.5	0.2	NA	1.00	37.0
15–24	5803	10.7	22.5	NA	1.92	35.6	610	12.8	9.3	NA	1.22	32.1	772	17.2	9.2	NA	1.51	36.9
25–34	9079	27.0	38.2	NA	2.28	32.7	826	29.4	15.6	NA	1.68	29.7	1096	40.9	13.4	NA	1.99	34.8
35–44	11 801	48.1	43.8	NA	2.12	28.3	1112	51.8	20.6	NA	2.84	26.3	1126	65.3	16.1	NA	2.26	32.3
45–54	15 090	75.2	47.7	NA	2.06	23.4	1423	80.3	26.6	NA	4.38	22.4	962	86.2	19.2	NA	2.50	29.2
55–64	7705	89.1	29.6	NA	1.54	17.6	694	94.3	19.6	NA	4.31	17.4	372	94.3	12.9	NA	2.14	24.3
65–74	2987	94.4	18.5	NA	1.19	13.7	191	98.1	10.0	NA	1.95	13.5	148	97.5	9.8	NA	1.41	20.0
75+	3112	100	18.3	NA	1.02	13.2	94	100	6.9	NA	1.45	14.1	117	100	11.3	NA	1.19	19.5
All	55 725	NA	27.9	NA	1.84		4980	NA	12.9	NA	2.41		4615	NA	9.7	NA	1.97	
	2017																	
0–14	328	0.4	1.0	137.1	1.00	37.2	66	0.6	0.7	119.4	1.00	32.4	91	0.9	0.6	265.2	1.00	42.6
15–24	8011	9.6	33.6	49.3	1.97	37.0	1125	10.4	17.0	83.3	1.58	32.2	1582	17.4	16.2	76.9	1.61	42.4
25–34	19 001	31.4	74.1	93.7	3.34	34.4	2274	30.2	35.0	123.9	2.87	30.1	2505	43.5	26.9	100.6	2.60	39.1
35–44	17 324	51.3	73.6	68.1	3.01	29.2	2180	49.1	40.7	97.4	4.23	26.3	2168	66.1	25.6	58.6	3.08	34.1
45–54	18 030	72.0	66.6	39.6	2.48	23.8	2670	72.4	49.9	87.7	6.71	22.5	1847	85.3	26.8	39.7	3.17	29.3
55–64	14 692	88.9	49.2	66.0	2.05	18.3	2392	93.2	48.8	149.4	9.34	18.1	966	95.3	20.5	58.9	2.94	24.1
65–74	5614	95.3	24.8	34.4	1.34	13.8	652	98.9	22.6	125.6	4.94	13.4	296	98.4	11.6	18.2	1.85	20.0
75+	4065	100	24.3	19.4	1.11	13.2	126	100	7.1	3.8	1.80	14.1	151	100	9.1	–19.0	1.23	19.5
All	87 067	NA	43.3	55.1	2.28		11 485	NA	26.9	109.1	3.91		9606	NA	16.3	68.8	2.44	

*Rate per 100 000 population.
†SIM-to-suicide rate ratio.
‡Projected 'years of life lost' at exact age at the beginning of the age interval.
SRR, suicide rate ratio; YLL, years of life lost.

Table 3 Patterns and change for self-injury mortality (SIM) by race/ethnicity, age and sex, USA, 2008 versus 2017

	White (non-Hispanic)						Black (non-Hispanic)						Hispanic					
	No. Deaths	Cumulative Deaths, %	Rate*	Period Change, %	SIM: SRR†	YLL‡	No. Deaths	Cumulative Deaths, %	Rate*	Period Change, %	SIM: SRR†	YLL‡	No. Deaths	Cumulative Deaths, %	Rate*	Period Change, %	SIM: SRR†	YLL‡
Age, years	**Male, 2008**																	
0–14	108	0.3	0.6	NA	1.0	33.6	22	0.6	0.5	NA	1.00	29.0	13	0.3	0.2	NA	1.00	35.5
15–24	4692	12.1	35.7	NA	1.85	33.5	489	14.1	14.8	NA	1.17	28.9	632	17.5	14.2	NA	1.49	35.4
25–34	6891	29.4	57.7	NA	2.15	30.3	641	31.8	25.6	NA	1.55	26.5	907	42.2	21.0	NA	1.94	32.7
35–44	8029	49.5	59.4	NA	1.90	25.7	769	53.1	30.3	NA	2.38	22.9	905	66.7	25.3	NA	2.16	29.1
45–54	9974	74.6	63.5	NA	1.81	21.0	959	79.6	38.2	NA	3.56	19.2	724	86.4	28.8	NA	2.37	25.1
55–64	5343	88.0	42.0	NA	1.38	15.9	520	93.9	32.4	NA	3.77	15.0	289	94.3	21.1	NA	1.99	20.6
65–74	2286	93.8	30.1	NA	1.11	12.7	147	98	18.2	NA	1.77	11.5	117	97.4	17.5	NA	1.24	18.0
75+	2486	100	41.7	NA	1.06	12.5	73	100	15.5	NA	1.30	12.7	94	100	23.1	NA	1.09	17.9
All	39 809	NA	40.6	NA	1.67		3620	NA	19.6	NA	2.10		3681	NA	15.1	NA	1.88	
	Male, 2017																	
0–14	227	0.4	1.4	125.4	1.00	35.4	46	0.6	1.0	108.6	1.00	28.9	61	0.8	0.8	314.9	1.00	39.3
15–24	6126	10.2	50.1	40.4	1.84	35.2	830	10.4	24.7	66.9	1.47	28.7	1232	17.1	24.6	73.1	1.58	39.1
25–34	14 090	32.9	108.3	87.7	3.11	32.5	1700	30.6	53.2	107.6	2.61	26.7	1995	43.4	40.8	93.8	2.51	35.9
35–44	12 164	52.4	102.7	73	2.77	27.1	1566	49.3	61.8	104.1	4.00	23.1	1729	66.2	39.8	57.3	3.04	31.1
45–54	12 058	71.8	89.4	40.7	2.26	21.7	1869	71.5	74.5	94.9	5.90	19.4	1449	85.4	41.7	44.5	3.18	26.4
55–64	9992	87.9	68.5	63.0	1.85	16.7	1766	92.5	78.8	143.7	9.44	15.5	749	95.3	32.8	55.5	2.77	21.6
65–74	4143	94.6	38.5	28.2	1.26	12.8	532	98.9	42.9	136.4	4.93	11.4	236	98.4	20.3	16.4	1.77	18.0
75+	3373	100	48.6	16.5	1.05	12.5	96	100	15.0	−3.5	1.65	12.7	123	100	18.5	−19.6	1.13	17.8
All	62 174	NA	62.7	54.5	2.09		8405	NA	41.2	109.6	3.62		7575	NA	25.4	68.1	2.39	
	Female, 2008																	
0–14	40	0.2	0.2	NA	1.00	36.9	8	0.6	0.2	NA	1.00	34.8	9	1.0	0.1	NA	1.00	41.4
15–24	1111	7.2	8.8	NA	2.24	36.7	121	9.5	3.7	NA	1.44	34.6	140	15.9	3.5	NA	1.61	41.2
25–34	2188	21.0	18.5	NA	2.82	34.7	185	23.1	6.7	NA	2.37	32.7	189	36.2	4.9	NA	2.28	38.4
35–44	3772	44.7	28.1	NA	2.78	31.2	343	48.3	12.0	NA	4.97	30.0	221	59.8	6.5	NA	2.76	35.0
45–54	5116	76.8	32.1	NA	2.80	26.3	464	82.4	16.3	NA	8.29	25.8	238	85.3	9.5	NA	3.01	31.0
55–64	2362	91.7	17.8	NA	2.08	19.6	174	95.2	9.0	NA	7.56	19.7	83	94.2	5.5	NA	2.86	25.0
65–74	701	96.1	8.2	NA	1.61	14.6	44	98.5	4.0	NA	2.93	15.0	31	97.5	3.7	NA	2.82	21.5
75+	626	100	6.7	NA	1.64	13.7	21	100	2.3	NA	2.33	15.1	23	100	3.6	NA	1.92	20.9
All	15 916	NA	15.7	NA	2.47		1360	NA	6.7	NA	3.98		934	NA	4.0	NA	2.4	
	Female, 2017																	
0–14	101	0.4	0.6	170.3	1.00	38.7	20	0.6	0.4	149.1	1.00	35.8	30	1.5	0.4	193.8	1.00	46.0
15–24	1885	8.0	16.3	84.6	2.53	38.5	295	10.2	9.1	145.0	2.03	35.6	350	18.7	7.4	109.2	1.75	45.6
25–34	4911	27.3	38.8	109.4	4.24	36.3	574	28.9	17.4	161.5	4.07	33.4	510	43.8	11.5	136.0	3.04	42.1
35–44	5160	48.4	44.1	57.1	3.74	31.7	614	48.8	21.7	81.0	4.95	29.8	439	65.4	10.6	63.8	3.25	36.9
45–54	5972	72.4	44	37.0	3.09	26.4	801	74.8	28.1	72.7	9.89	25.8	398	85.0	11.6	22.6	3.16	32.1
55–64	4700	91.3	30.7	73.0	2.67	20.4	626	95.1	23.5	162.2	9.07	20.7	217	95.7	9.0	62.9	3.74	26.5
65–74	1471	97.2	12.4	51.6	1.67	14.8	120	99.0	7.3	81.8	5.00	15.1	60	98.6	4.3	16.6	2.22	21.7

Continued

Table 3 Continued

	White (non-Hispanic)						Black (non-Hispanic)						Hispanic					
	No. Deaths	Cumulative Deaths, %	Rate*	Period Change, %	SIM: SRR†	YLL‡	No. Deaths	Cumulative Deaths, %	Rate*	Period Change, %	SIM: SRR†	YLL‡	No. Deaths	Cumulative Deaths, %	Rate*	Period Change, %	SIM: SRR†	YLL‡
75+	692	100	7.1	5.3.0	1.56	13.7	30	100	2.6	13.9	2.50	15.1	28	100	2.8	–22.5	2.00	20.9
All	24 893	NA	24.4	55.8	2.96		3080	NA	13.9	106.2	5.00		2032	NA	7.0	75.1	2.68	

*Rate per 100 000 population. The CDC cautions that rates based on cases fewer than 20 may be unstable.
†Self-injury mortality-to-suicide rate ratio.
‡Projected 'years of life lost' at exact age at the beginning of the age interval.

The surging tide of opioid deaths is now in the vanguard of public health concerns and commands pervasive media attention. However, despite their rising rate trend since 2000,[5] societal sensitivity to the overlapping[38 39] but generally less visible suicides[40] waxes and wanes with intermittent media stories on teenage clusters or celebrity deaths and important but intermittent reports on suicides among the active military and military veterans. Emphasising premorbid decedent behaviour rather than postmortem inference of decedent intent, SIM accommodates self-injurious drug deaths and misclassified drug suicides as importantly related 'elephants in the room' in current US MOD accounting and classification. Moreover, a comprehensive examination of SIM rates relative to rates of specific subsets—suicide and substance poisoning, in particular—likely would reveal substantial variations in regional mortality trends requiring local investigation of aetiology and locally tailored prevention planning, resource allocation and treatment.

Limitations

Our operationalisation of SIM currently augments registered suicides by all methods and any age at death with 80% of selected 'accidental' or unintentional drug poisoning deaths and 90% of selected undetermined drug poisoning deaths among persons aged >15 years. Although we believe they are conservative, these fractional estimates are nonetheless arbitrary. Confirmation or refutation of their accuracy as minima may be accomplished through in-depth analysis of selected samples of ME/C cases involving: (1) an assessment of sources of medications, including diversion/theft of medications, procurement of illicitly manufactured pills and documentation of associated doctor and pharmacy shopping in prescription drug monitoring databases; (2) such autopsy-confirmed evidence as a large amount of pills and fragments in the stomachs or small intestines of decedents and stigmata of injection drug use; (3) illicit drug concentrations in toxicological samples; and (4) verification of decedent drug paraphernalia at the death scene from medicolegal death investigators. Even if fortifying medicolegal death investigations of equivocal intent cases with formal psychological autopsy inquiries of key informants, it may often be impossible to establish whether a person dying from drug intoxication was intentional and therefore a suicide. However, we have confidence it would be possible to define that this person died from self-injurious behaviours rather than an 'accident'.

Other than in the suicide (ICD-10X65) component, deaths from alcohol poisoning were omitted in our operationalisation of SIM. Acute alcohol consumption is common among suicides as part of lethal drug cocktails or associated with more violent methods,[41] especially among men,[42] but is rarely the sole or primary agent in suicides. Alcohol poisoning deaths assigned as suicide, 'accident' or undetermined by medical examiners or coroners were subsumed under the non-drug category in the *WISQARS* database. They could not be differentiated within their assigned MOD. However, differentiation was enabled through accessing the federal, restricted access Wide-ranging Online Data for Epidemiologic Research database. Suicides by alcohol poisoning were few across the observation period, 2008–2017, with an annual average of 42.[43] 'Accident' (ICD-10X45) and undetermined alcohol poisoning deaths (ICD-10 Y15) in the US population aged 15 years and older averaged 2188 and 70, respectively. The combined rate of alcohol poisoning deaths assigned as 'accident' or undetermined for this age group remained stable at 0.9 per 100 000 population. By contrast, the rate for the corresponding opioid and drug death component,

which we represented in SIM, rose and ranged from 7.0 per 100 000 in 2008 to 24.5 in 2017. Besides 'accident' and undetermined alcohol poisoning deaths, not factored into SIM were the inaccessible numbers of relevant injury deaths that were potentially obscured within the mortality categories of assault (ICD-10X85), mental and behavioural disorders due to psychoactive substance use (ICD-10 F10-19) and ill-defined and unknown causes (ICD-10 R99). Other limitations of this observational study included our lack of detailed data on social determinants to explain plausible mechanisms for demographic variation in SIM trends and patterns, and inability to discern their potential relationships to state and local variation in autopsy and toxicological testing rates, or the type, quality and accreditation status of medicolegal death investigation systems.

CONCLUSION

Application of SIM exposed substantial excess burdens in the USA from substance poisoning relative to suicide for minorities, particularly non-Hispanic blacks, and for women generally. The continuing segregation of mortality statistics—and in turn, of public health prevention efforts that separate persons and populations based on the coding of events on the day of death rather than the nature of their daily lives and vulnerabilities—impedes broadly applied efforts targeting common risks. Using SIM, SIM-to-suicide rate ratios and SIM-attributable premature mortality to examine the burden of self-destructive, lethal behaviours draws attention to the rapidly growing challenges for clinical medicine and public health, while mitigating the confounding effects of differential undercounting of suicides as singular sentinel events often used by clinicians, regulatory agencies and policymakers to define distressed individuals and programmatic inadequacies, in addition to our distressed society.

In order to facilitate surveillance and aetiologic research on SIM, and hence the design and targeting of effective prevention and treatment, we suggest the inclusion of a check box on death certificates and in reports from ME/Cs, police and other first responders that signify 'self-injury' (or 'self-harm' regardless of intentionality) whenever appropriate. Without this tool, we are forced to estimate the changing patterns of SIM rates. SIM serves to counter the ingrained forensic notion that overdose deaths are 'accidents', and even CDC's substitution of the term 'unintentional' for 'accidental' fails to confront directly the consciously self-injurious nature of repetitive ingestion of toxic drugs. A societal imperative is the development and implementation of comprehensive strategies to address and prevent the common antecedents of self-injurious behaviours for women, racial/ethnic minorities and all groups.

What is already known on the subject

- Suicides are undercounted in the USA, in part reflecting discrepancies based on race/ethnicity and sex.
- Self-injury mortality (SIM), as a composite of registered suicides and estimated 'accidental'/undetermined substance-related fatalities, is increasing rapidly.

What this study adds

- Racial/ethnic and sex differences are obscured by separately presenting suicide rates and 'accidental' substance overdose mortality rates.
- Examination of SIM to suicide rate gaps exposed substantial excess burdens from substance poisoning for minorities, especially non-Hispanic blacks, and for women generally.
- Arbitrary distinctions based on determining the proximate manner of death fail to provide the necessary foundation for planning effective upstream prevention and clinical intervention strategies.

Author affiliations
[1]Department of Epidemiology, West Virginia University, Morgantown, West Virginia, USA
[2]Department of Psychiatry, University of Rochester Medical Center, Rochester, New York, USA
[3]Injury Control Research Center for Suicide Prevention, University of Rochester Medical Center, Rochester, New York, USA
[4]Division of Alcohol and Drug Abuse, McLean Hospital, Belmont, Massachusetts, USA
[5]Department of Psychiatry, Harvard Medical School, Boston, Massachusetts, USA
[6]Office of the Medical Investigator, University of New Mexico School of Medicine, Albuquerque, New Mexico, USA
[7]Department of Psychiatry and Behavioral Sciences, Johns Hopkins Medical Institutions Campus, Baltimore, Maryland, USA
[8]Department of Emergency Medicine, Rutgers New Jersey Medical School, Newark, New Jersey, USA
[9]Department of Biostatistics, Columbia University, New York, New York, USA
[10]School of Nursing, Columbia University, New York, New York, USA

Contributors IRHR conceived and designed the study and acquired the data. IRHR, EDC, HSC, HJ and KBN prepared the first draft of the manuscript. IRHR and HJ conducted the analysis. All authors were involved in the interpretation of the data, revision of the manuscript and provided final approval of the submission.

Funding This study was partially funded by the National Center for Injury Prevention and Control (grant no: R49CE002093).

Disclaimer The views expressed are those of the authors and do not necessarily represent the position or policy of the Centers for Disease Control and Prevention or the United States' Government.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open-access repository. All data relevant to the study are included in the article or uploaded as supplementary information.

ORCID iD
Ian R H Rockett http://orcid.org/0000-0002-4584-9337

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