

2015

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Recommended Citation

Murphy, Raegan and O'Connor, Siobhan (2015) "Methods of Suicide by Women in Ireland 1980-2009," *Irish Journal of Applied Social Studies*: Vol. 15: Iss. 1, Article 5.

doi:10.21427/D7M439

Available at: <https://arrow.tudublin.ie/ijass/vol15/iss1/5>

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Vol. 15(1), 2015, 46-56.

Abstract

Irish female methods of suicide from 1980 till 2009 were investigated in order to determine the likelihood of the method of suicide as determined by decade as well as the age at death. Secondary data analysis was conducted on the National Suicide Research Foundation (NSRF) dataset. Multinomial logistic regression was used to compare methods of suicide using odds ratios. Log-linear analysis was conducted in order to investigate possible interactions between the variables. A stepwise backward elimination procedure determined the most parsimonious model to account for the observed frequencies. Follow-up chi-square analyses were conducted on the three-way interaction in order to separately assess possible interactions of decade and age on method of suicide. Findings showed that the odds of hanging increased over time in comparison to overdosing and drowning. Interaction effects are present between all three variables and there is a significant association between age and decade for hanging but not so for overdosing or drowning. It is concluded that hanging is a method which is indeed increasing over time for women in Ireland.

Keywords: women; suicide; Ireland; methods; likelihoods

Introduction

This study focuses on the methods of suicide as used by women in Ireland between the years 1980 to 2009. While there is much research into male-only suicides there is little research into female-only suicide. There may or may not be differing reasons for and methods of suicide between the genders and the first step in finding out is to explore female suicide.

According to the World Health Organisation (WHO, 2013) almost one million people globally die from suicide each year. While there has been much research into suicide generally, few studies have focused solely on suicide by women and, in particular, women in Ireland. According to the 2011 Annual report of Ireland's National Office for Suicide Prevention (NOSP) compiled by the Health Service Executive (HSE, 2012), Ireland has the eighth lowest reported rate of death by suicide for females in the European Union (EU) and the rate of death by suicide has remained stable between 1980 (4.3 per 100,000) and 2009 (4.9 per 100,000). However, the standardised death rate in Ireland for suicide by women reached higher rates of 5.5 in 2003 and 5.4 in 2008 (in which year females in the 15-24 years age group in Ireland had the highest reported rate of death by suicide in the EU for females, at a rate of 6.7 per 100,000 population).

Increasing numbers of women are using more lethal and violent methods in acts of suicide (Beautrais, 2000; Byard et al., 2004; Lahti et al., 2011). Hanging may be perceived to be more accessible and simpler to perform (Biddle et al., 2010). A consistent finding in suicide research is that although women make more suicide attempts, men are more likely to die by suicide. This is highlighted by Beautrais (2006), who suggests that the lack of research in the area of women's suicide is due to a tendency to view suicidal behaviour in women as 'nonserious' and 'manipulative', and to view their suicidal behaviour as merely attention seeking and ineffectual. Beautrais (2003) proposes that the greater number of male deaths could be explained by gender differences in the choice of method, with men often choosing more lethal means. The methods of suicide that would be defined as violent and more lethal are hanging and the use of firearms. Non-violent methods include poisoning or drowning, where the chances of resuscitation or of rescue are greater.

During the so-called Celtic tiger years in Ireland (late 1990s - 2008) the National Suicide Research Foundation (NSRF, 2012) reported that the rates of suicide by women between 2001-2011 were at their highest in 2003 (n=111) and the lowest in 2006 (n=81). Given the relative economic prosperity experienced during this time, it may be reasonably expected that decreased financial hardship would lessen the financial burden on women. However, Walsh (2008) as well as Walsh and Walsh (2011) suggest that socioeconomic change among other indicators are seen to have little effect on rates of female suicide. Arensman et al. (2012) found that male suicide is related to higher unemployment rates. Corcoran and Arensman (2010) reported that female suicides in Ireland had a bimodal pattern with one peak in 25-34 year olds and the second peak occurring in 45-54 year olds. This finding is supported by research in the UK. In a study of official statistics and 'sociological autopsies' based on recorded suicides, Shiner et al. (2009) suggested that the perception in mass media that young men are most likely to be at risk of suicide was false and found that the number of suicides actually peaks in men in the 30-49 age range while for women it peaks in the 45-59 age range.

A socio-demographic study of hanging suicides in Ireland from 1980 to 2005 by Sarma and Kola (2010) reports that males are more likely to die through hanging and females through poisoning by solid or liquid substance. This study investigates female suicide data in Ireland and comments on the varying likelihoods of using different methods over time across age groups. To our knowledge, this is the first study to investigate these aspects in Ireland and is an important contribution to the study of suicide by women and the changing pattern in the methods of female suicides.

Method

This study analysed secondary data. Ireland's national Central Statistics Office (CSO) maintains records for all deaths including those by suicide. In a study of the Irish system of certifying suicide deaths Corcoran & Arensman (2010) describe the cause-of-death determination system as one where the police [An Garda Síochána, 'Guardians of the Peace', or colloq. 'the Gardaí] notify a coroner of a death whereupon the coroner orders a inquest to be held if not satisfied that death was by natural causes. After the inquest the coroner issues a certificate and based on this certificate, registrars produce a death

registration form which is forwarded to the CSO. The CSO record the information on a database, then partly complete and forward Form 104 to the Gardaí for completion. The Gardaí, in turn, provide an opinion as to whether death was accidental, suicidal, homicidal, or undetermined and the result is returned to the CSO. It is on the basis of this opinion and further information on other forms that the detailed cause (method) of death is assigned by the CSO in accordance with the International Classification of Diseases (ICD) guidelines. It is possible that deaths recorded as suicidal may well have been accidental (such as in the case of, but not limited to, poisonings for instance).

Method of suicide is recorded by the CSO under seven categories; overdose, poisoning, hanging, drowning, gun, cutting and 'other' (including *inter alia* jumping in front of vehicles and jumping from a height). The original dataset included all recorded female suicides in Ireland from 1st January 1980 to 31st December 2009 (N = 2435). Our analyses investigated three methods only, namely; hanging, drowning and overdosing as together these three methods accounted for 84.2% of the total number of suicides in the dataset. The analysed dataset (N = 2051) investigated numbers and methods of female suicide over time in Ireland for different age groups. The probability of choosing a method of suicide was assessed in order to determine if there was any significant change in the method over time for various age groups. Lastly, possible interactions between age and decade of suicide were investigated. Multinomial logistic regression and a log-linear analysis were conducted and the data adhered to the basic assumptions required. Multinomial logistic regression was used to compare women who died by drowning to those who died by hanging or by overdose.

Ethics

Aggregated and anonymised CSO data were collated which ensured that no data point could be isolated. Original variables included in the dataset were age, marital status, occupation, day of death, month of death, year of death, county, area type (urban, rural), and the method of suicide. Aggregated variables included age at death, decade of death and method of suicide. Ethical oversight and approval for the study was granted by two ethics committees. This research was carried out in accordance with the Psychological Society of Ireland's Code of Professional Ethics.

Results

Basic descriptive results

Rates for female suicide in Ireland over thirty years (1980-2009) are shown in Figure 1.

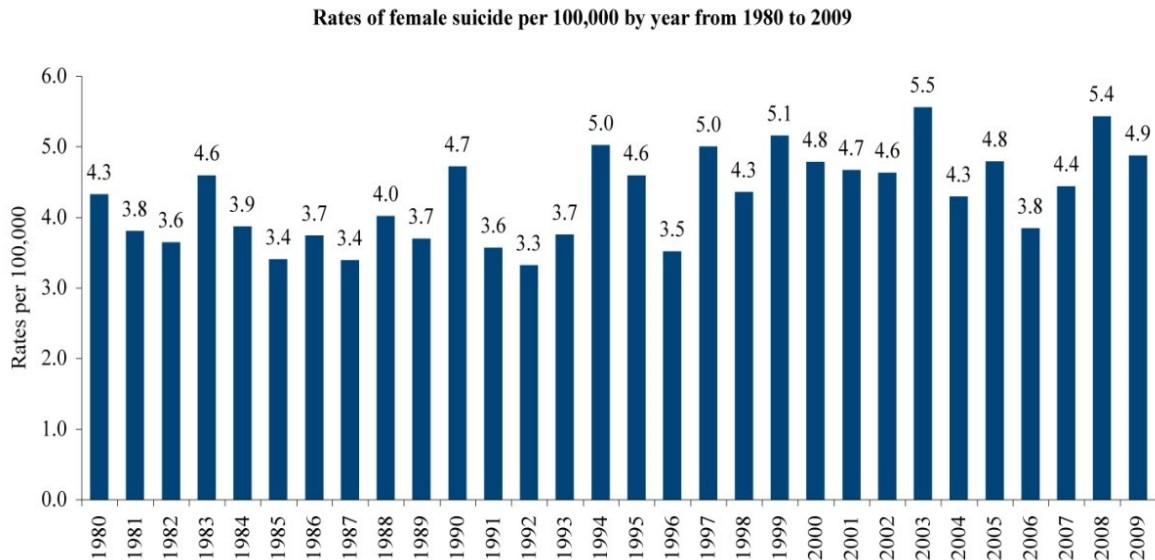


Figure 1: Rates of female suicide per 100,000 by year from 1980 to 2009

A total number of 2,435 female suicides was recorded. The rate of female suicides per 100,000 remained largely similar with a rate of 4.3 per year in 1980 and a rate of 4.9 per year in 2009. There are peaks and troughs in the rates over the thirty years. In 2003 the rate was at its highest at 5.5. In 1999 it was 5.1 and in both 1994 and 1997 it was 5 per 100,000. Of note is the decrease from 5.4 in 2008 to 4.9 in 2009. The lowest rate of 3.4 was recorded in 1985 and 1987. The total number of deaths by method are shown in Table 1.

Table 1: Frequency of methods of suicide by women 1980-2009

Method	Frequency (N)	(%)	Cumulative %
Drowning	766	31.5	31.5
Hanging	681	28	59.5
Overdose	604	24.8	84.3
Poisoning	167	6.9	91.2
Other	135	5.5	96.7
Gun	52	2.1	98.8
Cutting	30	1.2	100
Total	2435	100	

While the rates of female suicides have remained similar over the thirty year period, the methods employed by women have changed. The data were analysed and broken down into

five-year bands. The percentage of the methods of suicide used in each five-year band were extracted and is shown in Figure 2.

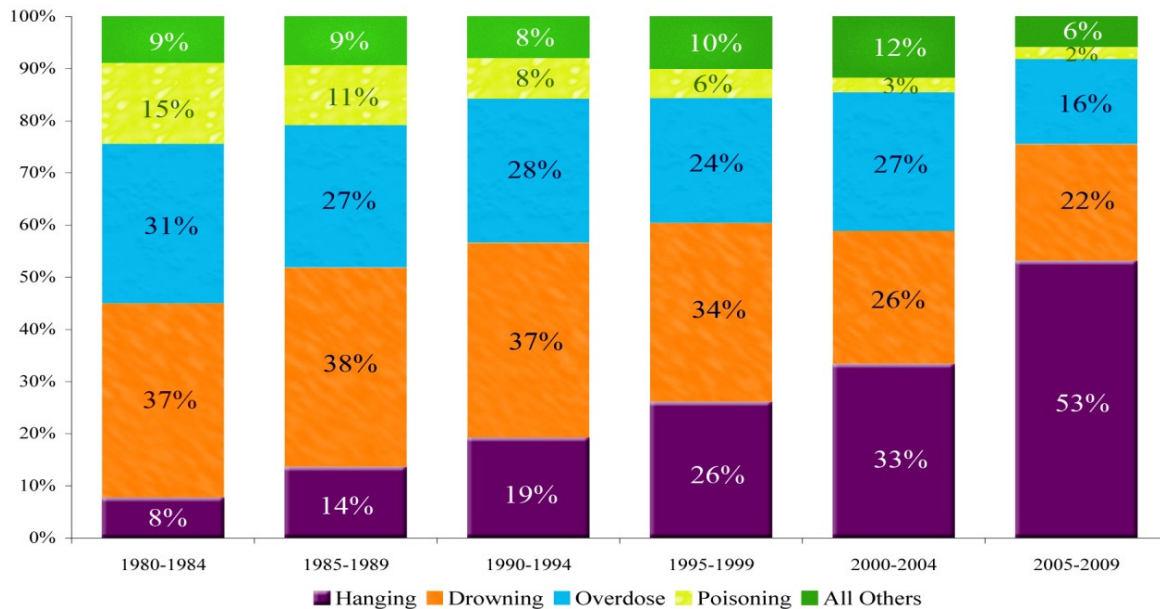


Figure 2: Method of Suicide by Women in Ireland in 5-Year Bands by % Change

During the years 2000-2004 the most common method of suicide was hanging which is four times as great as the use of this method in 1980-1984. In the last five years, 2005-2009, hanging has become the method of suicide for over half of female suicides with an increase in the use of the method to 53%. All other methods have gradually decreased over time.

Method likelihood over time and across age groups

Multinomial logistic regression was used to compare women who died by drowning to those who died by hanging or by overdose. 'Drowned' was used as the reference category as it had the highest frequency of occurrences. The data were categorized into three variables or parameters of interest: method of suicide (overdose, hanging and drowning), decade of suicide (1980-1989, 1990-1999, 2000-2009) and age at death (10-34, 35-54 and 55+). Odds ratios were obtained for each parameter. A forward entry stepwise procedure was conducted investigating a custom model of main effects and a two-way effect. The derived model, as depicted in Table 2 below shows an improvement over the null model. The likelihood ratio tests for decade and age yield significant results as predictors of method of suicide $\chi^2(2) = 58.051, p = 0.00$ for decade; $\chi^2(2) = 14.788, p = 0.00$ for age and $\chi^2(2) = 8.821, p = 0.01$ for decade x age.

Table 2: Likelihood Ratio tests

Model	-2 Log Likelihood	Chi-Square	df	Sig
Intercept Only	502.404	.	.	.
Final	119.510	382.894	6	.000

The low pseudo R-Square Cox and Snell (0.17) and Nagelkerke R² (0.2) values reflect the low variance accounted for in the dependent variable by this model but low values are often evidenced in logistic models. Pearson and deviance χ^2 statistics are significant which does not support evidence of good fit of the model to the data. This indicates that there is a significant difference between the model and the data.

Interpreting the parameter estimates in the multinomial logistic regression, as seen in Table 3 below, shows that as time progresses the odds of hanging compared to drowning is 3.7. Similarly, when overdose is used as the reference category, the odds of hanging are 4.2 greater than overdosing as time progresses. The odds of hanging in comparison to overdosing also increases as women get older but the finding was not significant. In sum there seems to be a significant increase in the likelihood of hanging over time in comparison to drowning and overdosing.

Table 3: Multinomial logistic regression

	B (SE)	95% CI for Odds Ratio		
		Lower	Odds Ratio	Upper
<u>Hanging vs. Drowning</u>				
Age	-.4 (.24) (ns)	.415	0.66	1.07
Decade	1.31 (.21)*	2.42	3.69	5.63
Age*decade	-.214 (.1)*	.662	.808	.985
<u>Hanging vs. Overdose</u>				
Age	.33 (.247) (ns)	.861	1.39	2.26
Decade	1.42 (.21)*	2.77	4.17	6.28
Age*decade	-.31 (.1)*	.602	.737	.903

*p<0.05

Interaction between decade of death and age at suicide

A log-linear analysis was conducted in order to investigate possible interactions between the variables as well as to determine the strength of each variable's contribution to a prediction model. The log-linear design consists of three main interactions (method, decade, age); three two-way interactions (method x decade; methods x age and decade x age) and one three-way interaction (method x decade x age). The null model (total

likelihood χ^2) is built on the supposition that all cell frequencies are equivalent. Table 4 below shows the observed cell frequencies for the three categorical variables.

Table 4: Number of people classified according to method, age and decade of suicide

	Method Used								
	Overdose			Hang			Drown		
	1980s	1990s	2000s	1980s	1990s	2000s	1980s	1990s	2000s
Age 10-34	72	67	61	25	94	219	39	58	39
Age 35-54	73	88	100	23	52	144	101	110	105
Age 55+	50	45	48	23	33	68	113	110	91

Table 5 shows the likelihood χ^2 values for all effects. The likelihood ratio χ^2 (26) for the model is 579.527, $p = 0.00$. Hence the observed frequencies differ from those expected by chance. Method, age and decade all evidence significant main effects as do the three two-way interactions evidenced from the partial associations. However, the three-way interaction effect is not significant.

Table 5: Likelihood ratio chi-square for the main variables and their interactions

Effects	df	Likelihood ratio chi-square
Total	26	579.527 *
Two-way and three-way interactions	20	432.897*
Three-way interaction	8	11.836
Method	2	19.217*
Decade	2	93.501*
Age	2	33.913*
Partial associations		
Method X Decade	4	195.407*
Method X Age	4	179.968*
Decade X Age	4	10.217*

* $p = 0.00$

A stepwise backward elimination procedure was also conducted in order to determine what the most parsimonious model would be to account for the observed frequencies. Stepwise backward elimination produced a model that included the three two-way effects and by

implication the three main effects. The likelihood ratio $\chi^2(4) = 195.407$, $p = 0.00$ for method x decade; the likelihood ratio $\chi^2(4) = 179.968$, $p = 0.00$ for method x age and the likelihood ratio $\chi^2(4) = 10.217$, $p = 0.00$ for decade x age. The three-way effect likelihood ratio $\chi^2(8) = 11.687$ was not significant. In sum, suicide is explained by the interactions between the method chosen, the age committed and the decade in which it occurred.

In order to unpack where exactly the significant associations are located, follow-up χ^2 analyses were conducted on the three-way interaction in order to separately assess interactions of decade and age on method of suicide. There was a significant association between age and decade for hanging, $\chi^2(4) = 13.395$, $p < 0.01$ but there was no significant associations for drowning or overdosing. In summary, the multinomial logistic regression evidenced the odds of hanging increasing over time in comparison to overdosing and drowning. The log-linear analysis evidenced that interaction effects are present between all three variables and the exact location of the significant association was shown from the χ^2 analyses which yielded a significant association between age and decade for hanging but not so for overdosing or drowning. Hanging is thus a method which is indeed increasing over time for all age groups.

Discussion

This study investigates the methods of suicide as used by women in Ireland from 1980 to 2009. The results from a multinomial logistic regression evidenced the odds of hanging were increasing over time in comparison to overdosing and drowning. This is an interesting finding as it accords with research which states that hanging may be perceived to be more accessible and also simpler to perform (Biddle et al., 2010). There was a significant association between decade and age for hanging. However, there were no significant associations for drowning or overdosing. The finding that women in the 45-59 age bracket have the highest rate of suicide accords with the data from The Office of National Statistics in the UK (2013) which reported similar findings. Also, international findings echo the Irish findings regarding the changing pattern of suicide by hanging over time (Lahti et al., 2011). Our findings also suggest that there is significant likelihood of suicide by hanging and that the use of hanging is increasing over time for women in Ireland. Descriptive statistics have shown that the use of hanging as a method of suicide increased from 8% in 1980-1985 to 53% in 2005-2009 and shows that women are using methods of attempted suicide which have higher likelihoods of resulting in death. The Irish findings are, once again, in accord with international findings in this regard (Beautrais, 2000; Byard et al., 2004; Lahti et al., 2011).

The results suggest that there is a changing pattern in female suicide towards the use of more lethal methods, which reflects the similar findings of the increased use of hanging by females as reported by Lahti et al. (2011) and Beautrais (2000). Although our findings suggests that older women are dying by hanging in comparison to overdosing more so than younger women, the results are not statistically significant. Possible reasons for increased suicides in general in older women over time include the difficulties in procuring employment and the concomitant increase in job loss (Martinson, 2012). However, Walsh (2008) states that reasons such as unemployment may not, in fact, be a causative factor in

female suicide even though job loss increases as women age (Martinson, 2012). Moreover, the evidence for Irish unemployment rates being linked to suicides among females is lacking (Walsh & Walsh, 2011). These trends do however concur with findings internationally which evidence the increased likelihood of older women dying by hanging in comparison to other methods (Byard et al., 2004; Corcoran & Arensman, 2010). Our non-significant findings for hanging in comparison to the other methods may be due to a lack of power in our analyses.

There has not being a great amount of research focusing on women-only suicide and there has been a propensity to study it in relation to male suicide. Beautrais (2006) suggests that this is due to a tendency to discount female suicide as not serious and it has been suggested that gender differences could be due to the use of more lethal methods of suicides by males. Värnik et al. (2009) suggest that the increase in the numbers of female suicide by hanging, as also evidenced in our study, may indicate a convergence of life-styles as women now occupy roles once within the purview only of men. As evidenced by Baker et al. (2013), Beautrais (2000), Byard et al. (2004) and Lahti et al. (2011) our findings also suggest that there is a rise of female suicide by hanging over the last decade. The descriptive analyses is clear in its rendering of this increase over time in Ireland and is supported by the significant findings of the odds of dying by hanging when compared to drowning and overdosing. Moreover, our findings are in accord with much of the literature regarding the association that age and decade has with the chances of dying by hanging. As the data are limited to three categorical variables it is impossible to infer the reasons behind some of the changing patterns. More data needs to be gathered before substantive assertions of this kind can be made.

Recommendations

Steps can be taken to reduce the availability and amount of prescription drugs and guns but it is difficult to suggest how to reduce the availability of equipment that can be used by a person intent on dying by hanging. There are an estimated two hundred Irish support groups offering support to suicidal people and their families, but there is very little co-ordination between these groups and there is little evidence to suggest what, if any, benefit such initiatives have on decreasing suicide rates. Further analyses of greater numbers of variables, will undoubtedly shed more light on possible reasons as to the shifting patterns in female suicide over time in Ireland.

Limitations

The study is an analysis of secondary aggregated data. Due to the need to anonymise data points and to ensure non-disclosure it is necessary to collapse data into categories thus losing richer information such as accurate country-wide geographic distribution of suicides. The most suitable analysis for categorical data investigating associations between variables is multinomial logistic regression, hierarchical log linear analysis as well as χ^2 analyses. Data are limited to the years from 1980 onwards.

Conclusion

In the first five-year period analysed, 1980-1985, hanging as a method of suicide accounted for 8% of all Irish female suicides. In the last five-year period analysed, 2005-2009, hanging accounted for 53% of all recorded Irish female suicides. Results show that the choice of hanging as a method of suicide is increasing over time. Suicide prevention policy could consider initiatives targeting this gender specific area, including debunking the myth that hanging as a method of suicide is a painless choice. The apparent changing trend in the methods of suicide used by women requires further exploration as does the need to understand why women are taking their own lives using more violent methods than previously.

Acknowledgements

The authors would like to thank the staff of the National Suicide Research Foundation (NSRF) for access to the data.

Biographical notes

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