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Characterising violent deaths of undetermined intent: a population-based study, 1999–2012

James Lachaud,[1] Peter Donnelly,[2] David Henry,[3] Kathy Kornas,[1] Tiffany Fitzpatrick,[1] Andrew Calzavara,[4] Catherine Bornbaum,[1,5] Laura Rosella[1,4]

[1]Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada
[2]Public Health Ontario, Toronto, Ontario, Canada
[3]Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Ontario, Canada
[4]Institute for Clinical Evaluative Sciences, Toronto, Ontario, Canada
[5]Health and Rehabilitation Sciences, Western University, Toronto, Ontario, Canada

Correspondence to
Dr Laura Rosella, Dalla Lana School of Public Health, Institute for Clinical Evaluative Sciences, University of Toronto, 6th floor, 155 College Street, Toronto, Ontario, M5T3M7, Canada; laura.rosella@utoronto.ca

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ABSTRACT

Objectives Violent deaths classified as undetermined intent (UD) are sometimes included in suicide counts. This study investigated age and sex differences, along with socioeconomic gradients in UD and suicide deaths in the province of Ontario between 1999 and 2012.

Methods We used data from the Institute for Clinical Evaluative Sciences, which has linked vital statistics from the Office of the Registrar General Deaths register with Census data between 1999 and 2012. Socioeconomic status was operationalised through the four dimensions of the Ontario Marginalization Index. We computed age-specific and annual age-standardised mortality rates, and risk ratios to calculate risk gradients according to each of the four dimensions of marginalization.

Results Rates of UD-classified deaths were highest for men aged 45–64 years residing in the most materially deprived (7.9 per 100 000 population (95% CI 6.8 to 9.0)) and residentially unstable (8.1 (95% CI 7.1 to 9.1)) neighbourhoods. Similarly, suicide rates were highest among these same groups of men aged 45–64 living in the most materially deprived (28.2 (95% CI 26.1 to 30.3)) and residentially unstable (30.7 (95% CI 28.7 to 32.6)) neighbourhoods. Relative to methods of death, poisoning was the most frequently used method in UD cases (64%), while it represented the second most common method (27%) among suicides after hanging (40%).

Discussion The similarities observed between both causes of death suggest that at least a proportion of UD deaths may be misclassified suicide cases. However, the discrepancies identified in this analysis seem to indicate that not all UD deaths are misclassified suicides.

Violent deaths, as classified by the Centers for Disease Control and Prevention,[1 2] include deaths classified as intentional self-harm (suicide), assault (homicide), undetermined intent (UD), legal intervention and operation of war. In Canada, the majority of violent deaths over the last decade have consisted of suicides, followed by deaths classified by UD, and homicide, whereas deaths from legal intervention and operation of war were relatively scarce.[3] Even in Ontario, the most populous province in Canada, which has historically experienced the greatest number of homicides in Canada,[4] vital statistics registered 3332 homicides over the 1992–2012 period compared with 3814 deaths classified as UD over the same period. However, while homicide and suicide have received great attention in public health,[5 6] UD-classified deaths remain less

understood, particularly in terms of associated or predisposing factors.

The term 'undetermined intent' was introduced by the eighth revision of the International Classification of Diseases (ICD-8) in 1968.[7] It is used to describe any external cause of death or injury-related death for which the intention cannot be established beyond any reasonable doubt by a medical or coroner examination. However, since the most common method of death described in UD cases is poisoning, various studies have argued that UD deaths may be a misclassification of suicide.[8–13] Other studies have shown that a large portion of UD deaths may be intentionally hidden or disguised suicides.[7 11] As a result, several epidemiological and psychiatric studies have called for UD deaths to be included directly into suicide counts,[10 14 15] thereby widening the continuum of intentionality of death.

In contrast, studies have revealed differences in psychiatric accounts and age-sex patterns of deaths classified as suicide compared with those classified as UD.[16–18] These differences do not preclude the assumptions of UD as misclassified suicides[19]; however, they suggest that UD may have higher incidence within specific demographic or socioeconomic groups.[2 19 20] Despite these concerns, the socioeconomic backgrounds of UD-related deaths have received little attention. Since the intent of death remains unclear, comparing the socioeconomic characteristics associated with UD compared with suicides can inform to what extent UD deaths should be considered as fully misclassified suicides.

This population-based study compared age, sex differences and socioeconomic gradients in violent deaths classified as UD and suicide deaths in the province of Ontario between 1999 and 2012.

METHODS

Data sources

The study used data from the Institute for Clinical Evaluative Sciences (ICES), which linked vital statistics from the Office of the Registrar General Deaths register with Census and administrative data for all Ontario residents, which contains yearly population estimates. These data sets were linked using unique encoded identifiers and analysed at ICES.

For the analysis, we extracted all deaths from 1999 to 2012 (inclusive) classified as UD (ICD9: E980-989/ICD10:Y10-Y34) (n=2812), in which the intentionality remained unclear after the medical and coroner examination because of insufficient

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information. For comparison, we also included suicide deaths (ICD9: E950-959/ICD10:Y60-Y84) (n=14 822).

Key variables

Socioeconomic status (SES) was operationalised using the Ontario Marginalization Index (ON-Marg). ON-Marg is a provincial adaptation of the Canadian Marginalization Index, which is based on the smallest census area level for which all census data are disseminated, and has been previously validated for health research use in Ontario.[21] The ON-Marg provides a multidimensional examination of marginalisation through four dimensions: material deprivation, dependency, residential instability (based on the residential mobility over the last 5 years) and ethnic concentration.[22] These ON-Marg dimensions are currently only available for Census 2001 and 2006. Therefore, this analysis was limited to decedents with a date of death between 1999 and 2012 (inclusive), where 2001 Census-derived values were used for the period of 1999–2003 and 2006 values for 2004–2012. Each dimension score was divided into quintiles, where quintile 1 corresponds to the least materially deprived (dependent, residentially unstable, or part of larger ethnic concentration of recent immigrants or visible minority) dissemination areas in the province and quintile 5 to the most materially deprived.[22]

Other variables

As other variables of interest, we retained sex and age at time of death. Age at time of death was categorised as follows: <15, 15–24, 25–44, 45–64 and ≥65 years old. All analyses were performed in SAS V.9.4.

Statistical analyses

We calculated age-standardised death rates per 100 000 using the direct method and the 1991 standard population,[23] and age-specific rates were computed, dividing the number of UD deaths over the population of the respective age group for that given year. For comparison purposes, we computed risk ratios by dividing the proportion of deaths occurring in the first quintile of each ON-Marg dimension by the proportion of deaths occurring in the other quintiles. To address the confounding effect of age and sex in our comparison analysis, risk ratios were computed separately by sex and age groups, 25–44, 45–64 and ≥65 years old. For risk ratios, we used a log-binomial regression, which is

appropriate for comparing proportions between groups, given that we did not have person-years of follow-up.

RESULTS

Table 1 shows the general patterns of distribution of all UD and suicide deaths in Ontario over the 1999–2012 period. In total, 2812 UD deaths occurred over the study period, 64.2% among men and 35.8% among women. In comparison, there were 14 822 suicide deaths over the study time period, 74.8% among men and 25.2% among women. We observed no substantial difference in the average age of death, 46.1 years for UD deaths and 45.7 years for suicide; however, the overall age distribution significantly differed (p<0.001). Specifically, the proportion of deaths among those 15–24 years old was greater for suicides (11.8%) compared with UD deaths (6.7%).

Trend and patterns of UD deaths and suicide

Figure 1 shows the annual age-standardised mortality rates for UD and suicide deaths. From 1999 to 2012, UD deaths decreased from 1.6 to 0.9 per 100 000 population, whereas suicides remained relatively stable around 8.0 per 100 000 population over the same period. Mortality rates for both suicide and UD deaths were significantly higher among men compared with women (3.17 and 1.81, respectively; p<0.0001). These sex differences remained relatively consistent over the study period.

Figure 2 represents age-sex specific trends in suicide and violent UD deaths and demonstrates the highest UD and suicide rates among people aged 45–49 years (3.0 and 12.5 per 100 000 population, respectively), followed by those 50–54 years (2.73 and 12.4 per 100 000, respectively), both statistically higher than the oldest age group (p<0.0001). Moreover, the lowest rates of UD and suicide mortality were observed among those 15 years of age and younger (0.12 and 1.17 per 100 000, respectively).

Marginalization gradients

We observed a marginalization gradient, primarily related to material deprivation and residential instability (table 2). Both suicide and violent UD death rates are higher among those living in the most deprived areas; however, these differences were more pronounced for UD deaths than suicides. Relative to material deprivation, men aged 45–64 years have the highest UD death rates reaching a maximum of 7.9 per 100 000 population (95% CI 6.8 to 9.0). The highest UD death rate was observed for

Table 1 Characteristics of violent deaths of undetermined intent and suicide deaths that occurred in Ontario, Canada, between 1999 and 2012

Characteristics	Suicide			UD deaths			p Value*
	N	%	95% CI	N	%	95% CI	
Sex							
Male	11 089	74.8	74.0 to 75.6	1806	64.2	62.0 to 66.4	
Female	3733	25.2	24.5 to 25.9	1006	35.8	34.0 to 37.5	<0.0001
Total	14 822	100		2812	100		
Age group (years)							
<15	126	0.9	0.0 to 2.5	62	2.2	0.0 to 5.9	
15–24	1750	11.8	10.3 to 13.3	188	6.7	3.6 to 9.8	
25–44	5244	35.4	34.3 to 36.5	1043	37.1	34.4 to 39.8	
45–64	5571	37.6	36.7 to 38.5	1170	41.6	39.6 to 43.7	
≥65	2131	14.4	13.6 to 15.2	349	12.4	10.8 to 14.1	<0.0001
Total	14 822	100		2812	100		

*p Value indicates significant difference in characteristics between deaths of undetermined intent using χ^2 test.
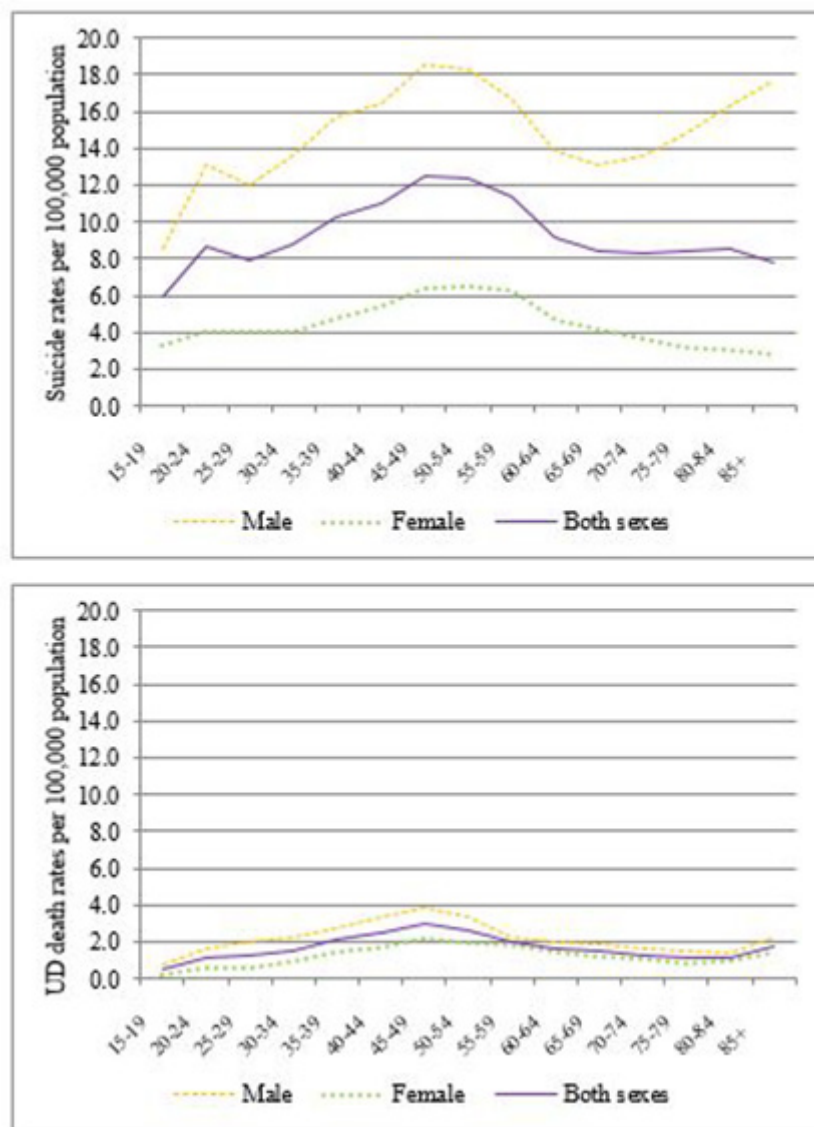UD, undetermined intent.
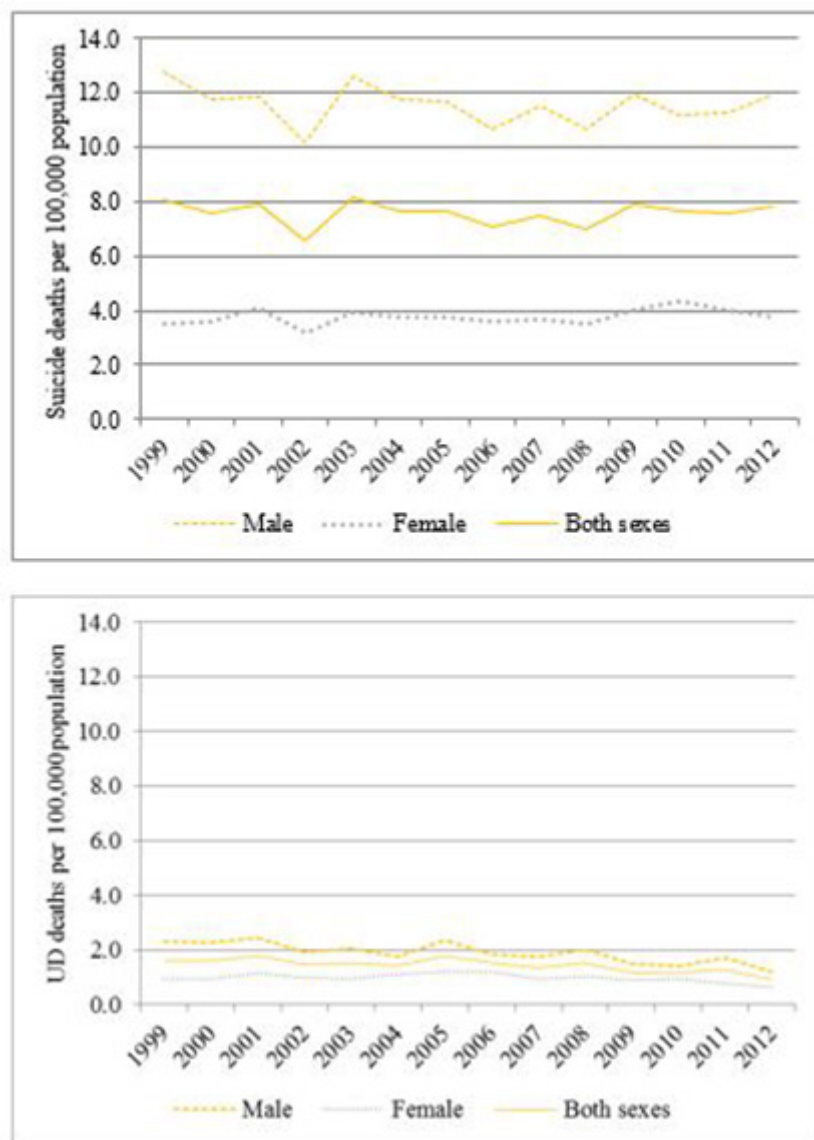
Figure 1 Trend of violent deaths of undetermined intent (UD) and suicide mortality rates by sex per 100 000 population in Ontario over the 1999–2012 period (age-standardised rates).

residential instability (8.1 per 100 000 population among men aged 45–64 years (95% CI 7.1 to 9.1)). Findings were similar for suicide where the highest rates were observed among the most materially deprived and residentially unstable men aged 45–64 years (28.2 and 30.7 per 100 000 population, respectively). The gradient between the most and least materially deprived was also highest among men aged 45–64 years; however, female disparity was also high in this age group. Among those who died of suicide, the most residentially unstable female group aged 25–44 years had a higher risk ratio compared with their male counterparts aged 25–44 years (3.2 vs 1.9). This finding suggests that material deprivation and residential instability gradients were higher for younger women aged 25–44 years when compared with women in the older age groups (45–64 and ≥65). Moreover, suicide risks were generally lower in areas of higher ethnic concentration compared with the lowest areas; however, this finding was not apparent for UD deaths. Female UD variations across ethnicity gradients were variable for suicide but higher among areas of high ethnic concentration compared with areas with lower ethnic concentration

over the age of 45. The highest male/female risk ratios for UD deaths were observed among young adults aged 25–44 years. For suicide deaths, the male/female risk ratios were the highest among those who had the lowest ethnic concentration (6.7), followed by those who were the most materially deprived (6.5) in the age group (65 and older).

Method of death

Figure 3 demonstrates the distribution of the documented methods of death for both UD and suicide cases. For violent deaths of UD, the most common method was poisoning for both men and women, although this percentage was higher among women (74% vs 44%). For suicide, poisoning remained the most common method for women (44%), and the second most common for men (21%), after hanging (43%). Hanging was much less prevalent among UD cases for women, representing only 3% of UD deaths. Firearm/explosive UD deaths were rare for both male and female UD deaths; however, firearms were documented among 17% of suicides for men.

Figure 2 Annual age-specific mortality rates for violent deaths of undetermined indent (UD) and suicide per 100 000 population by sex over the period 1999–2012.

DISCUSSION

This population-based study characterised all UD-classified deaths and suicides in Ontario, Canada, between 1999 and 2012. We observed that younger adults aged 25–44 years and adults aged 45–64 years were disproportionally affected by both UD-classified deaths and suicides. Although the marginalization gradient was more pronounced for UD deaths, these results showed large similarities with suicides. Both UD and suicide deaths demonstrated higher risk among young adults aged 25–44 years and adults aged 45–64 years residing in the most materially deprived and residentially unstable neighbourhoods. Material deprivation and residential instability gradients were higher for young adult women, whereas they were higher in men aged 45–64 years for UD-classified deaths, and in both male age groups of 45–64 and ≥65 years, respectively, for suicide. The pattern of lower risk of suicide in areas with higher ethnic concentration was only present for suicides. Finally, we identified some differences in the method of death. Hanging remains the primary method of death for suicide, followed by poisoning. Poisoning was observed to be the most common method of death

in UD cases. However, we found similarities in the sex distribution between suicides and UD-related deaths, namely poisoning, drowning, firearms/explosives and falling.

These results confirm that there are both similarities and discrepancies between deaths classified as UD and suicide within the Ontario population. A previous study from Sweden[19] observed a similar pattern when examining demographic differences between suicide and UD-classified deaths. Specifically, the distribution of suicides across education levels and birthplaces was very close to patterns observed for UD-classified deaths, suggesting key similarities between suicide and UD-classified deaths; however, the distribution observed across marital status was different between the suicide and UD-classified death groups, suggesting noteworthy discrepancies between the groups. Another study from the USA[2] showed that UD-classified deaths occurred primarily among men, and largely among those between 35 and 54 years old who were never married, with the highest rates occurring among the most socioeconomic disadvantaged groups. Further confirmation for the presence of both similarities and discrepancies between suicide and UD-classified
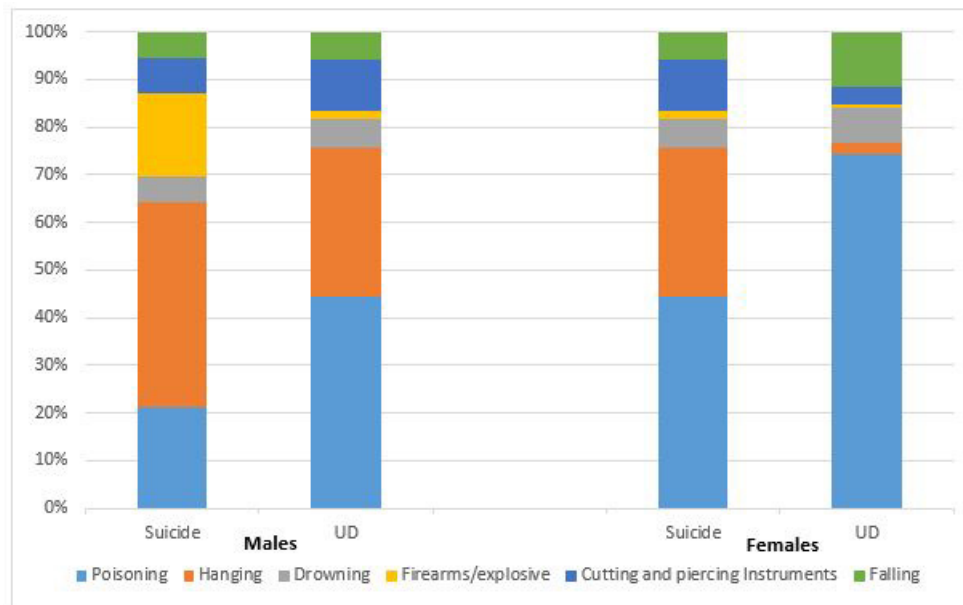
Table 2 Rates of violent deaths of undetermined intent and suicide per 100 000 population and risk ratios by ON-Marg dimensions according to age categories in Ontario, Canada, over the 1999–2012 period*†

ON-Marg	Ages 25–44 years						Ages 45–64 years						Ages ≥65 years					
	Male			Female			Male			Female			Male			Female		
	Rate	95% CI	RR	Rate	95% CI	RR	Rate	95% CI	RR	Rate	95% CI	RR	Rate	95% CI	RR	Rate	95% CI	RR
UD deaths																		
Deprivation																		
1	1.5	1.3 to 1.8	1.0	0.6	0.4 to 0.8	1.0	2.0	1.6 to 2.4	1.0	1.4	1.0 to 1.7	1.0	1.9	1.3 to 2.6	1.0	1.4	0.9 to 1.8	1.0
5	4.2	3.6 to 4.8	2.7	2.2	1.7 to 2.7	3.6	7.9	6.8 to 9.0	3.9	4.9	4.0 to 5.7	3.6	3.9	2.7 to 5.1	2.0	2.2	1.5 to 2.9	1.6
Dependency																		
1	1.8	1.5 to 2.1	1.0	1.0	0.8 to 1.2	1.0	3.5	2.9 to 4.1	1.0	2.4	1.9 to 2.8	1.0	1.9	1.0 to 2.8	1.0	2.0	1.2 to 2.8	1.0
5	3.7	3.1 to 4.3	2.0	1.4	1.0 to 1.8	1.3	3.7	3.1 to 4.4	1.1	2.3	1.8 to 2.7	1.0	2.5	1.8 to 3.1	1.3	1.6	1.1 to 2.0	0.8
Instability																		
1	1.2	0.9 to 1.5	1.0	0.5	0.4 to 0.7	1.0	1.4	1.0 to 1.7	1.0	1.1	0.8 to 1.3	1.0	1.7	1.1 to 2.4	1.0	1.3	0.8 to 1.9	1.0
5	4.1	3.5 to 4.6	3.4	2.3	1.9 to 2.7	4.2	8.1	7.1 to 9.1	6.0	5.2	4.4 to 5.9	4.9	3.8	2.9 to 4.8	2.2	2.4	1.8 to 2.9	1.8
Ethnicity																		
1	2.8	2.2 to 3.4	1.0	1.4	1.0 to 1.8	1.0	3.0	2.3 to 3.6	1.0	1.8	1.3 to 2.3	1.0	2.4	1.6 to 3.1	1.0	1.4	0.9 to 1.9	1.0
5	2.1	1.8 to 2.4	0.8	1.0	0.8 to 1.2	0.7	3.5	3.0 to 4.0	1.2	2.5	2.1 to 2.9	1.4	2.3	1.6 to 3.0	1.0	1.7	1.2 to 2.2	1.2
Suicide																		
Deprivation																		
1	9.6	8.9 to 10.3	1.0	3.4	3.0 to 3.8	1.0	15.1	14.0 to 16.2	1.0	5.5	4.8 to 6.1	1.0	18.4	16.4 to 20.4	1.0	5.2	4.3 to 6.1	1.0
5	18.3	17.0 to 19.6	1.9	6.6	5.8 to 7.4	1.9	30.1	26.1 to 30.3	1.9	11.8	10.5 to 13.2	2.2	25.9	22.8 to 29.0	1.4	4.0	3.0 to 5.0	0.8
Dependency																		
1	11.6	10.9 to 12.4	1.0	4.4	4.0 to 4.9	1.0	20.9	19.5 to 22.4	1.0	8.2	7.3 to 9.1	1.0	19.5	16.6 to 22.5	1.0	5.6	4.2 to 7.0	1.0
5	16.5	15.2 to 17.8	1.4	5.0	4.3 to 5.7	1.1	21.6	20.0 to 23.1	1.0	7.4	6.6 to 8.3	0.9	19.6	17.8 to 21.4	1.0	4.2	3.5 to 4.8	0.7
Instability																		
1	9.3	8.6 to 10.0	1.0	2.5	2.1 to 2.8	1.0	13.6	12.6 to 14.6	1.0	4.6	4.0 to 5.1	1.0	19.9	17.6 to 22.3	1.0	4.5	3.5 to 5.5	1.0
5	17.8	16.7 to 18.9	1.9	7.9	7.1 to 8.7	3.2	30.7	28.7 to 32.6	2.3	13.8	12.5 to 15.1	3.0	23.4	21.0 to 25.8	1.2	5.9	5.0 to 6.8	1.3
Ethnicity																		
1	17.3	15.8 to 18.7	1.0	4.6	3.8 to 5.3	1.0	23.8	22.0 to 25.5	1.0	6.3	5.4 to 7.2	1.0	23.5	21.1 to 26.0	1.0	3.5	2.7 to 4.3	1.0
5	9.9	9.3 to 10.5	0.6	4.4	4.0 to 4.8	1.0	17.7	16.6 to 18.8	0.7	7.7	7.0 to 8.4	1.2	18.6	16.6 to 20.5	0.8	6.0	5.1 to 7.0	1.7

*The full table is provided in online supplementary appendix.
†In accordance with data privacy requirements, values for groups aged '<15' and '15 to 24' are not provided in this table as the number of deaths was too small to report.
ON-Marg, Ontario Marginalization Index; UD, undetermined intent.

Figure 3 Proportion of violent deaths of undetermined intent (UD) and suicides according to methods by sex in Ontario, Canada (1992–2012).

deaths was also observed in a Spanish study.[24] In both the Swedish and American studies, poisoning remained the primary method of death for UD-classified deaths. In Sweden, hanging was the most common method used in male suicide cases whereas in the USA firearms remained the most frequent method.

As previously mentioned, several epidemiological and psychiatric studies treat UD-classified deaths as misclassified suicides.[10 14 15] Our results demonstrate that not all UD-classified deaths fit the characteristics of suicide deaths, although a substantial portion of UD-classified deaths are likely suicides. Additionally, it remains unclear whether those potential suicide cases should be considered as fully intended suicides, indirect or covert forms of suicide, or even fatal self-neglecting behaviour, sometimes referred to as 'suicidal erosion'.[25 26] Since the intentionality of death remains unclear in UD-classified cases, it is difficult to ascertain whether these deaths were: misclassified through medical or coroner examination, indirect or hidden forms of suicide, or even subject to altered evidence of the death intention by family members.[7 16 19 27] It is noteworthy that deaths from suicidal erosion can be easily classified as undetermined or even accidental, even after thorough coroner investigation. Specifically, suicidal erosion may generate a passive self-harm behaviour, such as deliberately refusing to take life-preservation measures needed, poisoning including non-compliant or strict control of medication, exposure to dangerous places or not seeking help through appropriate medical institutions.[28 29] Previous studies showed passive suicide ideators may refuse to consciously plan or endorse a suicide attempt, but may remain consciously exposed to death threats.[29 30] Thus, a death from such suicidal erosion with no 'apparent' active decision or a prior suicide attempt could bias a medical or coroner examination to classify the death as UD.

Our research findings are subject to several study limitations. Although the four dimensions of ON-Marg include many of the usual socioeconomic measures, some contextual variables such as family values, tolerance level to psychological pain or distress and personal expectation are not measured. Additionally, whether socioeconomic hardship may lead to passive suicide, and the mechanisms that underlie such a relationship,

could not be directly measured in this study. The present study was not designed to address such complexity, but rather to characterise the patterns of UD compared with suicide in a large Canadian province. In addition, although the four dimensions of the ON-Marg provide an advantage from a population-based perspective, this research is limited to area-level assumptions, which may not hold at the individual level. Finally, given the relatively small numbers when stratifying by sex and SES, we were unable to present findings according to more narrow age categories. As such, there may have been socioeconomic variation within the age strata that may be further influencing the distribution between suicide and UD deaths that we were unable to detect.

This study provided a comprehensive comparative analysis of all violent deaths classified as UD and suicide in Canada's most populous province, Ontario. The study of these deaths with four dimensions of marginalization allowed us to examine a broader description of the area-level SES profiles of both UD deaths and suicide. The results also show some important differences in the method of deaths employed in suicide and UD cases, and point to the role of potential indirect suicide and passive behaviours from suicidal erosion as contributing factors to this phenomenon.

What is already known on the subject

► Violent deaths of 'undetermined intent' (UD) are any violent death for which the intention cannot be established beyond any reasonable doubt by a medical or coroner examination, or in cases where a coroner is not available, through application of a 'balance of probabilities' approach.
► Owing to classification issues, several epidemiological and psychiatric studies treat UD deaths as misclassified suicides.

What this study adds?

► The socioeconomic gradient is higher in UD deaths than among those whose deaths were classified as suicide, but with a similar distribution among age group and sex.

Author note Non-discriminatory language: One of the four dimensions of the area-level marginalisation index used in the paper is the ethnicity concentration. This dimension includes two census-based variables: percentage of visible minority and percentage of immigrants of the smallest census area level, dissemination area (DA). However, the ethnicity in itself is not reported in the paper.

REFERENCES

1 CDC Center for Disease Control and Prevention. Injury prevention & control: division of violence prevention. 2015 http://www.cdc.gov/violenceprevention/nvdrs/faqs.html

2 Karch DL, Lubell KM, Friday J, *et al*. Surveillance for violent deaths — National Violent Death Reporting System, 16 States. *MMWR Morb Mortal Wkly Rep* 2008;57:1–44.

3 Statistics Canada Deaths, by cause, chapter XX: external causes of morbidity and mortality (V01 to Y89), age group and sex. 2015 http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&p2=33&id=1020540 (accessed Aug 2016).

4 Statistics Canada Homicide offences, number and rate, by province and territory 2015 http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/legal12a-eng.htm (accessed 15 Sep 2016).

5 WHO. *The global status report on violence prevention*. Luxembourg: World Health Organization, 2014.

6 Rutherford A, Zwi AB, Grove NJ, *et al*. Violence: a priority for public health? (part 2). *J Epidemiol Community Health* 2007;61:764–70.

7 Värnik P, Sisask M, Värnik A, *et al*. Massive increase in injury deaths of undetermined intent in ex-USSR Baltic and Slavic countries: hidden suicides? *Scand J Public Health* 2010;38:395–403.

8 O'Carroll PW. A consideration of the validity and reliability of suicide mortality data. *Suicide Life Threat Behav* 1989;19:1–16.

9 Breiding MJ, Wiersema B. Variability of undetermined manner of death classification in the US. *Inj Prev* 2006;12(Suppl 2):ii49–54.

10 Neeleman J, Wessely S. Changes in classification of suicide in England and Wales: time trends and associations with coroners' professional backgrounds. *Psychol Med* 1997;27:467–72.

11 Ohberg A, Lonnqvist J. Suicides hidden among undetermined deaths. *Acta Psychiatr Scand* 1998;98:214–8.

12 Rockett IR, Kapusta ND, Coben JH. Beyond suicide: action needed to improve self-injury mortality accounting. *JAMA Psychiatry* 2014;71:231–2.

13 Skinner R, McFaull S, Rhodes AE, *et al*. Suicide in Canada: is poisoning misclassification an issue? *Can J Psychiatry* 2016;61:405–12.

14 Lucey S, Corcoran P, Keeley HS, *et al*. Socioeconomic change and suicide: a time-series study from the Republic of Ireland. *Crisis* 2005;26:90–4.

15 O'Donnell I, Farmer R. The limitations of official suicide statistics. *Br J Psychiatry* 1995;166:458–61.

16 Chishti P, Stone DH, Corcoran P, *et al*. Suicide mortality in the European Union. *Eur J Public Health* 2003;13:108–14.

17 Lester D. Miscounting suicides. *Acta Psychiatr Scand* 1992;85:15–16.

18 Thibodeau L, Lachaud J. Impact of economic fluctuations on suicide mortality in Canada (1926-2008): testing the Durkheim, Ginsberg, and Henry and Short theories. *Death Stud* 2016;40:305–15.

19 Björkenstam C, Johansson L-A, Nordström P, *et al*. Suicide or undetermined intent? A register-based study of signs of misclassification. *Popul Health Metr* 2014;12:1–11.

20 Kleiman EM, Law KC, Anestis MD. Do theories of suicide play well together? Integrating components of the hopelessness and interpersonal psychological theories of suicide. *Compr Psychiatry* 2014;55:431–8.

21 Matheson FI, Dunn JR, Smith KL, *et al*. Development of the Canadian Marginalization Index: a new tool for the study of inequality. *Can J Public Health* 2012;103(8 Suppl 2):S12–6.

22 Matheson FI, Dunn JR, Smith KLW. Ontario Marginalization Index-User Guide Ontario. version 1.0. Ontario: Centre for Research on Inner City Health, St Michael's Hospital, 2016.

23 Statistics Canada. Canadian population standard. 2015 http://www.statcan.gc.ca/pub/82-003-x/2013008/article/11857/tbl/appa-eng.htm (accessed 10 Mar 2017).

24 Salmerón D, Cirera L, Ballesta M, *et al*. Time trends and geographical variations in mortality due to suicide and causes of undetermined intent in Spain, 1991-2008. *J Public Health* 2013;35:237–45.

25 Ciment J. *Social issues in America: an encyclopedia*. Armonk, NY: M.E. Sharpe, 2015.

26 Hicks BB. *Youth suicide: a comprehensive manual for prevention and intervention*. Bloomington, Indiana: National Educational Service, 1990.

27 Bertolote JM, Fleischmann A. A global perspective on the magnitude of suicide mortality. In: Wasserman D, Wasserman C, eds. *Oxford textbook of suicidology and suicide prevention*. New York: Oxford University Press, 2009.

28 Osgood NJ. Prevention of suicide in the elderly. *J Geriatr Psychiatry* 1991;24:293–305.

29 Simon RI. Passive suicidal ideation: still a high-risk clinical scenario. *Current Psychiatry* 2014;13.

30 Szanto K, Reynolds CF, Frank E, *et al*. Suicide in elderly depressed patients: is active vs. passive suicidal ideation a clinically valid distinction? *Am J Geriatr Psychiatry* 1996;4:197–207.