

Differences by age and sex in adolescent suicide

Stephanie Lee,^{1,2} Jeremy Dwyer,^{2,3} Eldho Paul,⁴ David Clarke,^{5,6} Sophie Treleaven,^{1,7} Robert Roseby^{1,8}

The prevalence of suicide among adolescents in Australia increases markedly with age. This increase, which is also observed in many other countries, occurs during a period when adolescents are experiencing developmental changes in biology and psychology, as well as socio-cultural changes associated with the transition from childhood to adulthood.¹⁻³ Suicide is the leading cause of death of Australian adolescents,⁴ hence suicide prevention is a high priority for the government and community.

A substantial body of literature suggests that older and younger adolescent suicides differ not just in frequency, but also in nature. Australian studies have found that the ratio of male-to-female suicides increases with age; older adolescent suicides more frequently occur in the setting of diagnosed mental illness; trends in suicide methods shift with age; and school-related and parental conflict are more common in younger adolescents, while relationship issues become more prominent in older adolescent suicides.⁵⁻⁸ International research has likewise found significant differences in the sex ratio of deceased, suicide methods, prevalence of mental ill health, types of stressors that may have precipitated suicide and the likelihood of expressing suicidal ideation; though findings between studies are inconsistent.^{3,9-16} These findings strongly suggest adolescent suicide prevention strategies must take into account social and developmental changes across adolescent years rather than treat adolescents as a homogenous population.

Abstract

Objectives: To compare demographic and psychosocial characteristics of completed suicide between younger and older adolescents, and by sex.

Methods: Data was collected from the Victorian Suicide Register, which contains information on suicides reported to the Coroners Court of Victoria.

Results: Between 2006 and 2015, there were 273 completed suicides aged 10-19 years, with none aged 10-12 years. There were 171 (63%) suicides in the older adolescent group (17-19 years), and 102 (37%) in the younger group (13-16 years). Males comprised 184 cases (67%) and females 89 (33%). A higher proportion of both younger and female adolescents had experienced abuse, peer conflict and bullying. There was also a higher incidence of previous self-harm in younger and female adolescents. Older adolescents were more likely to not be in formal education, employment or training.

Conclusion: Suicide in younger adolescents and females appear to share characteristics, and differ from older and male adolescents. Negative interpersonal relationships and previous self-harm with possible co-existing mental illness appear to be key differentiating features.

Implications for public health: Understanding completed suicide is an important step towards prevention, and our results suggest a need for developmentally and sex-specific suicide prevention strategies.

Key words: suicide, mental health, paediatrics, adolescent, youth

In the Australian literature, one area of adolescent suicide that is relatively under-developed is the interaction between sex and age. Several international studies have explored this intersection with respect to suicide stressors and mental health history,^{9,13-15} however, recent Australian studies^{6,7} have been more limited. Sex-based differences have long been identified as a key feature of suicide among young people.¹⁶ The purpose of this study is to build upon existing Australian literature and further elucidate how the suicide profile of adolescents changes not only with age but also with sex. Previous adolescent suicide studies use age 15 to delineate older from younger

adolescents, reflecting the tendency in research to group statistics into age bands of five years. The World Health Organization (WHO)¹⁷ and United Nations Children's Fund (UNICEF)¹⁸ categorise younger and older adolescents as 10-14 and 15-19 years of age. These notional five-year bands divide populations somewhat evenly, but might not be the most appropriate approach for analysis of phenomena which occur at different rates with increasing age, such as suicide. The end of childhood, and beginning and end of adolescence do not have clearly delineated ages. Studies on adolescent suicide have categorised older and younger age groups differently, with cut-points ranging from

1. Monash Children's Hospital, Victoria

2. Coroners Prevention Unit, Coroners Court of Victoria

3. Melbourne School of Population and Global Health, The University of Melbourne

4. Monash Centre for Health Research and Implementation, School of Public Health and Preventive Medicine, Monash University, Victoria

5. Department of Psychiatry, School of Clinical Sciences, Monash University, Victoria

6. Monash Health, Victoria

7. Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM), Victoria

8. Department of Paediatrics, School of Clinical Sciences, Monash University, Victoria

Correspondence to: Stephanie Lee, Monash Children's Hospital, 246 Clayton Rd, Clayton, Victoria 3168; e-mail: stephlee11@hotmail.com

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15 to 17 years of age.^{9,14,15} Additionally, as both WHO and UNICEF acknowledge,^{17,18} substantial age-based differences are observed between individuals and populations with respect to the continuum of biological and psychological development during adolescence. Socio-cultural practices regarding rights and expectations of adolescents also vary widely by age.^{19,20}

The state of Victoria in 2015 had an estimated population of approximately 5.9 million people, of whom approximately 700,800 (11.8%) were 10-19 years of age.²¹ In Victoria, all adolescents are legally required to complete a minimum four years of secondary schooling (which is usually completed between 16-17 years), then participate in further full-time education, training or employment until they reach the age of 17 years.²²

We hypothesise that due to the significant changes occurring throughout adolescence, there are differences in the characteristics of completed suicide between younger and older, and male and female adolescents. These differences may help identify those at risk and therefore allow the development of more targeted adolescent suicide prevention strategies. We postulate that Victoria's education and training participation requirement is a strong socio-cultural rationale to compare Victorian adolescent suicide between age groups 10-16 and 17-19 years, as participation in education, training or employment may be a protective factor.

Method

Study design

This study comprised a retrospective review of suicide deaths reported to the Coroners Court of Victoria (CCOV) over the ten-year period January 1, 2006 to December 31, 2015, where the deceased was aged between 10-19 years.

Data source

The data source was the CCOV's Victorian Suicide Register (VSR). In Victoria, all deaths from suspected non-natural causes must be reported to the CCOV for investigation. If at any stage of investigation, the Coroner and/or VSR coders determine the circumstances of a death are consistent with suicide, the death is entered into the VSR. The VSR entries are reviewed and updated as coroners' investigations progress, with deaths added

and removed as necessary to ensure it reflects current knowledge. Cases of death by intentional self-harm but not found to be suicide are not included. Most information is directly coded from a review of coronial records, which include the police report of death to the coroner, autopsy and toxicology reports and coronial brief (which may include records from treating health professionals; statements from family, friends, witnesses and employers; and scene photography).

The VSR contains data for every Victorian suicide reported between 1 January 2000 and the present. For each case, there are over 150 coded and free-text data fields that are recorded. A data dictionary guides coding. Data includes age and sex of the deceased, the suicide method, location of fatal incident, location of usual residence, and date of death report. An enhanced dataset includes sociodemographic information about sexuality, place of birth, relationship status and employment status; history of physical and mental ill health; identified interpersonal and contextual stressors; and contacts with health and other services before death. Coding data sources and associated quality processes are described in detail elsewhere.²³

Case identification

Cases included are those on the VSR occurring in the 10 years between 1 January 2006 and 31 December 2015, where the deceased was aged 10-19 years inclusive.

Data compilation

For each relevant death the full VSR record was extracted, including all core and enhanced data. The data was compiled to produce binary variables pertaining to: sex; age (10-16 or 17-19); location of usual residence (Metropolitan Melbourne or regional Victoria); country of birth (Australia or other); evidence that the deceased identified as lesbian, gay, bisexual, transgender, queer and/or intersex (LGBTQI); relationship status; diagnosed mental illness; history of suicide attempts and/or self-harm; occupation; expressions of intent to suicide; suicide method. Additionally, evidence was recorded regarding the presence of the following stressors: exposure to abuse; family/partner/peer conflict; exposure to bullying; partner separation; sexuality; substance misuse; exposure to previous suicide of another person; and post-mortem presence of alcohol and/or illegal drugs in toxicology.

For the purposes of this study, certain definitions in the data dictionary are important, which are detailed below.

Intent: Verbal or written indicators as to presence of expressions of suicidality, both around the time of death and historically.

Previous suicide attempt: Records or reports in which the deceased had engaged in self-injury behaviour/s with any wish, expectation or probability of death.

Previous self-harm: Previous self-injury behaviour/s with no evidence to indicate these were suicide attempts.

Stressors: Generally restricted to the previous six months. Stressors relevant to this study are detailed as follows.

- Interpersonal stressors
 - Partner separation
 - Family/partner violence
 - Family/partner/peer conflict (Conflict is defined as "a situation in which interdependent people express (manifest or latent) differences in satisfying their individual needs and interests, and they experience interference from each other in accomplishing these goals".²⁴ There is evidence that this conflict caused stress for the deceased.)
- Abuse
 - The perpetrator or victim of physical, sexual, psychological, emotional, financial, legal, civic, or systemic abuse; constraints and restrictive practices; physical, passive or emotional neglect; wilful deprivation.
- Bullying
 - The perpetrator or victim of repeated and intentional hurt or harm to another person or group of people who feel helpless to respond.

Statistical analysis

Descriptive and inferential statistics were calculated using the Stata software version 14 (StataCorp, College Station, Texas, USA). Data were summarised using frequency tables, presenting subject counts and percentages. Differences in proportions between groups (younger versus older and male versus female adolescents) were compared using chi-square tests for equal proportions or Fisher's exact tests where numbers were small. Completed suicide rates according to age and sex were estimated using Victorian population data

for adolescents aged 13-19 years collected by the Australian Bureau of Statistics.²¹ The 95% confidence intervals (95%CI) were determined with the exact binomial distribution. All calculated *p*-values were two-sided and *p* < 0.05 indicated statistical significance.

Ethical oversight

Victoria's State Coroner gave permission for the researchers to access VSR data. Ethics approval was obtained from the Department of Justice and regulation Human Research Ethics Committee (JHREC), reference number CF/17/10450.

Results

Results are presented as summary data by age and sex, overall characteristics, then characteristics by age group and sex (Table 1).

Summary data by age and sex

During the 10-year period to 31 December 2015, there were 273 completed suicides in the 10-19 year age group. There were no suicide deaths aged 10-12 years, hence younger and older groups were dichotomised using the cut-off points 13-16 years and 17-19 years. There were 102 (37%) suicide deaths in the younger group and 171 (63%) in the older group. Males comprised 184 cases (67%) and females 89 (33%). Female cases comprised a larger proportion of the younger compared to older group (*p*=0.039), although males outnumbered females overall. Suicide counts by age are presented in Figure 1.

Suicide rates are presented in Figure 2. The overall suicide rate for adolescents was 5.58 per 100,000 (95%CI: 4.94-6.29) population aged 13-19 years. The overall rates for males and females were 7.33 (95%CI: 6.31-8.47) and 3.74 (95%CI: 3.0-4.6) per 100,000 persons aged 13-19 years, respectively. The suicide rates per 100,000 persons were 3.76 (95%CI: 3.07-4.56) for younger adolescents and 7.85 (95% CI: 6.72-9.12) for older adolescents. The suicide rate for younger males (aged 13-16 years) was 4.38 (95%CI: 3.35-5.63) and for younger females was 3.1 (95%CI: 2.23-4.21) per 100,000 persons. The suicide rate for males increased from younger to older adolescence, with the suicide rate for older males (aged 17-19 years) being 11.01 (95%CI: 9.15-13.14). Suicide rates for females did not differ as much between age groups, with the rate for older females being 4.53 (95%CI: 3.34-6.0) per 100,000 persons.

Table 1: Comparison of suicide characteristics in younger versus older adolescents, and male versus female adolescents, n (%).

Variable	Total	Younger	Older	<i>p</i> -value (younger vs. older)	Male	Female	<i>p</i> -value (male vs. female)
Demographics							
Female	89 (33)	41 (40)	48 (28)	0.039	-	-	-
Older	171 (63)	-	-	-	123 (67)	48 (54)	0.039
Metropolitan	167 (61)	58 (57)	109 (64)	0.259	109 (59)	58 (65)	0.346
Born overseas	22 (8)	5 (5)	17 (10)	0.139	17 (9)	5 (6)	0.303
LGBTQI	18 (7)	5 (5)	13 (8)	0.384	11 (6)	7 (8)	0.556
In a relationship	67 (25)	28 (28)	39 (23)	0.0388	39 (21)	28 (31)	0.065
Mental health							
Diagnosed mental illness	108 (40)	42 (41)	66 (39)	0.673	67 (36)	41 (46)	0.126
Previous self-harm	99 (36)	50 (49)	49 (29)	0.001	41 (22)	58 (65)	<0.0001
Previous suicide attempt	97 (36)	36 (35.5)	61 (36)	0.95	48 (26)	49 (55)	<0.0001
Occupation							
Student	167 (61)	92 (90)	75 (44)	<0.0001	98 (53)	69 (78)	0.0001
Employed	63 (23)	4 (4)	59 (35)	<0.0001	52 (28)	11 (12)	0.004
NEET	43 (16)	6 (6)	37 (22)	0.001	34 (19)	9 (10)	0.075
Intent	158 (58)	60 (59)	98 (57)	0.806	107 (58)	51 (57)	0.89
Method							
Hanging	166 (61)	70 (69)	96 (56)	0.041	104 (57)	62 (70)	0.037
Jump from height	16 (6)	5 (5)	11 (6)	0.602	*	*	0.223
Train	38 (14)	13 (13)	25 (15)	0.665	25 (14)	13 (15)	0.82
Vehicle – pedestrian	*	*	*	0.558	*	*	0.249
Vehicle – driver	6 (2)	*	*	0.416	*	*	0.182
Suffocation (plastic bag)	7 (3)	*	*	1	*	*	0.433
Inhalation	8 (3)	*	*	0.714	*	*	0.718
Overdose	6 (2)	*	*	1	*	*	0.395
Self-immolation	*	*	*	0.53	*	*	0.547
Firearm	13 (5)	5 (5)	8 (5)	1	13 (7)	0	0.006
Drowning	*	*	*	0.53	*	*	1.0
Motor exhaust	6 (2)	*	*	0.087	*	*	0.667
Stressors							
Abuse	104 (38)	52 (51)	52 (30)	0.001	53 (29)	51 (57)	<0.0001
Family conflict	132 (48)	57 (56)	75 (44)	0.055	82 (45)	50 (56)	0.072
Partner conflict	78 (29)	30 (29)	48 (28)	0.812	42 (23)	36 (40)	0.003
Peer conflict	87 (32)	44 (43)	43 (25)	0.002	49 (27)	38 (43)	0.008
Bullying	68 (25)	35 (34)	33 (19)	0.005	31 (17)	37 (42)	<0.0001
Separation from partner	87 (32)	27 (27)	60 (35)	0.139	56 (30)	31 (35)	0.465
Sexuality	20 (7)	7 (7)	13 (8)	0.821	11 (6)	9 (10)	0.219
Exposure to suicide	42 (15)	13 (13)	29 (17)	0.351	27 (15)	15 (17)	0.64
Substance misuse	105 (38)	33 (32)	72 (42)	0.109	75 (41)	30 (34)	0.262
Post mortem presence of alcohol	60 (22)	14 (14)	46 (27)	0.011	47 (26)	30 (15)	0.041
Post mortem presence of illicit substance/s	36 (13)	10 (10)	26 (15)	0.202	25 (14)	11 (12)	0.779

Note:

* Suppressed data to protect confidentiality (where *n*<5)

Overall characteristics

Forty per cent of cases had a diagnosed mental illness, with no significant difference between age groups or sex. The percentage of subjects with at least one previous suicide attempt was significantly higher in those with a diagnosed mental illness (57%), compared to those without (22%, *p*<0.0001). Intent was indicated in almost half of all cases. The most common methods of suicide in decreasing

order were hanging; train; jump from height; and firearm. Eighty-seven per cent of cases had experienced at least one significant stressor preceding their death.

Characteristics by age group: younger (13-16 years) vs. older (17-19 years) adolescents

There was a relatively higher prevalence of previous self-harm in younger adolescents.

The majority of cases under 16 years of age were students, with a higher proportion of older adolescents classified as not in formal education, employment or training (NEET). Hanging was a relatively more common method of suicide in younger compared to older adolescents. Younger adolescents who died from suicide were more likely to have been exposed to the stressors of abuse, peer conflict and bullying. Alcohol was found in post-mortem toxicology in a higher proportion of older adolescents.

Characteristics by sex: male vs. female adolescents

Females were more likely to have demonstrated previous deliberate self-harm or a suicide attempt. Females were more likely to be students, whereas males were more likely to be in employment. Hanging was a

relatively more common method of suicide in females, while firearm was utilised by males only. Females were more likely to have been exposed to abuse, peer conflict, bullying and partner conflict.

Discussion

This study reveals key differences in completed suicide recorded in younger compared to older adolescents, and male compared to female adolescents. Previous studies have demonstrated that young people who die from suicide are significantly more likely than the general population to have a serious mental health illness.^{2,3,25} This is consistent with our study, in which 40% of adolescents had a formally diagnosed mental illness, which is much higher than the reported 14% in the general Australian

population.^{26,27} However, our study did not reflect previous adolescent suicide studies that demonstrated the prevalence of diagnosed mental illness increasing with age.^{7,11} The lack of difference by age group in our study may be because there was actually a high rate of mental illness (41%) in the younger adolescent group. This could suggest that adolescents who are diagnosed at a younger age with mental illness may be at increased risk for suicide.

The lifetime prevalence of deliberate self-harm in adolescents has been estimated at 10-18%, with higher rates in females compared to males.²⁷⁻³⁰ Our study demonstrated that adolescents who died from suicide had higher rates of previous deliberate self-harm compared to the general population. Our study's results were consistent with previous studies demonstrating that male adolescents are more likely to die by suicide than females.^{2,3,31} There is a 'gender paradox' of suicide, in which suicidal behaviour and deliberate self-harm is more common in females, but completed suicide is more common in males.² The results of our study appear to be in line with this 'gender paradox'.

Known associations and risk factors for both self-harm and suicide in adolescents are similar and often overlap. These factors include low socioeconomic status, restricted educational achievement, parent separation, adverse childhood experiences, interpersonal difficulties, mental disorders, and drug and alcohol misuse.^{2,3,31,34} Deliberate self-harm in adolescents can be a gateway to subsequent suicidal behaviour.³³ In comparison to studies in the general population, which demonstrate the prevalence of deliberate self-harm is higher in older compared to younger adolescents,^{27,28} our study showed that previous self-harm was relatively more prevalent in younger adolescents who died by suicide. This finding is consistent with one UK study³² and warrants further analysis, as it suggests that younger adolescents with self-harming behaviours may be at increased risk of subsequent suicide. Adolescent presentations to hospital after self-harm often involve disclosure of suicidal intent,³⁵ and are a means for flagging increased risk for subsequent engagement with mental health professionals.

In 2016, 5.1% of Australians aged 15-19 years were classified as NEET.³⁷ Our study showed rates of NEET were much higher in adolescents who died by suicide, with

Figure 1: Suicide counts by age and sex.

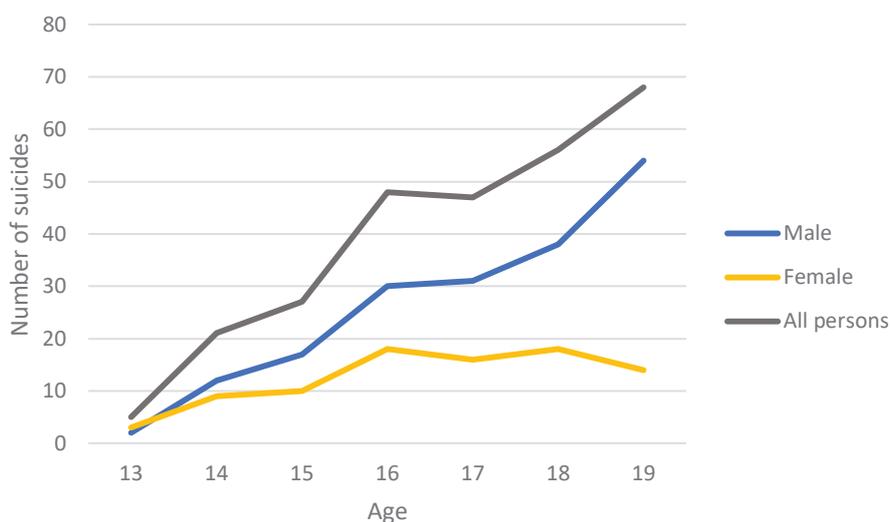
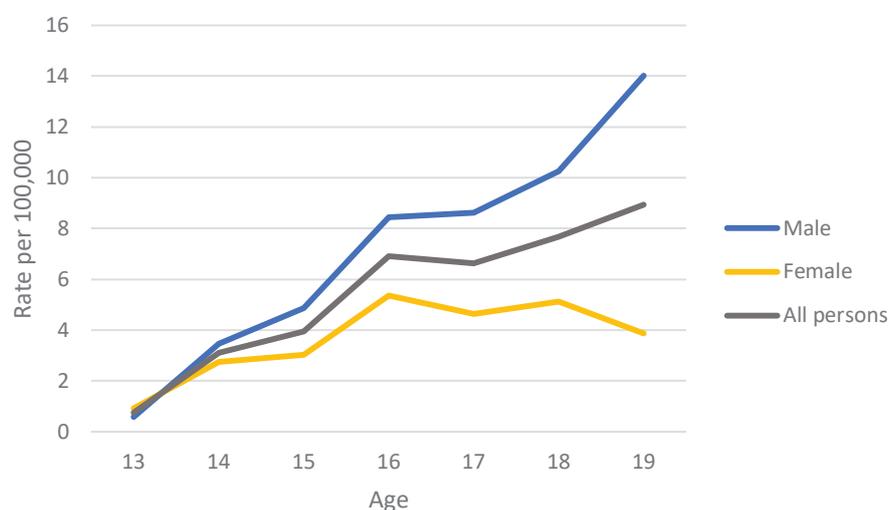


Figure 2: Suicide rates by age and sex.



a prevalence four times higher for older adolescents, and three times higher overall. Other studies have shown even higher rates of disengagement in education or employment, with up to one in five school-aged children who completed suicide not attending school at the time of their death, and one-third of adolescents being unemployed.³⁸⁻⁴⁰ In line with our hypothesis, this may suggest that participation in education, training or employment may be a protective factor, and conversely that adolescents classified as NEET may be at increased risk for suicide. It is recognised that a lack of formal educational qualification is a risk for suicide.²⁵ Unemployment and disengagement with education are likely to have detrimental effects on mental health and emotional wellbeing. The reasons why engagement in education and training or employment are likely to be important protective factors needs to be further explored.

Consistent with our results, previous studies have demonstrated that hanging is the most frequent method in adolescent suicides, with this method decreasing with age.^{7,15,43} Previous studies have demonstrated inconsistent findings regarding evidence of intent in adolescent suicide. One psychological autopsy found the majority of young people who die from suicide communicate their intent, but not usually on the day of death.⁴¹ Other studies describe younger adolescents who died from suicide as being more likely to have demonstrated suicidal behaviour or ideation than the general population,^{15,42} whereas others have found younger adolescents are less likely to communicate suicidal intent.^{9,15} Another study showed that approximately one-third communicated suicidal intent in the preceding 12 months, with no observable difference between age groups.⁷ In our study, intent (both implicit and explicit) was communicated in almost half of all cases, with no significant difference between age or sex. The reasons for such differences between studies may be due to the definition of intent – particularly implicit intent – being somewhat subjective, and parameters for timing (e.g. previous 24 hours compared to previous month) may have differed between studies.

Compared to the general population, young people who die from suicide are more likely to have had exposure to stressors, both chronic and acute.^{3,7,31,42,44} These stressors are

multiple and varied and include interpersonal conflict, relationship problems, bullying and abuse. In our study, peer conflict and bullying was seen at higher rates in both younger and female adolescents. There is strong evidence highlighting bullying as a risk factor for suicidal behaviour in adolescents,⁴⁵⁻⁴⁹ with a particular impact on female suicide.⁴⁷ However, to our knowledge, no previous studies have specifically demonstrated this concerning relationship between increased incidence of bullying in younger adolescent suicide. Our finding of almost six in 10 young females who died by suicide being exposed to abuse also warrants attention. Compared to the general adolescent population, children and adolescents who complete suicide are significantly more likely to have experienced physical, sexual or emotional abuse.^{42,50,51} Abuse in all its forms is harmful and potentially amenable to reduction. This study may add weight to efforts that contribute to abuse prevention and post-abuse supports. Relationship breakdown, interpersonal loss and rejection are also common precipitants to youth suicide,⁴¹ and the prevalence of relationship problems in suicide has been shown to increase with age.^{7,11} Our study did not observe this increase by age, but this may be because there was actually a relatively high proportion (29%) of younger adolescents exposed to partner conflict. This may suggest an association between partner conflict in younger adolescents and risk of suicide.

In Australia, the legal age for purchase and consumption of alcohol is 18 years. Alcohol abuse is less common in younger children compared to adolescents who complete suicide,^{14,52} and is consumed less frequently prior to death compared to older adolescents.^{9,15} Our study may reflect this trend, with younger adolescents having alcohol on post-mortem toxicology at almost half the incidence of older adolescents.

Limitations

The VSR is a comprehensive and detailed database. However, data quality is affected by the potential for variability obtained from external sources. For example, data obtained from family reports to police or the court may be inconsistently obtained due to the emotional complexities of bereavement, with cultural and religious overlay. Although we have referenced studies demonstrating prevalence of possible suicide associations and risk factors in the

community (including NEET, diagnosed mental health illness, deliberate self-harm, exposure to abuse), this study did not have a community control group. This must be taken into account when drawing conclusions from our data. The findings of this study may be subject to survivor bias; that is, the findings are not applicable if the survivor population is different from non-survivor population. Hence, caution is required when determining relevance to adolescents with self-harming or suicidal behaviours, as those who survive suicide attempts may have different characteristics from those who do not. Although stressors were coded for the preceding six months, we were not able to accurately capture the timing of a stressor, only its presence or absence. Our study recorded exposure to the stressors of abuse and bullying, but did not differentiate between perpetrator and victim status. Elucidating this difference would be especially helpful for prevention and intervention strategies.

Implications for public health

Relevance for future research, practice or policy

The reason for studies such as this is to inform interventions aiming to reduce deaths by suicide.

Our view is that preventive efforts should note:

- Significant differences between older and younger adolescent completed suicide with regards to education and employment status.
- Negative interpersonal relationships appear to be a key characteristic of both younger and female suicides, with peer conflict, exposure to bullying and abuse all significantly higher in these groups. These characteristics require further clarification, in particular, differentiating between victims and perpetrators of abuse and bullying. The issue of cyberbullying is also becoming more prevalent and further studies should also incorporate this.
- Abuse can take many forms – most certainly all harmful – and further studies could focus on the impact of different subtypes of abuse on suicidal behaviour.
- There is a need for better indicators of risk around suicidal behaviour, particularly in those with mental illness.

Conclusion

The characteristics of suicide differ between younger and older adolescents, and male and female adolescents. Understanding completed suicide is an important step towards prevention, and our results suggest a need for developmentally and sex-specific suicide prevention strategies.

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The conclusions, findings, opinions and views or recommendations expressed in this paper are strictly those of the author(s). They do not necessarily reflect those of CCOPMM. No CCOPMM data was accessed for this study.

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