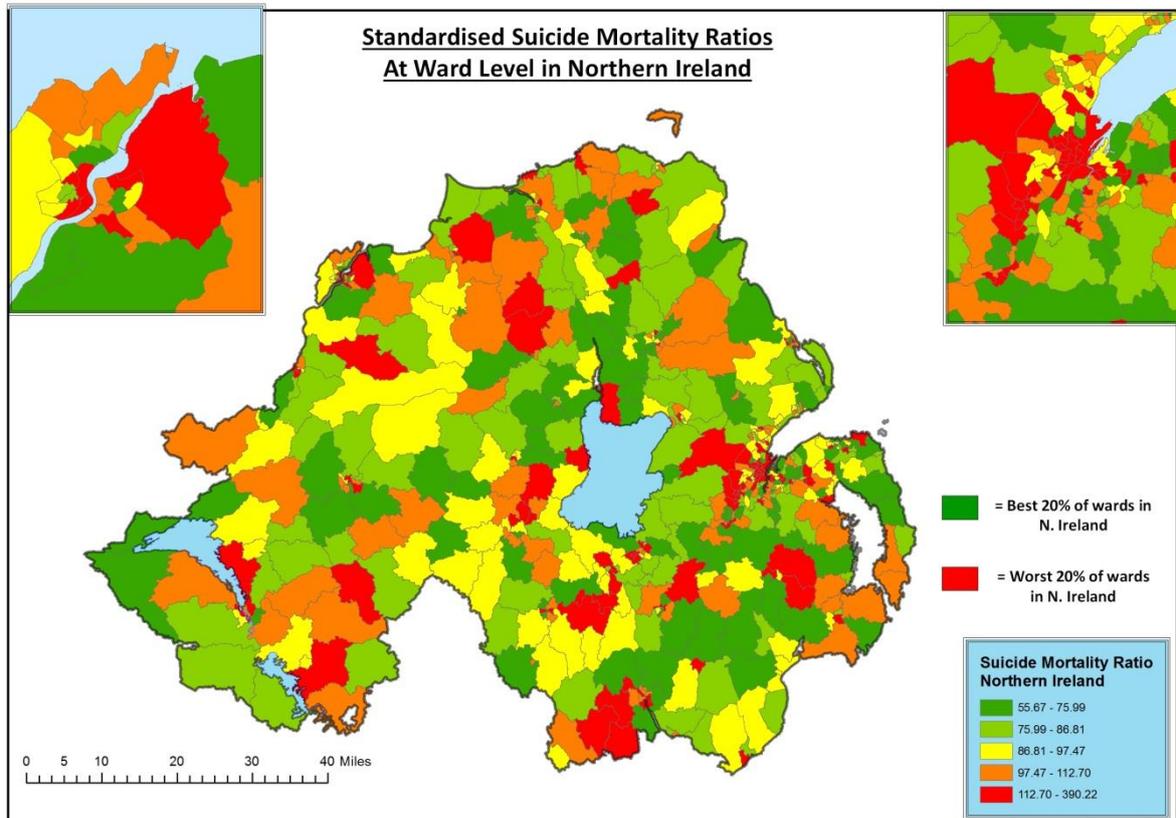


# Death by Suicide: A Report Based on the Northern Ireland Coroner's Database



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## Preface and Acknowledgements

The common perception is that deaths from suicide are largely preventable. The silent 'but how?' in the sentence is more problematic. This report sets out to address the issue of suicide by a search for those things that are associated with deaths by suicide. Few adults in society will have been fortunate enough not to have known someone who has taken his or her own life. On an individual level a wide variety of explanations are possible, and often these are framed by what our relationship has been with the person. With hindsight it is often possible to see the sad circumstances that led to the death, and with the same hindsight it is often apparent that the emotional burden presumed to be involved in the final act was evidence of a sensitivity little understood by others.

Certainly an analysis at the individual and emotional level is required, both for understanding and illumination of how the 'heart' deals with all too concrete events. While death is experienced as a unique event for those directly involved, it also has a social reality which binds it to the life and death of others. In order to see this social reality and its implications for relationships we need to stand outside the death of a unique and irreproducible individual and search for possible commonalities between the deaths of individuals frequently unknown to one another.

In part one of the report recorded events associated with the deaths of individuals are examined in a search for patterns of commonalities. These patterns tell us about the social characteristics of those for whom the data is available, and their presence indicates that deaths by suicide are not isolated or random events. They speak to underlying concepts

that link the events. This can be clearly seen in the presentation of frequencies and cross-tabulations where factors of gender, age, occupation etc all indicate that the burden of suicide is borne more heavily by some sections of society, and yet the uniqueness of the event has its own unique source of explanation.

Individual characteristics are seldom if ever sufficient as descriptions, since they never occur in isolation and are themselves dependent on the frequency of the characteristics in the society. This report attempts to deal with this problem through the use of a range of multivariate statistical models, where numerous measures can be included within the one analysis to help elucidate some aspect of the problem. However, numbers are slippery things and without controlling for other possible factors can be misleading and may not have much generalisation to the wider society where societal characteristics are ignored. In the current report, when we come to examine possible neighbourhood effects in part 2 of the report, the level of area aggregation and population characteristics are then adjusted for these background factors.

Much remains to be done, and no report or research project answers all the potential questions. Some are addressed while others are sidestepped for now. We hope that the information provided within this report will allow us to clarify and rethink some of our current understandings and assist us in our search for better solutions to one of society's most urgent public health issues. The information contained in this report provides a description of numbers and rates of suicide in Northern Ireland, using data derived from the Coroner's database. We are appreciative of the assistance provided to us by staff in the Coroner's Office in Belfast, and we thank the Senior Coroner Mr John Leckey and his colleagues for their advice and assistance. Our thanks also go to the Presiding Judge of the Coroners

Service, Lord Justice Weir. Finally, our thanks to staff within the Public Health Agency for their support both financial and practical and to the reviewers of the report for their feedback.

## Executive Summary

### Recommendations following from the current analysis

#### *Means by which the deaths occurred*

In Northern Ireland hanging was the most common method of suicide, particularly among males, and among the younger age groups; this was followed by overdoses. These findings offer few obvious options for suicide prevention interventions. However they highlight the need for continued vigilance of very high risk individuals and consideration of the ways in which to restrict access to items that may be used as ligatures. As a result, there is a need to understand and identify the factors that may precipitate suicidal behaviours.

The low proportion of deaths by firearms in comparison with other Western cultures (for example the US) may reflect the restrictions on the ownership of these weapons in the UK. In addition, the reduced rates of suicide, following the restriction of a particular means, suggest that substitution of an alternative method is not common (Barber & Miller, 2014). This also suggests that efforts to restrict access to detailed information about hanging and other methods remains important, and that the media have a central role to play in this regard.

In addition there is evidence that restricting access to detailed information about means of suicide, such as information from the internet about specific methods of hanging, may influence rates and methods used. Therefore efforts to ensure that the media reporting of suicide is monitored, and that reporters are trained in methods for the appropriate reporting of deaths by suicide..

With death by drowning at 8%, i.e., over 130 by this means, place may well be important. This again points to the importance of having accurate recording systems so that place of death is recorded accurately. This will allow contagion effects to be monitored and addressed. Again, there is some evidence that media reporting influences choice of location so the guidance regarding this should be promoted and the impacts assessed. Careful consideration should be given to how we can influence and change behaviour around the locations where deaths by suicide are common. Some strategies which aim to reduce suicidal behaviour, including efforts to “raise awareness” may actually draw attention to the issue and may be associated with an increase in deaths at particular sites.

### ***Characteristics and prior suicidal behaviour***

Around 50% of the sample had either a recorded prior suicide attempt or a record of suicidal thoughts. This group in particular needs to be targeted for assistance, since they are known within the health system. However, this also requires the accurate linking of information, e.g., self-harm, health records, and cases where suicide has occurred. It is therefore necessary to explore the factors predicting future attempts among people who self-harm through the linkage of suicide and self-harm databases.

Hand written notes remain the most common means of communication of suicidal intent. The increasing use of electronic means of communication of intent reflects changes in the ways in which people communicate generally and the increased use of text messaging and other electronic communications among younger people. Electronic communications, particularly public posts on social media may offer opportunities for analysis to establish linguistic markers and predictors of suicide. These should be examined to identify possible areas for suicide prevention.

### ***Alcohol intoxication at the time of death***

While alcohol is a contributory factor in a lot of deaths, it is also evident that nearly half the sample had no significant amounts of alcohol in their body. Nevertheless the role of substances (both legal and illegal) and their interaction with cognitive states and life events needs to be better understood.

Alcohol, above the legal limit, was present in 41% of cases, and was more common among males and young people. These figures of course, reflect the patterns of alcohol use in NI generally. They also point to the probable need to link suicide prevention with strategies for the reduction in harm due to drugs and alcohol.

The rate for mental disorders, as defined by DSM/ICD criteria, is high in Northern Ireland, with lifetime prevalence of around 40%; with 14% of the population showing evidence of suffering from the effects of substance disorders (Bunting et al., 2012). A proportion of the deceased would therefore have had substance disorders including alcohol addiction. Many would have used alcohol to deal with stress or manage mental health problems. In certain cases the impulsivity associated with the effects of alcohol intoxication may have contributed to the suicide. Alternatively, individuals may have taken alcohol to reduce the fear or pain associated with the suicidal act. The associations between alcohol use, abuse and the effects of intoxication on suicidal behaviour require further research.

### ***Prescription medication at the time of death***

Over 80% of the sample had a recorded prescription. Of those with prescriptions, nearly 40% were being prescribed anti-depressants. The need for a greater therapeutic input within doctors' surgeries would probably be the easiest point of contact, and could also be

the most efficient. The risks from deaths by suicide need to be given a higher priority within the context of clinics. Screening should be considered within the context of the intervention sought by the person; and within this, suicide prevention could play a role.

### ***Adverse event prior to death***

The recording of adverse events is difficult, and in the present database these are recorded for only 60% of the respondents. Nevertheless, this is likely to be a key factor in the decision, impulsive or otherwise, to take one's own life. A higher priority needs to be given in clinical and other types of interactions to the causes of negative feelings and to a closer examination of reactions to particular sets of events. Many of these interactions will be based on learned experiences, and are strongly influenced by patterns of attachment in early childhood, hence the role of family and education cannot be ignored.

The largest category of adverse events, experienced by a third of those who died by suicide, is that of relationship breakdown or discord. Efforts to support people with relationship difficulties and to help people manage conflict in relationships are therefore to be encouraged in terms of suicide prevention. Finally, one in ten (10.7%) of those who died by suicide have recorded events relating to experiences of death and grief, again emphasising the need to support people in coping with loss.

### ***Employment status and occupation***

It is difficult to judge the extent to which any given occupation group is under or overrepresented in the population. In this report significant evidence is produced to show that deprivation is closely associated with the number of deaths in a particular area. By inference, changes, or potential changes in status, need to be given close attention. The

findings for occupation re-affirm that particular groups are likely to have a higher risk of suicide, the results also support a possible skill level gradient in risk, with lower-middle skilled occupations encountering the greatest risk (Milner, Spittal, Pirkis, La Montagne, 2013).

Over 50% of the individuals in this sample were recorded as having been unemployed at the time of death. This is a surprising number and requires much closer examination. Much of the previous research has ignored this group, when examining occupation (see for example, the meta-analytic review on suicide by occupational group by Milner, Spittal, Pirkis, La Montagne, (2013) for an overview.

### ***Age and service use***

In the current dataset, we had a medication record for 80% of the sample; however, this number is much less when it comes to recording service use. Part of this discrepancy is likely to arise from the fact that service use is poorly recorded in the current dataset, but on the other hand some of it is likely to have arisen because of a reluctance to engage with services. This avoidance of services, and possible stigma associated with usage, obviously needs to be continually addressed. Nevertheless, the data also indicates that many individuals have used health services in the weeks before their death; and as such, ways should be explored to identify those who are in need of greater assistance.

### ***Diagnosis prior to suicide***

With close to 70% of the current sample who had a diagnosed health related condition at the time of death, this presents a clear point of contact. However since we are looking at a small number in the context of the overall number of patients, computerised screening, and possibly better still, getting professionals to ask clients about suicidal thoughts, plans and

intentions should be considered. Further, given the widespread use of smart phones and other computerised means of communications there is likely to be a role for textual interventions.

### *Health services*

Contact with services is obviously related to condition and symptoms. Approximately 22% of the sample had a recorded mental and physical health condition; with a further 36% presenting with recorded mental health problems only. Females were more likely to have had a recorded mental health condition with or without a diagnosed physical condition. The time taken by individuals to report either or both mental or physical health symptoms is too long. For example, within Northern Ireland it takes well over 10 years on average, from the onset of mental health symptoms (such as depression, which is reported in the literature as having a strong association with suicide), to the reporting of these symptoms to personnel within the health service, for many mental health conditions (Bunting et al., 2012). This has consequences for individual functioning and the treatment of any given condition, and in particular this is the case for males. More information needs to be available to everyone and in particular to males about the symptoms that can and should be responded to, and to knowledge that interventions are available and successful, particularly as they relate to suicidal thoughts and intentions.

Services, especially in areas where the SMRs are substantially higher, should be targeted for greater awareness of the problem. The role of Applied Suicide Intervention Skills Training, within the general public, and especially targeted in areas with high recorded numbers of deaths by suicide, is likely to repay dividends. A greater use of services in these areas needs to be considered. Indeed the use of services within these areas may provide

useful strategic information. Are more or fewer individuals within certain Wards accessing services? Have individuals who are delivering the services been appropriately trained, and is this training ongoing?

### ***Overall trajectory in the number of deaths***

The upward trajectory of deaths calls for a societal level response in order to reduce the overall number of deaths, which evidently affects all sections and classes of society.

Potentially different strategies may be usefully focused on these different strata.

There is certainly good evidence for a societal level strategy for suicide prevention given the number of deaths by suicide; however, the current analysis indicates that target interventions at the Ward level may be a useful strategy, given the greater preponderance of deaths by suicide in some locations. While suicide and mental health are strongly associated, as indeed are many other factors as the report indicates, it is not helpful to conflate these groups of individuals. As many as 40+% of the population are likely to have, at some stage during their life, symptoms that could be classified within a DSM/ICD mental health classification, and since the numbers of deaths by suicide are much lower, there is a clear lack of focus when they are both conflated.

### ***Age and location***

There is some evidence, within the current analysis, that deaths within Wards may be higher in specific age bands. However, given the present sample number this is a preliminary result. At a societal level, once an adjustment has been made for the number of individuals in a specific age band, no evidence was found that deaths were more likely in the 16 – 39 age group when compared with those in the 35 -64 age group. For now there are not

sufficient grounds to target specific age cohorts, at the societal level; however, at the Ward level this could be an option.

There are clearly area effects. How much of this is contagion, and how much is due to random effects that may themselves be related to other factors has not been addressed in this report? These issues need to be examined with possibly more appropriate techniques.

### ***Gender and age***

Many more deaths from suicide occur amongst males – approaching 80% of deaths.

However, Table 3.1 indicates that the age at which deaths occur is likely to, on average, be differentiated on the basis of age. As a percentage, more males are likely to have died from suicide in the age group 16 to 34 years; while as a percentage value, more females are likely to die in the age category 35 to 64 years. Whether or not the same stressors are involved for females as for males is not clear, but what is evident is that, on average, age is an important differentiator as to the likelihood of taking one's own life. However, this potential interaction between gender and age provides some evidence for a more targeted focus on women in the 35 to 64 age group. In the current analysis we found little evidence for a straightforward effect for age; however, in the context of gender, there may be a differential effect depending on age. This requires closer examination.

### ***Location***

Deaths by suicide are far from random events. Location is an important corollary of these premature events. A key location indicator is deprivation, and this is particularly marked in those locations (Wards) where levels of deprivation are highest. In order effectively to tackle deaths by suicide, the characteristics of the lived location must be addressed. Area specific

targeting of a suicide prevention programme is required, through a people-based approach via the targeting of subpopulations.

Targeting deprivation is certainly important, since the role of social and personal stressors is evident throughout this document, and indeed in the wider research literature. More consideration should be given to what is loosely described as 'social (community) capital'. Strategies for the development and enhancement of the role of an active civic society should continue to be supported and developed, especially within areas that are under stress in terms of poverty, high numbers of deaths from suicide, ill health, unemployment, etc. The availability of support for relationships, job seeking, health and wellbeing, debt management, etc., are obviously all important. Continuous professional development need not be the preserve of middle class occupations but could potentially be available within a community setting. Those delivering services, in a voluntary or paid capacity within a community, should be given the opportunity to develop a greater awareness of the problems that are common within an area/community. Organisations, including churches, frequently have deep roots within the community and have the potential, and some would add the motivation, to raise awareness of the problems that are encountered by the wider community within which they exist. Our choices (rational and otherwise) frequently lie in how we are able to relate to others within our community of wellbeing. Having a reason to live is the important therapy.

### *Information and data*

A much more systematic approach is needed for the recording of information, so that key individual and social characteristics, and the interactions between them, can be better understood.

Data linkage has assisted the current analysis, and this should be extended to include more health and social data, and in particular information relating to self-harm and suicide.

Much better pathways need to be established for the development and recording of accurate information relating to deaths by suicide. Too much of the reporting is at such a high level of generality that it is more likely to obscure facts rather than to disclose them. Consideration should be given to the reporting of real time data, with appropriate steps taken to ensure confidentiality.

Given the extent to which yearly data fluctuates, it is important that aggregated data is available, as it is only then that trends, clustering, 'contagion' and contextual effects can be identified. Hence, the need to continue with the work commenced in this project, in collaboration with staff in the Coroner's Office.

### Recommendations based on current knowledge

The above points, based on the current data, are here considered within the wider framework of knowledge under three subheadings: Policy and Principles, Services and Research.

#### **Policy and Principles**

### ***Adoption of a strategic approach to suicide prevention***

The findings of this research support the adoption of a dedicated suicide prevention strategy.

This strategy should adopt a comprehensive and broad approach in keeping with the contemporary theories of suicide. The strategy should consider the background or contextual factors that increase the likelihood of suicidal thoughts; the supports and treatments available for people who have suicidal thoughts, as well as the factors affecting engagement and access to services; and finally the factors which increase the likelihood of behaviour in response to suicidal thoughts.

### ***Examine the mental health and suicide prevention implications of policy decisions***

Suicide in Northern Ireland appears to be associated with mental health difficulties, exposure to the conflict and also exposure to stress; particularly economic deprivation. The interactions between these factors and the link with suicidal behaviour should be considered when deliberating social and economic policies in Northern Ireland. In order to address the high suicide rates in Northern Ireland, policy decisions should be reviewed to examine their impact on those at high risk. In NI these groups include those who have mental health difficulties, people who live in areas of deprivation, populations who have been exposed to violence and people who are unemployed.

The literature demonstrates that people who are LGBT and Travellers are at particularly high risk of suicide. Whilst it was not possible to identify these subgroups in the current study, it is important that policy decisions relating to these groups are scrutinised for their impact on mental health and suicide prevention.

### ***Alcohol and other substances of abuse***

This study has demonstrated the association between substance use and suicide. The high proportion of people who have consumed alcohol prior to death and the associations between alcohol use, mental disorders and suicidal behaviour mean that harm reduction strategies have a role to play in suicide prevention in NI. All policies relating to alcohol and substances should be consistent with a suicide prevention ethos.

### ***Means of death and the communication and reporting of suicides***

The examination of the methods of suicides used in NI demonstrates the need to develop safety strategies for any particular sites where people have taken their own lives. Information and communication about suicide, particularly method of suicide, should be a priority in terms of reducing access to means. Safe communication regarding suicide and adherence to the guidelines for the reporting of suicide should be promoted.

### **Services**

#### ***Public understanding of mental health and stigma surrounding mental illness and suicidal ideation***

The rates of undiagnosed mental health disorders in the population of people who died by suicide are a cause for concern. The low levels of recorded mental disorders and disengagement from services, particularly among men in this study, may be a consequence of a reluctance to disclose mental health difficulties or may reflect the importance of somatic symptoms in men's suicidal ideation. These findings support the need for increased public awareness of the symptoms of mental health disorders and the ways in which support and services can be accessed. In particular, efforts should be made to address the stigma surrounding the disclosure of suicidal feelings, the feelings that are associated with suicidal

behaviour and/ or the symptoms of mental health disorders. Continued attention needs to be given to the provision of a range of support services for people who are suicidal. These services need to target the diverse needs of the different sub populations of people who die by suicide in terms of age, gender, occupation, social class and location. This means that different high risk groups may require different types of services.

### ***Suicide prevention helplines***

The seasonal patterns and days/ times of deaths by suicide in NI support the provision of a dedicated 24 hour helpline service for people who are suicidal, or for people who are concerned about someone who is suicidal. Such a service gives people who are suicidal and those who are concerned, a clear pathway for referral at the times of the day, night and weekends when the risk of death is highest, and as such this is an important element of a suicide prevention strategy, though the effectiveness of such services requires monitored evidence.

### ***Suicide prevention among non-health care professionals***

Suicide remains a relatively rare behaviour and many of those who die may not disclose their feelings to health care providers or have contact with health care professionals. It is therefore recommended that the providers of goods and services to people from high risk groups should receive training in communicating about suicide and suicide prevention work.

### ***Treatments and services for people with mental health disorders***

The findings from this study demonstrate the importance of continued investment in mental health services in NI. People with mental disorders should have timely access to evidence based treatments for mental disorders.

### ***Primary care***

Primary care remains the main gatekeeper to mental health services and is the main source of care prior to death by suicide. Efforts should continue to ensure the adequate resourcing of primary care, clear referral pathways to secondary mental health care services and training of practitioners in primary care in ways of facilitating the disclosure of suicidal thoughts.

### **Research**

#### ***The recording of information about suicides in NI***

The suicide database and self-harm register provides a unique and important opportunity to examine the impact of conflict on suicide and suicidal behaviour in a population emerging from a period of violence. The database of deaths from suicide should therefore be retained and kept up to date. There is however, a need for revised data collection procedures to ensure that the circumstances surrounding each death are recorded appropriately in order to examine patterns and trends. This should include the routine systematic collection and analysis of data on conflict exposure and deprivation, as well as the data required for the completion of psychological autopsies and international comparisons. It is also important that existing data, such as that contained within health and social care databases and the self-harm registry, is linked with the data on deaths by suicide. This would allow any patterns, risk factors and opportunities for intervention prior to death to be examined.

### ***Service evaluation***

Services for people with mental health disorders and/ or suicidal thoughts should have a theoretical basis and should be subjected to ongoing evaluation to establish their effects and impact.

### ***Understanding depression, mental health and suicide***

Further research is required into suicidal behaviour and into the associations between suicidal behaviour, mental health disorders and the impact of exposure to trauma or violence. The history of conflict and the associations between conflict exposure and suicidal behaviour make NI an appropriate place to examine these associations and the impact of interventions, treatments and broader social and health policies on mental health outcomes and suicidal behaviour.

### ***Research into the impact of community services***

There is a wide range of organisations in NI which provide services for people with suicidal thoughts. In addition, there are campaigns to destigmatise mental illness and promote the disclosure of suicidal thoughts. Given the impact of media portrayal of suicide it is important that this should be subjected to rigorous evaluation.

## Part 1. Individual Characteristics

### 1.1. Suicide statistics in Northern Ireland

A major source of preventable deaths in Northern Ireland, and worldwide, is where death by suicide has been involved. Deaths by suicide are only a small proportion of the number of suicide attempts. For every suicide there are estimated to be between 12 and 25 attempted suicides, with females being three times more likely than men to make an unsuccessful attempt (WHO, 2009). Suicide is the primary cause of premature death in mental health service users, and as such its prevention is of great concern to clinicians worldwide (McMyler & Prymachuk, 2008). The financial implications are far-reaching in terms of combined direct and indirect costs, with a yearly estimate of £9 billion in the UK (Thomas & Morris, 2003; Gilbody 2004). Northern Ireland is the sole region in the UK to have demonstrated an overall increase in recorded suicides in the last decade (Snowcroft, 2013; Tomlinson, 2012; NISRA, 2014). However, disparity in coronial reporting suggests unreliability, particularly with regard to those 'narrative' verdicts which are increasingly used in England, Scotland and Wales (Gunnell et al., 2011; Carroll et al., 2012). Such verdicts tend not to be used in NI where there is a single coroner's service, increasing the consistency of the recording procedures.

Within the framework of suicidal behaviour, service use may be considered either in terms of utilization in the presence of suicidal behaviour, or as a consequence of associated factors which may lead to suicidal behaviour, such as depression (Cheung & Dewa, 2007; Bethell & Rhodes, 2008). The pathway between medical presentations and suicidal acts is well documented, despite the behaviour being frequently unrecognized by health

professionals (Clark et al, 2008). However, ambiguity remains as there are few studies of non-medical presentations or uptake of services within the community and their association with suicidal behaviour (Hawton & Saunders, 2009). The past decade has seen significant increases in uptake with an estimated 20% of the population using mental health services either singularly or in combination with other services (Simon, Savarino, Operskalski, & Wang, 2006). When reviewing service use within a given population, specific issues require consideration, such as socio-demographic indicators, social perceptions, compliance and cost. Each of these can have a significant impact on the availability, potential and realized access to potentially life-saving treatment.

## 1.2. The Bamford Review and 'Protect Life-A Shared Vision'

The growing problem of suicide and its impact on communities in Northern Ireland influenced the 2002 launch of The Bamford Review by the Department of Health, Social Services and Public Safety (DHSSPS). The review sought to consider all aspects of equality and service delivery in accordance with the rights of those with mental health needs. Acknowledging the significant role and important influence of the community in promoting positive mental health it stated its commitment to:

'....review the strategy for mental health promotion, embracing public health measures to reduce mental illness and suicide.'

'...include detailed consideration of the linkages and interfaces between health and social care, education, culture arts and leisure, employment and housing, the complementary roles

of statutory and non-statutory services, and the issues surrounding multi-disciplinary and multi-agency working.'

Following the Bamford Review, the Department of Health, Social Services and Public Safety implemented the suicide prevention strategy 'Protect Life - A shared Vision' in 2006, with a key objective 'to reduce the suicide rate in Northern Ireland.' The report detailed the need for increased awareness and understanding of the issues surrounding suicidality in all areas of the NI population. Associations between suicide and gender, age, deprivation and socio-economic status, higher prevalence rates of suicide in urban rather than rural location were outlined, as well as the huge economic implications of suicidal behaviour on society in terms of both direct and indirect costs. The strategy targeted a 10% reduction in suicide by 2008 with a further 5% by 2011, and also aimed to achieve a significant reduction in cases of deliberate self-harm. Emphasis was placed on the need for inter-departmental collaboration and closer co-operation between voluntary, community and statutory settings, as well as continued training and development in medical, community and educational settings.

### 1.3. Mental Health

Mental disorders are the single biggest risk factor for suicide and it is estimated that 15% of those diagnosed with depression eventually take their own lives. Recent evidence has shown that Northern Ireland has some of the highest rates of mental health disorders, when compared with a range of other societies. The Northern Ireland Study of Health and Stress was the first study to provide representative estimates of a wide range of mental disorders in Northern Ireland based on validated diagnostic criteria. The study was part of the World Mental Health (WMH) Survey Initiative by the World Health Organization (WHO). This initiative was established to co-ordinate a series of epidemiological studies of mental

disorders using a standardised survey instrument and sampling methods in 28 countries around the world. The study used the Composite International Diagnostic Interview (CIDI) (Kessler et al, 2008) and obtained valid information about (a) the prevalence and correlates of mental disorders (as outlined in the Diagnostic and Statistical Manual of the American Psychiatric Association (APA, 1994) (b) the level of unmet need, (c) treatment adequacy and (d) the societal burden of mental disorders. The study found that over 39% of the Northern Ireland population met the criteria for diagnosis of a mental disorder at some point in their lifetime (Bunting et al., 2012a) and that over 23% of the population met the criteria for having a mental disorder in the past 12 months (Bunting et al., 2012). The current and lifetime rates of mental disorders in Northern Ireland are among the highest of those countries involved in the WMH initiative worldwide and lower than only the US (47.4%) and New Zealand (39.3%) (Bunting et al., 2012; Ferry et al., 2012a).

The risk factors for mental disorders in Northern Ireland are similar to those of other western countries, women were significantly more likely to have lifetime anxiety and mood disorders, men had significantly greater odds of having impulse-control and substance disorders. Age at interview was also significantly associated with having a disorder with an overall trend of decreasing odds as age increased. Individuals who were separated or divorced were more than twice as likely as those who were married to have anxiety, mood and substance disorders. Having a low or low-average income was associated with significantly elevated odds of having anxiety, impulse-control and substance disorders.

There is emerging evidence that the civil conflict may be associated with elevated levels of mental health problems in Northern Ireland. Individuals who stated that they had ever lived 'as a civilian in a place where there was ongoing terror of civilians for political, ethnic, religious or other reasons' were almost twice as likely to have mood disorders, and

more than twice as likely to have anxiety and impulse-control disorders as those who had not endured this trauma (Bunting et al., 2013). 37.4% of the population have experienced a conflict related traumatic event and this figure rises to 40.8% among the over 45s. Conflict related traumatic events were associated with a higher risk of mental disorders generally and a high risk of developing post-traumatic stress disorder specifically (Ferry et al., 2013, 2014). Ferry et al. (2011) estimate that around 27% of PTSD cases can be attributed to the conflict. Post-traumatic stress disorder was estimated to cost the Northern Ireland Economy £172 million in 2008 alone (Ferry et al., 2011). There is also evidence that people in NI who have experienced conflict related traumatic events are more likely to have suicidal ideation and plans than those with other types of traumas, even when the effects of mental disorders are controlled for (O'Neill et al., 2014). In addition, school children in NI who have reported having experienced the conflict have higher rates of self-harm (O'Connor et al., 2014).

#### 1.4. Primary Care

In addition to mental disorders, people with physical disorders have an increased risk of self-harm and suicide (Singhal et al., 2014). Health service contact offers an opportunity for the delivery of suicide prevention interventions; however, the inconsistencies in the recording of suicides have resulted in few studies of the patterns of health service use prior to death by suicide. Studies of UK primary care contact prior to suicide demonstrate that certain populations, younger people and females, are more likely to present to their General Practitioner prior to death (Power et al., 1997; Stark et al., 2012). Studies of all health service use has shown that a greater proportion of individuals who die by suicide have contact with primary care providers than with mental health specialists (Luoma et al., 2002). Secondary care service users also continue to access primary care services in the period

prior to death by suicide (Pearson, et al, 2009). The objective of the current study was to examine the characteristics and service use history of those who died by suicide in NI, as well as mental/ physical diagnoses at time of death.

## 1.5. Risk Factors and Services

It is difficult to detect imminent suicide; however, an awareness of the epidemiologically determined risk factors is useful in particular for primary and secondary prevention efforts. Understanding the impact of service use and suicidal behaviour make it easier to tailor suicide prevention efforts, improve treatment, and ensure targeted information that may accommodate a positive outcome. Clinicians play a key role at the point of access to treatment, with an opportunity to ascertain ideation history, interpersonal stress and coping factors, in addition to predictive factors such as marital status, age and employment status.

More widely, the reduction of stigma attached to help seeking for mental health problems or suicidal behaviours may also play a role, as it may be likely that a reduction in mental health disorder symptomatology could reduce suicidal behaviour (Centre for Substance Abuse Treatment, 2008). Compelling results emphasising the immediacy of need for assessment, intervention and prevention of suicidal behaviour have prompted a direct response from the World Health Organisation's statement on suicide prevention, highlighting the need for adequate treatment of suicide risk in people with mental illness (Bertolote & Fleischmann, 2009). Such steps are driving forward primary, secondary, and tertiary prevention strategies at both universal population level and to targeted populations.

Previously, a lack of interface between substance abuse and psychiatric services hindered recognition of co-occurring disorders in patients attending for treatment. This gap has narrowed with the development of inclusive community care initiatives for those with

mental health disorders, thus highlighting the additional risks of self-harm and substance abuse (Abou-Saleh & Janca, 2004).

While the pathway between medical presentations and suicidal acts is well documented (Nada-Raja et al, 2003; Clark et al, 2008), ambiguity remains in the area of non-medical presentations as well as uptake of community services in relation to their association with the behaviour (Hawton & Saunders, 2009). Retrospective research has reported that while visits to General Practitioners may increase prior to the final act, a high percentage of these visits are recorded as having a medical basis rather than to address mental health issues (Appleby, 1996). It is estimated that 20% of the population use mental health services Simon, Savarino, Operskalski, & Wang, 2006); as such, treatment options for mental health issues can be collapsed into two categories of medical and non-medical services, operationalised as those who can prescribe pharmacological support and those who offer differing levels of non-medical support such as counselling or community care.

## 1.6. Prior suicidal behaviour and completed suicide

Strong links between self-harm and suicides have been identified, as has an association with suicidal ideation (Hawton & James, 2005). Deliberate self-harm is associated with psychiatric and personality disorders and their co-morbidity, and suggests a continuum of self-harming behaviour which may culminate in a suicide attempt. An extension of this supposition is supported by research suggesting that suicidality may be considered a continuum of behaviour beginning with an endorsement of suicidal ideation and ending with a serious attempt to take one's own life (Lester, 2000).

This report indicates that whilst suicide prevention efforts typically target the young, the average age of the individuals in this population was 40 years and the rates of suicide

were highest in those aged 20-50 years. The cohort of people who were most at risk of suicide several decades ago continue to remain at risk as they grow older. In NI, this is the population who witnessed the years of the conflict when violence was at its peak. Several theorists have elucidated an association between exposure to violence and the enactment of suicidal ideation (Klonsky and May, 2014; Joiner 2005; O'Connor, 2011). The possible link between suicide and the conflict is supported with the evidence of the role of the conflict in elevating the rates of mental disorders (Bunting et al., 2013; Ferry et al., 2013) and the links between conflict related trauma and suicidal behaviour (O'Neill et al., 2014). This is in keeping with Tomlinson's (2012) contention that the increased rates of suicide in NI since the peace agreement are a consequence of the decline in social cohesion and social connectedness which was characteristic of the conflict. The breakdown in social connectedness, along with exposure to violence and high levels of mental disorders may have promoted the increase in suicide rates.

## 1.7. Employment status and Occupation

Increasingly, aetiological theories of suicide acknowledge the role of life stress in the development of suicide behaviours (Foster, 2011; O'Connor, 2011). Employment status is likely to represent one such factor since a litany of studies has demonstrated a link between unemployment (e.g. job loss or long term unemployment) and suicidality (Eliason & Storrie, 2009; Lundin & Hemmingsson, 2009; Schneider et al., 2011). Nonetheless, employee suicides have begun to receive growing public interest; studies show that specific occupational groups may be more susceptible to compromised mental health, an important intermediary of suicide behaviour, as well as suicide attempt and death (Hawton, Agerbo,

Simkin, Platt, & Mellanby, 2011; Meltzer, Griffiths, Brock, Rooney, & Jenkins, 2008; Milner, Spittal, Pirkis, & LaMontagne, 2013).

Much of the research thus far has demonstrated a higher burden of suicide amongst medical professions such as doctors, nursing staff, veterinarians as well as pharmacists and a range of other medically related occupations (Bartram & Baldwin, 2010; Hawton, Agerbo, Simkin, Platt, & Mellanby, 2011; Meltzer, Griffiths, Brock, Rooney, & Jenkins, 2008; Platt, Hawton, Simkin, & Mellanby, 2010). For instance, in one Danish national study, Hawton et al (2011) postulated that the risk of suicide would be higher amongst medical occupations than both teachers and the general population. Using data spanning 1981-2006 they concluded that nurses, doctors and dentists respectively experience a greater risk ratio in comparison to both reference groups. Likewise, policing as well as those involved in agricultural occupations (e.g. farmers and farm labourers) have been found to exhibit a higher rate of suicide compared to other occupational groups (Browning, Westneat, & McKnight, 2008; Judd et al., 2006; Violanti, 2010). Several explanations have been proposed for these observed findings; most notably that access to means of suicide as well as habituation to death due to repeated exposure may enhance risk. Yet not all studies have substantiated these hypotheses (Skegg, Firth, Gray, & Cox, 2010) and moreover some studies fail to corroborate a heightened risk amongst certain highly skilled medical professionals such as veterinarians (Hawton et al, 2011).

Indeed, in contrast to the aforementioned research, studies have also demonstrated excess mortality within lower skilled occupations. In a recent systematic review, Milner, Spittal, Pirkis, & LaMontagne, (2013) synthesised information from thirty-four studies pertaining to occupational skill level and the association with suicide outcomes. From this, they concluded that there was a stepwise gradient in risk, with elementary or low skill

occupations displaying the highest level of risk. Roberts, Jaremin, & Lloyd (2013) drew similar conclusions regarding excess mortality within lower skilled occupations in Britain when examining occupational mortality rates over a 30 year period from 1979-2005. While excess mortality was originally documented for highly skilled occupational groups including veterinarians (ranked first), pharmacists (fourth), dentists (sixth), doctors (tenth) and farmers (thirteenth), they witnessed a decline in mortality within these groups from 2001–2005. They noted a corresponding influx in rates within manual occupations during the same time frame.

Unfortunately however, comparably fewer studies address risk within these lower skilled occupations (Milner et al., 2013). Furthermore, as Skegg, Firth, Gray, & Cox (2010) highlight, risk commonly varies across countries, and therefore corroborative findings are required in a variety of contexts. As such, this necessitates a corresponding assessment of risk within the context of Northern Ireland.

## Methods

This research project involves the analysis of data of a very sensitive nature. Accordingly, the researchers obtained ethical approval from the University of Ulster Research Ethics Committee prior to commencement of the study.

The electronic database was compiled by Dr Colette Corry. Following the required security checks and discussion with the Coroner's office, Dr Corry was granted permission to access the data files in the Coroner's office. Each case of undetermined death or ICD 'suicide' was given a unique code. In each case Dr Corry elucidated the required data from the file and entered it onto an SPSS data file encrypted using 'Ironkey Systems' ([www.ironkey.com/about](http://www.ironkey.com/about)) on a password protected laptop stored in a locked cabinet at the Coroner's Office. This data is also held in 'master and slave' format by means of secure USB flash devices which are encrypted by and held by both the Principal Investigator (Professor Brendan Bunting) and Dr Corry in locked cabinets in their respective offices on campus. In accordance with the University Of Ulster Code Of Practice for Professional Integrity in the Conduct of Research<sup>1</sup>, it is expected that data should be retained for more than 6 years. After this period it will revert to the Coroner's Office.

### 2.1. Report Aims

This report aims to examine the unique characteristics of completed suicides in Northern Ireland from 2004 to 2010 and the possible associations between area level variables. The proposed research will consider the geographical distribution of suicide in Northern Ireland, using data generated from the records of completed suicides in the NI Coroner's Office. As well as socio-demographic information, the report also aims to examine whether a possible

stepwise gradient in suicide risk exists among differing occupational skills levels by reporting the proportion of suicide deaths within each occupational group in Northern Ireland.

## 2.2. The database

Confidentiality and anonymity were of utmost importance; it was essential that the names and personal details of the deceased could not be identified from the data file. Names and other identifying features were not included in the database. Address information was encrypted to numeric coding. Unusual cases were collapsed into the category 'other' to protect the anonymity of the deceased. Each case was given an individual code, the names and personal details linked to each code are known only to the staff of the Coroner's office. Both the research team at the University of Ulster and the staff at the Coroner's office are bound by a strict code of confidentiality. The research team at the University of Ulster are also bound by the ethical codes of the British Psychological Society and have completed training in Good Clinical Practice.

The data on location was transformed into an anonymised format suitable for Geographic Information Systems analysis by generating 'x/y' coordinates. Data was derived from the NI Coroner's office, in agreement with the Lord Chief Justice (Declan Morgan) and Mr Justice Weir (Presiding Coroner). Demographic information was gathered on those deceased through suicide. Spatial location information was determined through geo-referencing of individual full or partial postal address records e.g. house number, street, town/townland, county and unit postcode). Each record was allocated unique geographic X and Y (Irish grid) co-ordinates and a Census Output Area (COA) ID using the Land and Property Services' 'Pointer' address Geo-coding database, and saved as an ESRI shape file for mapping and analysis in a Geographic Information System (GIS). Individual records were

identified in the database using only anonymous numeric ID's and do not contain any specific address information that would lead to the identification of any particular individual. Area-based socio-economic information such as the Noble area deprivation scores (available from the Northern Ireland Statistics and Research Agency – NISRA) was appended to the anonymised individual records using the relevant Census Output Area code. The specific x and y coordinates were used in the GIS for basic mapping purposes and for geo-statistical analysis to investigate the presence/absence of spatial clustering in the data. Individual anonymity and Data Protection legislation requirements are assured, as name and address information was removed from any datasets used in the project and individuals are recorded only by an anonymous (but unique) numeric ID and an X and Y coordinate.

### 2.3. Data Structure

Northern Ireland is divided into 890 Super Output Areas. Information was obtained at the level of postcode, nested within a number of higher level structures. The data within much of this nested structure was linked to information obtained from the Census. Deaths from suicide and misadventure within each of the Super Output Areas were recorded from information held by the Coroner's Office.

Postcode information was linked to COA, SOA, Wards and LGDs. At the postcode level, information was obtained on the person's age, sex and related socio-demographic information. The data was structured according to the number of deaths per year.

## 2.4. Data Items

Data was accessed through coronial files which contained cause of death, demographic information and personal history. Police reports and statements from the bereaved also provided important information on events surrounding death; levels of available information varied from case to case. Table 2.1 illustrates data items accessed at three levels: cause of death, demographic information and personal history.

**Table 2.1. Data accessed from coronial records**

Cause of Death	Demographic Information	Personal History
Coroner's verdict, with or without an inquest	Gender	Prior adverse event
		Family and personal history
		Stressful or traumatic life events
Official cause of death	Date of birth	Prior physical health diagnoses with prescribing history
Toxicology results including prescribed or illicit drugs, and alcohol levels	Marital status	Contact with services (primary, secondary, tertiary)
	Living arrangements	Treatment history
	Employment status	
Method of suicide	X/Y geographical coordinates	Prior psychiatric health diagnoses with prescribing history
Presence of suicide communication (note, text etc)	Ethnicity/Nationality	Enquiry case notes (death in tertiary care/custody/services)

## 2.5. Analyses

Multinomial logistic regression was used to examine associations between socio-demographic indicators and the contact with services prior to death. The reference categories were: males, contact with tertiary level services, last contact with services over one year and single marital status. Age was based on the mean age. 'Last point of service' considered the last time contact with services was made by the deceased, while 'level of contact' classified whether that treatment was primary, secondary or tertiary. A code of "none" in last point of service use includes those cases where no information on service use was available. Three mutually exclusive diagnostic outcomes were defined: (a) the presence of mental health disorder, (b) the presence of a physical health disorder, and (c) presence of both physical and mental health disorder. Analyses were implemented using the IBM SPSS package (IBM Corporation, 2012).

For the purpose of the analysis on occupation, only individuals in employment at time of death were selected (35%; n=583). An identification code demarcating the roles and responsibilities of each occupation was attached to the job title of the deceased prior to their death. This process was facilitated by information supplied by the Office of National Statistics (Office of National Statistics). This enabled the re-formatting and grouping of these codes into nine standardised occupational groups in accordance SOC 2011 guidelines (Office of National Statistics). These nine occupational groups are outlined below and differentiated by level of qualifications, training and skill required.

1. Managers, directors and senior officials
2. Professionals
3. Associate professional and technical occupations
4. Administrative and secretarial

5. Skilled trades
6. Caring, leisure and other service occupations
7. Sales and customer service
8. Process, plant and machine operatives
9. Elementary

### 3. Classification and socio-demographic pre-disposing risk factors

Note: In 2011 NISRA (NI) adopted a change in the classification of deaths in line with World Health Organisation (WHO) new coding rules. The change results in some deaths previously coded under 'mental and behavioural disorders' now being classed as 'self-poisoning of undetermined intent' and therefore included in figures 3.1. Theoretically, this could mean that more deaths could be coded with an underlying cause of 'event of undetermined intent', which is included in the national definition of suicide. A total of 1682 deaths occurring between 2005 and 2011 were examined, within the current analysis. Of these, 1398 were classified as suicide, the remaining 284 as undetermined cause of death.

#### 3.1. Age and gender

Men were notably overrepresented among those who died by suicide (78%), with an overall average age of 40.3 years (SD=16.04). Men were also younger (mean=39.7, SD=15.9) than females (mean=42.1, SD=16.1) at time of death (p-values <0.01). Males were overrepresented in the younger age groups while the inverse was seen for women. The highest incident rate in women occurred among those aged 35-44years, while for men those aged 16-24 demonstrated higher proportions. The lowest overall rates were seen in those aged 65 years and over (Figure 3.1.).

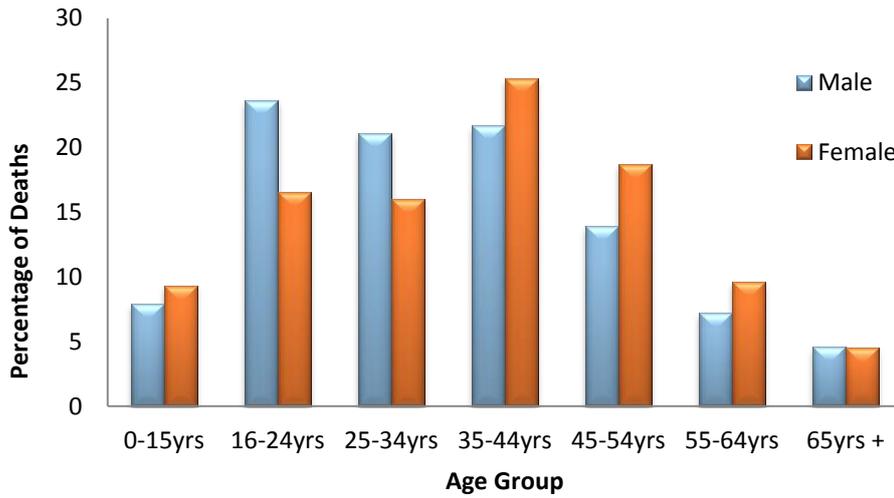


Figure 3.1. Age and gender distributions of completed suicide

### 3.2. Marital Status

Almost half of the deceased were single at time of death (47%), while 22.9% were married.

A total of 17.5% had experienced a marriage breakdown, with 9% co-habiting in either a heterosexual or same sex relationship.

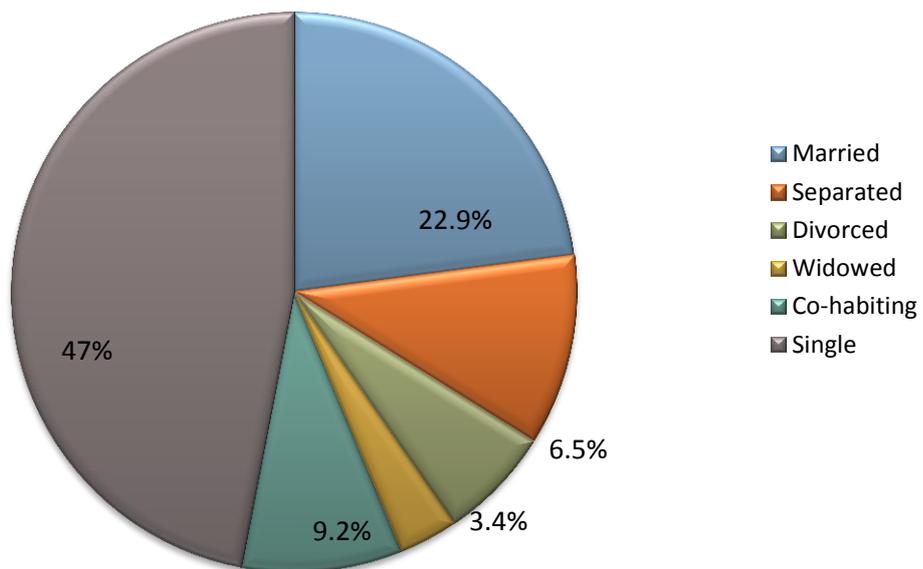


Figure 3.2. Marital status at time of death

### 3.3. Living arrangements

Almost a third of those who died by suicide lived alone at time of death (31.4%), while 22.8% lived in the parental home. This included both younger individuals and those who returned to the family home in adulthood. More than two fifths lived with a spouse (21%), with 9% co-habiting in a marriage-like relationship.

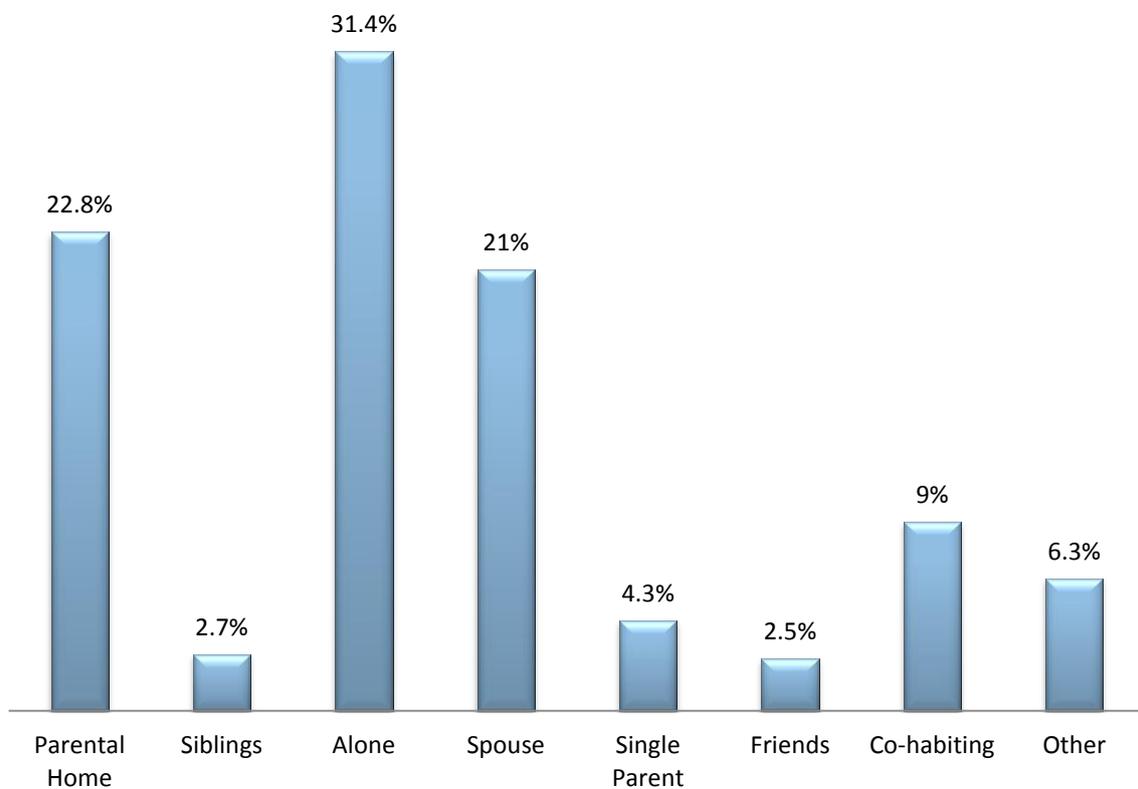
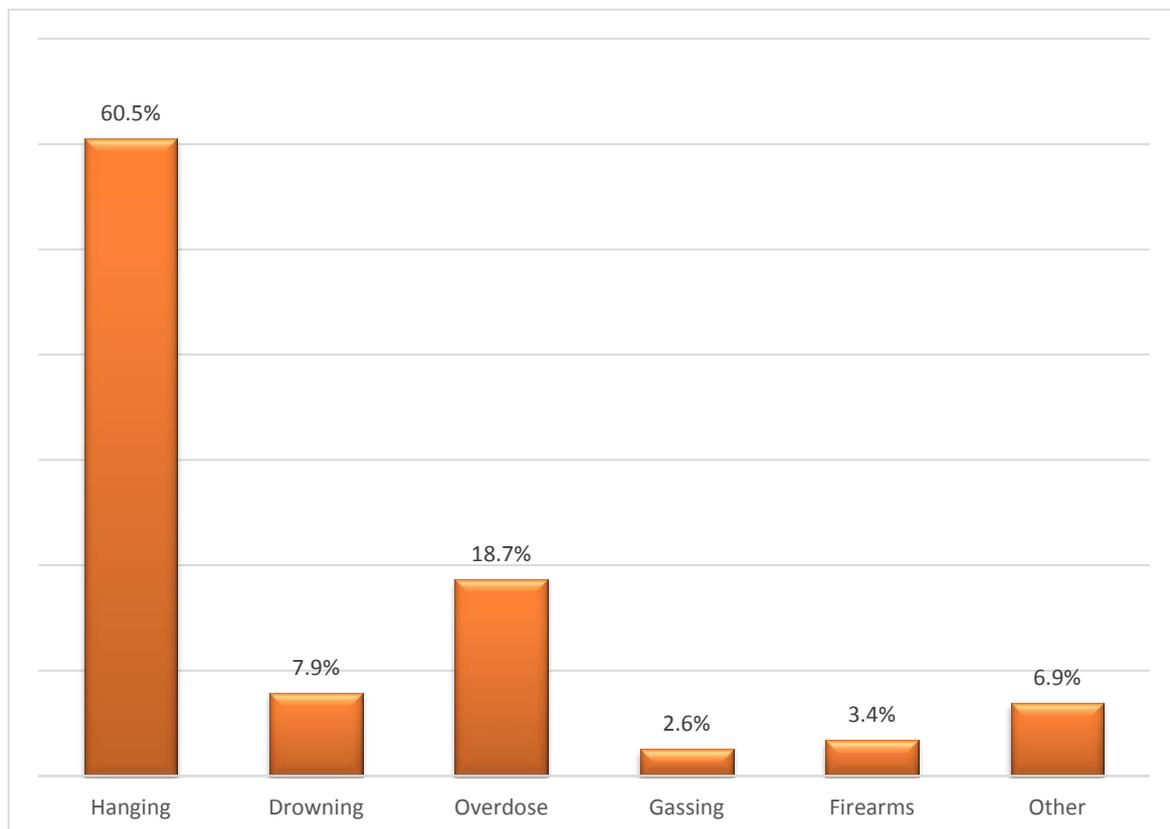


Figure 3.3. Living arrangements at time of death

### 3.4. Means of death

More than half of those who died by suicide did so through hanging (60.5%), of which 83.3% were male. A further 18.7% died following overdose, the majority of these (31.6%) being female. Drowning accounted for 7.9% of all suicides, with men more than twice more likely

than women to choose this method of death (71% and 29% respectively). Of the 3.4% who died using a firearm, 95% were male. The smallest proportion of deaths (2.6%) was attributed to carbon monoxide poisoning or 'gassing.' Those who died by 'Other' means included jumping from a height, stepping in front of a train and cutting.

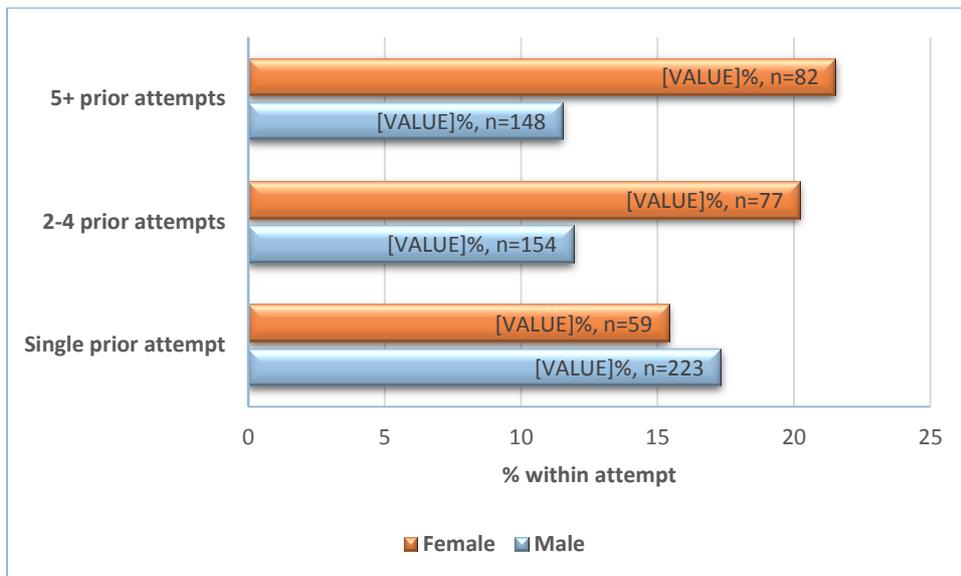


**Figure 3.4. Chosen method of suicide**

### 3.5. Characteristics and prior suicidal behaviour

More than one third (37%) of the deceased had prior suicide attempts recorded in official documents, either through medical or police records or via witness statements. Of these, almost one fifth (18%) were known to have made two or more suicidal gestures prior to the fatal event.

Statistically significant gender differences were identified with regard to number of previous suicide attempts (Figure 3.5). Males were more likely to have made only one previous attempt compared to females (17.3% and 15.4%). This finding prevailed among individuals who made 2-4 prior attempts and those who made five attempts or more.



**Figure 3.5.** Prior suicidal behaviour

Over two thirds of the deceased (66.3%) had not provided a suicide note or any communication regarding their plans for suicide. The most common means of communication was a handwritten suicide note (26.6%). Text messages were sent by 4.5% of the cohort (the majority of these were sent by people aged less than 40 years). Almost an equal proportion of males and females who communicated a prior suicidal intent did so by means of a handwritten note (22.8% and 23.1% respectively). Males were more likely to send a text message prior to death than females with 4.5% choosing this option in comparison to 1.9%. Females, however, were more likely than males to make a telephone call prior to their demise (0.8% compared with 0.5%).

### 3.6. Alcohol intoxication at time of death

The legal driving limit in Northern Ireland is 80 milligrams of alcohol in 100 millilitres of blood or 107 milligrams of alcohol per 100 millilitres of urine. This was chosen as a means by which to assess intoxication levels prior to death. There was evidence of alcohol in the system of 41% of the deceased at the time of post mortem. Males were more likely to have taken alcohol (46%) than females (33.9%). In certain cases, for example death by drowning, it would not have been possible to assess alcohol levels post-mortem. The majority of the deceased did not have alcohol present at time of death (45.1%), particularly those in older age categories (61.3% aged between 60 and 69 years, and 67.5% aged 70 years and over). Those aged between 20 and 29 years were less likely to have a zero blood/urine alcohol reading (36.3%) than other age cohorts. The youngest age group (between 10 and 19 years) had the highest proportion of individuals with twice the legal limit of alcohol in their system (19.8%). Amongst this group of individuals a substantial number had over three times the legal driving limit (16.7%) of alcohol in his/her system. Those in the age groups 20-29 years and 40-49 years were most likely to have blood/ urine alcohol levels of up to four times the legal driving limit (7.7% in both groups). This pattern was similarly observed for the 40 to 49 years cohort with readings of up to five times the Northern Ireland drink driving limit (2.5%).

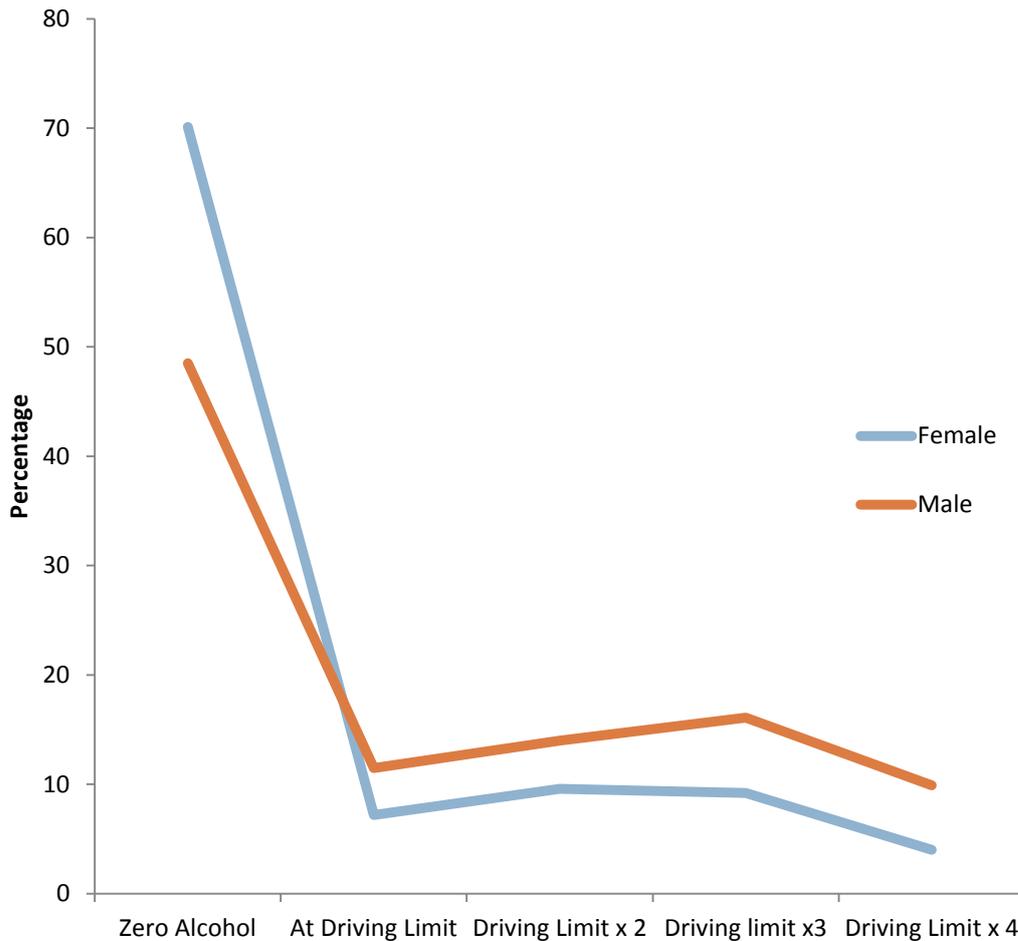


Figure 3.6. Postmortem alcohol reading

### 3.7. Prescription medications at time of death

Medical details, including any existing medical conditions and the names of medications that had been prescribed, were provided by the General Practitioners (GPs) or doctors of the individuals following their death. Prescription details were unavailable for 18% of the sample, therefore analysis was carried out on the remaining 1,371 cases. The majority of these cases was male (78.3%), while the mean age was 39.96 years old. The prescription medications were then coded according to the British National Formulary (BNF), which classifies medications according to the system of the body upon which they act (Joint

Formulary Committee, 2013). These medications were coded according to their typical licensed use. Unlicensed uses and specific combination uses were disregarded. If the medication was not contained within the BNF, such as those that have been discontinued, it was coded according to the most relevant category. Medications with different purposes or multiple BNF categories were coded in consultation with the person's medical notes.

Almost two thirds (65.1%) of the sample had been prescribed a medication (Table 3.1.). Antidepressants were the most common (37.3%), followed by hypnotics/anxiolytics (28.2%). Females (78.2%) were more likely than males (61.5%) to have been taking any medication,  $\chi^2 (1, N = 1,371) = 27.8, p < .001$ . Females were also more likely to have been taking each of the most common types of medication as well as taking a greater number, with almost half (46.3%) prescribed more than three medications. There was also a significant association between age and prescribed medications.

The majority of those aged 65 and over (91.2%) had been prescribed a medication prior to their suicide and were the group most likely to be prescribed a greater number of medications with 64% prescribed more than three. However, there were variations in the types of medication prescribed, with the 50-64 year old age group rather than the oldest group of individuals most likely to have been prescribed antidepressants, analgesics and antipsychotics. Antidepressants were included in many of the most common medication combinations, these were taken exclusively by 8.5% of the sample, in conjunction with hypnotics/anxiolytics by 2.5% and alongside antipsychotics by 1.9%.

Just over half of the sample (51.7%) had been prescribed medication relating to a mental health disorder, with one fifth (20.2%) taking a mental health medication exclusively. A smaller proportion of individuals (45.2%) had taken a medication for a physical condition,

with 13.6% taking a physical health medication exclusively. Almost one third (31.6%) of the sample had been prescribed medications for both mental and physical health conditions.

**Table 3.1. Most commonly prescribed medications**

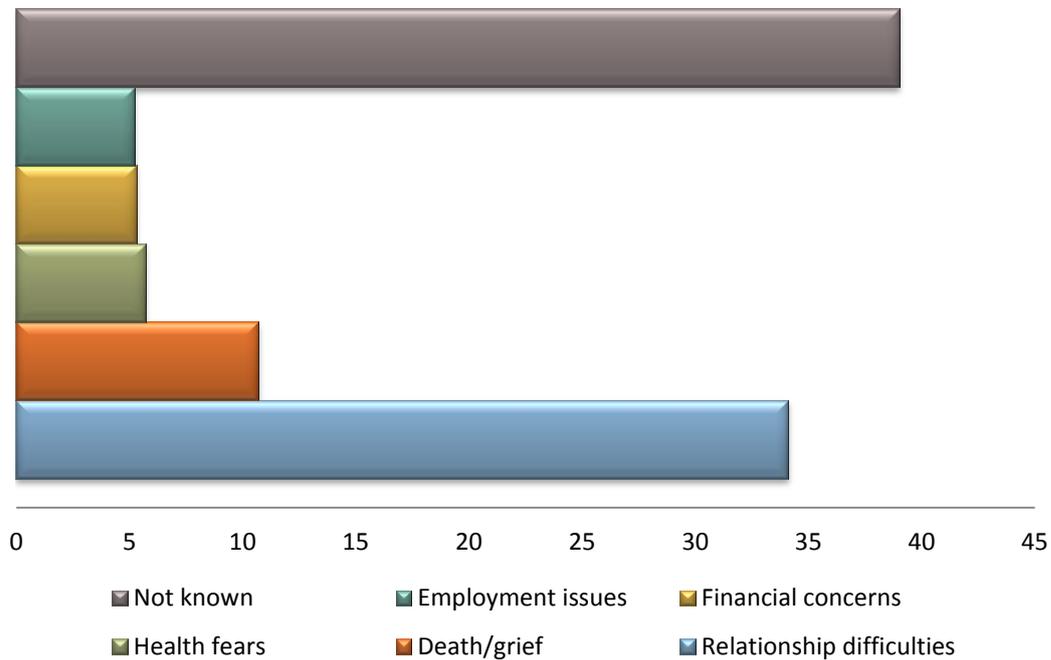
	Any (%)	Gender (%)			Age (%)					$\chi^2$
		Fem	Male	$\chi^2$	<25	25-34	35-49	50-64	65+	
<i>n</i>	1,371	298	1,073		277	288	436	256	114	
Any medication	65.1	78.2	61.5	27.8* **	35.7	60.1	68.6	85.2	91.2	190.3***
Antidepressant	37.3	53.7	32.8	42.6* **	16.6	32.3	44.3	52.7	39.5	89.1* **
Hypnotic/anxiolytic	28.2	40.9	24.6	30.0* **	6.9	18.1	35.3	42.6	45.6	131.2***
Cardiovascular	17.7	23.8	16.0	9.2**	0.7	4.5	16.7	32.4	63.2	289.0***
Analgesic	15.2	22.1	13.2	13.7* **	2.9	9.0	17.7	28.5	21.1	81.5* **
Gastrointestinal	14.8	19.5	13.5	6.1*	2.2	6.6	16.3	26.2	35.1	114.6***
Antipsychotic	14.4	23.2	11.9	23.0* **	6.9	13.9	15.8	19.5	16.7	19.5* **
Number of medications prescribed										
1	20.6	18.8	21.1		22.4	28.8	19.0	14.5	14.9	
2	13.9	13.1	14.1		8.7	14.9	15.1	16.8	12.3	
3+	30.7	46.3	26.4		4.7	16.3	34.4	53.9	64.0	
Common medication combinations										
Antidepressant only	8.5	9.1	8.3		7.6	14.2	9.4	4.3	1.8	
Hypnotic/anxiolytic only	3.2	2.0	3.5		1.4	4.2	3.4	3.9	2.6	
Antidepressant and hypnotic/anxiolytic	2.5	2.0	2.6		2.5	1.0	3.2	2.3	3.5	
Antidepressant and antipsychotic	1.9	3.0	1.6		1.8	3.5	1.4	2.0	0	

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$

### 3.8. Adverse events prior to death

Information pertaining to events precipitating death was gathered from numerous sources within coronial files, such as family statements generated by attending police officers or doctors reports. Either singly or in combination, 61% of cases had experienced adverse events prior to suicide. Relationship difficulties were noted as the primary adverse event experienced by the deceased (34.1%). This category included those who were both married and co-habiting and also a small proportion that were known to be in a same sex relationship. Relationship discord and breakdown were mutually exclusive, as were discord and breakdown with reported incidence of violence. Death/illness included, among others, spouse, family members, romantic partner and in one case a family pet (10.7 %). Fears for own health was of particular concern to those with chronic health conditions or a recent diagnosis (5.7%). Financial crisis included reports of recent job loss or bankruptcy, debt worries and business failure (5.3%), while employment worries related to issues such as fear

of redundancy and pending disciplinary action (5.1%).



**Figure 3.8. Percentages of adverse events experienced prior to death**

### 3.9. Employment status and Occupation

Approximately 35% (N=583) of those who died by suicide were employed at time of death compared to 50.3% who were classified as unemployed (including unemployed, retired, student, homemaker). For the remainder of the sample, no information concerning the employment status of the deceased was available. Descriptive statistics relating to employment status, gender and mental health diagnosis for individuals who were in employment at time of suicide in Northern Ireland are presented in Table 3.9. The mean age of deceased employees was 37.46 years (s.d.=12.5). Of those who were employed, males represented the highest proportion of suicides equating to 84% of the sample compared to 16% of females who were employed at the time of death. Fifty percent (50.1%) of these individuals had at least one diagnosed mental health condition prior to death.

**Table 3.9. Demographic Statistics for employee suicides**

Employed ( Y / N)	(34.8% / 50.3%)
Gender (F/ M)	(16.0% / 84.0%)
Mental Health ( Y/ N)	(50.9% / 49.1%)
Married	28.1%
Separated	11.8%
Divorced	5.5%
Widowed	1.0%
Co-habiting	12.7%
Single	40.3%

Table 3.10 illustrates the occupational breakdown of employee suicides disaggregated by gender from 2005-2011. For the combined years, skilled and elementary workers represented the highest proportion of employee suicides accounting for 26% and 20.1% respectively. Thirty point one percent of male employee suicides were involved in skilled occupations at time of death compared to 4.3% of female employees. Comparably, 21.9% of employed male suicides and 10.8% of employed female suicides were working in elementary occupations prior to death. The highest proportion of female suicides was documented for those employed in professional occupations (21.5%). In addition, the greatest proportion of mental health diagnoses was noted for individuals employed in skilled and elementary occupations (20.9%, 18.5%) respectively.

**Table 3.10. Occupational percentage breakdown by year of death, mental health diagnosis and gender**

Year	Manag.	Profes.	Assoc. P	Admin	Skill	Service	Sales	Process	Elementary
%									
2005	7.2	2.4	13.3	7.2	34.9	4.8	3.6	10.8	15.7
2006	7.1	6	10.7	4.8	26.2	4.8	3.6	11.9	25
2007	7.5	8.8	8.8	6.3	18.8	8.8	12.5	12.5	16.3
2008	5.8	4.7	4.7	2.3	29.1	2.3	5.8	14	31.4
2009	5	10	6.3	6.3	27.5	5	10	13.8	16.3
2010	6.7	5.6	4.5	5.6	24.7	9	7.9	21.3	14.6
2011	1.3	16.5	2.5	5.1	20.3	6.3	10.1	16.5	21.5
Total	5.9	7.6	7.2	5.3	26	5.9	7.6	14.5	20.1
Male	5.9	4.9	8	2.9	30.1	3.3	6.6	16.4	21.9
Female	5.4	21.5	3.2	18.3	4.3	19.4	12.9	4.3	10.8
Mental health Diagnosis	8.1	9.1	6.7	8.8	20.9	7.7	8.1	12.1	18.5

Manag. = Manager; Profes. = Professional; Assoc. P = Associate Professional; Admin= Administrative

Within each year, amongst those who were employed, the findings revealed a consistently higher proportion of suicides within skilled and elementary occupational groups. For instance in 2008, elementary and skilled occupations represented respectively 31.4% and 29.1% of employee suicides in that year. However, within each occupational group, the percentage of suicides varied by year; for instance, the percentage of those who died by suicide within managerial groups peaked in 2007 (7.5%) and then gradually declined in the following years. At this time, the observed percentage was the lowest documented for all of the occupational groups at 1.3%. Similarly rates declined for associate professional occupations.

In contrast, the percentage of suicides denoted by professional occupations was lowest in 2005 accounting for 2.4% of suicides within this category. However, this increased

to 16.5% of suicides in 2011, yet professional occupations represented a smaller proportion of suicides overall (7.6%). In 2008, for both skilled and elementary workers, there was a sharp fall in deaths from the previous year (skilled 18.8 vs 29.1) (elementary 16.3% vs 31.4%) and the decline continued from that year onwards.

## 4. Use of Health Services and Diagnosis Prior to Death

### 4.1. Gender and service use

Women were more likely to present themselves to personnel within the Health Service in the period up to 14 days before end of life, relative to men (23.9% vs 18.2% respectively), ( $n = 326$ ) ( $\chi^2 = 6.12, p < .05$ ), as shown in Table 4.1. A higher proportion of men had not utilised any service in the year prior to death (3.1% vs. 1.1%), ( $n = 47$ ) ( $\chi^2 = 5.41, p < .05$ ). Similarly, a statistically significant difference was found for gender and use of secondary and tertiary services (specialized consultative care). Men were more likely not to progress beyond primary service level (52.6% of men compared with 41.8% of women), ( $n = 839$ ) ( $\chi^2 = 13.67, p < .01$ ). In contrast, females were more likely to utilise secondary level services, ( $n = 406$ ) ( $\chi^2 = 5.24, p < .01$ ). This gender difference in services used was also evident for tertiary care, with higher rates of use among females ( $n = 98$ ) ( $\chi^2 = 5.01, p < .05$ ).

**Table 4.1. Last point of service use and service level prior to death**

Service Profile		Total %	n	Men	n	Women	n	$\chi^2$
Last Service Use	1-2 weeks	19.5	326	18.2	236	23.9	90	6.12*
	2 wks-2 months	9.9	165	9.7	126	10.4	39	0.14
	2-6 months	6.8	113	7.2	93	5.3	20	1.58
	6 months – 1 year	2.8	47	3.3	43	1.1	4	5.41*
	1 year >	3.2	53	3.5	46	1.9	7	2.69
	None/Not known	57.9	969	58.1	753	57.4	216	0.05
Service Level	Primary	50.1	839	52.6	682	41.8	157	13.67**
	Secondary	24.3	406	23	298	28.7	108	5.24**
	Tertiary	5.9	98	5.2	67	8.2	31	5.01*

\* $p < .05$ ; \*\* $p < .01$

## 4.2. Age and Service Use

For around 40 to 50 percent of deaths we had no record of the person having approached health services. Engagement with staff within the health service was higher amongst those over 40 years with close to 20% engaging with services in the week before death (19.9%), however associations with age group failed to reach statistical significance ( $\chi^2 = .08$ ,  $p > .05$ ). The highest overall service presentations were recorded in those over 70 years (27%). A similar pattern emerged for this age group with regard to help seeking in the month prior to death, while those aged between 20 and 29 years engaged in services more frequently in the two months prior to death (8.2%). The 60-69 years age group were most frequent service users in the period up to four months preceding suicide (7%), while individuals aged

below 19 years were more likely to access services between six months and one year prior to death (6.6%) (Table 4.2).

**Table 4.2. Age group and Last Services**

Age Group	NK	Up to 1wk	1-2wks	2-4wks	1-2M	2-4M	4-6M	6M-1Yr	1 Year +	Total
Up to 19 yrs Count	72	22	5	8	5	6	6	9	4	137
% w/Age Group	52.6	16.1	3.6	5.8	3.6	4.4	4.4	6.6	2.9	100
% w/Last Services	9	7.1	5.9	6.5	4.9	8	10.2	13.6	8.3	8.2
20-29 yrs Count	180	45	19	29	30	23	14	17	11	368
% w/Age Group	48.9	12.2	5.2	7.9	8.2	6.2	3.8	4.6	3	100
% w/Last Services	22.6	14.5	22.4	23.4	29.4	30.7	23.7	25.8	22.9	22.1
30-39 yrs Count	166	59	13	19	21	15	16	13	12	334
% w/Age Group	49.7	17.7	3.0	5.7	6.3	4.5	4.8	3.9	3.6	100
% w/Last Services	20.8	19.	15.3	15.3	20.6	20	27.1	19.7	25	20
40-49 yrs Count	183	75	21	31	19	13	8	16	11	377
% w/Age Group	48.5	19.9	5.6	8.2	5	3.4	2.1	4.2	2.9	100
% w/Last Services	23	24.1	24.7	25	18.6	17.3	13.6	24.2	22.9	22.6
50-59 yrs Count	107	38	14	20	16	6	10	7	7	245
% w/Age Group	43.7	23.7	5.7	8.2	6.5	2.4	4.1	2.9	2.9	100
% w/Last Services	13.4	18.6	16.5	16.1	15.7	8	16.9	10.6	14.6	14.7
60-69 yrs Count	54	32	8	8	8	9	4	3	3	129
% w/Age Group	41.9	24.8	6.2	6.2	6.2	7	3.1	2.3	2.3	100
% w/Last Services	6.8	10.3	9.4	6.5	7.8	12	6.8	4.5	6.2	7.7
70+ yrs Count	35	20	5	9	3	3	1	1	0	77
% w/Age Group	45.5	26.6	6.5	11.7	3.9	3.9	1.3	1.3	0	100
% w/Last Services	4.4	6.4	5.9	7.3	2.9	4	1.7	1.5	0	4.6
Total Count	797	311	85	124	102	75	59	66	48	1667
% w/Age Group	47.8	18.7	5.1	7.4	6.1	4.5	3.5	4	2.9	100

### 4.3. Diagnosis prior to suicide

Under a third (31%) of the deceased had no recorded condition at time of death (n=510).

Combined physical and mental health conditions were recorded for 22% of the sample

(n=365), mental disorder only was recorded for 36% (n=599) while 12% (n=199) had

recorded physical health condition only (Table 4.3). Overall, 69% of all those who died by suicide had a diagnosed health condition.

Gender specific rates of mental, physical and combined conditions are also presented in Table 4.3. Women were significantly more likely than men to have a recorded health condition (75% vs. 67.8%,  $N = 1253$ ) ( $\chi^2 = 27.80$ ,  $p = <.001$ ). Women were more likely than men to have mental health condition only, however the difference was not statistically significant, (39.1% vs.34.8%, respectively). Almost twice as many men had physical condition only ( $n = 173$ ) ( $\chi^2 = 11.47$ ,  $p <.001$ ). In contrast, women were significantly more likely to have a combined mental and physical health disorders at point of suicide ( $n = 109$ ) ( $\chi^2 = 14.62$ ,  $p <.001$ ).

**Table 4.3. Prevalence of mental, physical and combined diagnoses prior to death**

Diagnosis	Total %	N	Men	N	Women	n	$\chi^2$
<b>Mental</b>	35.8	599	34.8	452	39.1	147	2.29
<b>Physical</b>	11.9	199	13.3	173	6.9	26	11.47**
<b>Combined</b>	21.8	365	19.7	256	29.9	109	14.62**
<b>None</b>	30.5	510	32.1	416	25	94	6.88*

\*\* $p < .001$  \* $p < .05$

#### 4.4. Risk factors associated with types of diagnosis in the deceased

Table 4.4 provides results of a multinomial logistic regression illustrating socio-demographic associations with health condition at time of suicide. The comparator group is comprised of individuals who did not have a mental, physical or combined health diagnosis as well as those for whom no information was available. When the effects of the demographic, socio-economic and service type variables were considered simultaneously, several associations with suicide emerged. Females were nearly 3 times as likely as males to have had both mental and physical health conditions, and they were at least twice as likely to have had a mental health condition when compared with those without a known condition. However, males were just as likely as females to have a recorded physical health condition.

Age was a significant indicator for all health conditions; a one year increase from the mean of 40.31 years produced an increased risk of .03 units for mental health disorder, .07 units for physical disorder and .07 units for combined mental and physical disorders ( $p < .001$ ). . Individuals who were married or co-habiting presented decreased risk of mental

disorder (over 50% less), while those who were divorced or widowed were over twice as likely to have both a recorded mental and physical disorder. Those with a recorded mental health condition were over two and half times as likely to be in receipt of services at primary care level prior to suicide when compared with those with no record of having used services within the last two weeks. Where the person had both a mental and physical health condition then the odds of attending health services within the previous two weeks before death was over four times that of a person who was without a record of having had either, or both, a mental and/or physical health condition.

Those with both a recorded mental and physical health condition were much more likely to have attended services within the time periods (1-2wks; 2wks – 2mths; 2mths – 6mths) when compared to those with no recorded health condition.

**Table 4.4. Multinomial Logistic Regression Analyses of Risk Factors Associated With Diagnosis compared to those without a known condition (reference category)**

Risk factor	Outcome 1: Mental health diagnosis		Outcome 2: Physical health diagnosis		Outcome 3: Combined mental and physical health diagnosis	
	OR	95% CI	OR	95% CI	OR	95% CI
Female	<b>2.2**</b>	1.4, 3.5	1.1	0.6, 2.0	<b>2.8**</b>	1.7, 4.4
Age <sup>a</sup>	<b>1.03**</b>	1.0, 1.04	<b>1.07**</b>	1.05, 1.09	<b>1.07**</b>	1.06, 1.09
Care level <sup>b</sup>						
<i>None</i>	<b>0.01**</b>	0.002, 0.04	<b>0.01**</b>	.001, .09	<b>0.02**</b>	0.01, 0.09
<i>Primary</i>	<b>0.1**</b>	0.01, 0.3	0.4	0.08, 2.4	<b>0.1**</b>	0.02, 0.4
<i>Secondary</i>	0.5	0.1, 2.3	1.3	0.2, 8.2	0.7	0.1, 3.2
Last point of service <sup>c</sup>						
<i>None</i>	1.3	0.6, 2.7	1.9	0.7, 5.4	1.9	0.7, 5.1
<i>1-2 weeks</i>	<b>2.6*</b>	1.1, 6.0	2.4	1.7, 7.5	<b>4.4**</b>	1.5, 12.6
<i>2 weeks – 2 months</i>	1.9	0.8, 4.6	2.9	0.9, 9.4	<b>4.4**</b>	1.5, 13.0
<i>2 – 6 months</i>	2.0	0.8, 5.0	2.5	0.7, 8.0	<b>3.3*</b>	1.0, 10.5
<i>6 months – 1 year</i>	0.4	0.1, 1.2	1.6	0.4, 6.1	1.6	0.5, 5.8
Marital status <sup>d</sup>						
<i>Not known</i>	0.02	0.004-0.1	<b>0.1**</b>	0.01, 0.5	<b>0.01**</b>	0.001, 0.1
<i>Married/cohabiting</i>	<b>0.6*</b>	0.4, 0.9	0.8	0.5, 1.3	0.7	0.5, 1.1
<i>Separated</i>	0.9	0.5, 1.6	0.5	0.3, 3.6	0.8	0.4, 1.6
<i>Divorced/widowed</i>	1.6	0.7, 3.8	1.3	0.5, 3.6	<b>2.4*</b>	1.0, 5.5

OR = Odds ratio; CI = Confidence interval.

<sup>a</sup>=Residual: age centred from mean = 40.3 years; <sup>b</sup>=Residual: Tertiary level care, <sup>c</sup>=Residual: 1 year upwards, <sup>d</sup>=Residual: Single.

\* $p < .05$ , \*\* $p < .01$

## 4.5. Conclusions based on individual characteristics

The highest proportion of suicides was among males, and younger males presented a higher risk relative to females, who demonstrated higher incidence rates in later years. As such, this report confirms the gender differences in suicide rates (Snowcroft, 2013). The increased proportion of suicides among older women should not be neglected. Women were more likely to have a history of suicide attempts, and had more recorded previous attempts than males. In keeping with the literature on gender and mental health service use (Kovess-Masfety et al., 2014), females were more likely to engage in help seeking behaviour, to receive referrals to secondary care, and to have a recorded mental disorder than males. At an overall rate of 58% male, 69% female, the proportion of those with a recorded mental disorder is relatively low, particularly for males, when we consider that psychological autopsy studies indicate rates of mental disorders of over 90% among those who die by suicide (Foster et al., 1997; Cavanagh et al., 2003; Mann et al., 2005); however, the role of mental health as a corollary to deaths from suicide is obvious.

The findings for occupation re-affirm that particular groups are likely to encounter a heightened propensity for suicide behaviours. Furthermore, the results also support a possible skill level gradient in risk with lower-middle skilled occupations encountering the greatest threat (Milner et al., 2013). Since previous research has failed to establish that lower socio-economic status may account for this finding (Milner et al., 2013), alternative explanations should be explored. For instance, at least for those who were employed at the time of death, the contribution of work stress may be one avenue of further investigation which may help clarify the risk differential between these groups. Indeed, a limited number of studies have begun to demonstrate a relationship between work stress (e.g. high demand and low control) with suicide outcomes (Ostry et al., 2007; Tsutsumi, Kayaba, Ojima,

Ishikawa, & Kawakami, 2007) and this is known to fluctuate by occupation (Bültmann, Kant, Schröer, & Kasl, 2002). Further research should also consider harassment at work as a possible stressor which may contribute to suicide risk given that negative acts at work have been implicated in stress responses previously (Hogh, Hansen, Mikkelsen, & Persson, 2012).

Males were less likely to receive services beyond primary care. There are a number of possible explanations for this. There is a wealth of evidence to indicate that men are reluctant to disclose mental health concerns with their General Practitioner and other health care providers (Snowcroft, 2013). Men were more likely than women to have a physical health diagnosis only, however their physical conditions may in fact reflect the physical symptoms of an undiagnosed affective disorder. Contemporary theories of suicide view suicidal behaviour as goal directed, as a means of addressing pain and distress (Klonsky and May 2014; Joiner 2005; O'Connor, 2011) and somatic symptoms are a key feature of depression. The patterns revealed in this report suggest that some men attended to the physical or somatic, symptoms of mental disorders such as depression or anxiety, rather than disclosing emotional distress or low mood. In addition, men may have been unwilling to recognise suicidal ideation as indicative of a mental health problem meriting disclosure. Further research on men's experience of mental disorder and the role of physical symptoms in depression and suicidal ideation is necessary to obtain an understanding of the barriers to help seeking in this group.

It may be argued that service contact within the two weeks prior to suicide represents an opportunity for intervention if suicidal ideation is assessed by clinicians and ideation reported. However only one in five of those who died by suicide in this report (18.2% and 23.9% for males and females respectively) presented to health services during this period of

time. In fact these results show that males had a tendency to disengage with services prior to death. Help-seeking should be promoted among those who are vulnerable to suicide, and supports the need to raise awareness of the benefits of disclosing mental health difficulties and suicidal ideation. Efforts to reduce the stigma of mental disorder and recognition of suicidal ideation as indicative of disorder, particularly among males, are therefore to be welcomed. The high rates of suicide across the age groups and the mean age of death (43 years) reflects current trends and creates concern regarding the mental health of this population cohort. The increased likelihood of service contact in those aged over 40 years and the high levels of presentations in those over 70 years may be seen to reflect increased opportunities for intervention. However when we examine the reasons for last contact, we again find that males are less likely to report mental health concerns and are more likely to seek treatment for physical health conditions.

This report shows that primary care remains the most common health service used in the period prior to death by suicide. This finding concurs with other studies of service use prior to death by suicide (Luoma et al., 2002; Pearson et al., 2009). Those with only mental disorders were more than twice as likely to have made primary care contact in the two weeks preceding death, while those with combined disorders were over four times more likely to have utilised services during this time. Being in contact with health services for physical illnesses in the last three months was associated with an increased likelihood of receiving help for mental-health problems. Primary care therefore continues to play an important role in suicide prevention and these findings add weight to the argument for enhanced screening for suicidal ideation in this setting. It remains important to strengthen clinicians' knowledge of specific manifestations of suicidal ideation which may or may not be identified by service users as related to mental health. The capacity of primary care services

to provide services to people who are suicidal also requires examination, particularly since many deaths by suicide occur outside of General Practitioner surgery opening hours.

This was the first time that coronial files were used to assess the characteristics and service use history of those who died by suicide in NI. The findings offer a unique insight into this population, and it is important that they inform suicide prevention policies and service delivery. In common with the rest of the UK, the data on suicide in NI is subject to issues of data reliability, most prominent perhaps the delay between death and registration. Also problematic is the issue of determining cause of death; this ambiguity was addressed in 1968 with the inclusion of an 'undetermined' category whereby suicide is implied. In this report, deaths categorised as undetermined as well as suicide were examined in order to obtain a more accurate indicator of the characteristics of those who die by suicide.

However there invariably remains a proportion of deaths by suicide which are not recorded in either category (Tomlinson, 2012). The data on marital status and mental and physical disorders was based on information recorded by police officers from relatives and other informants. Information on medical records was inconsistent and in some cases medical records were not available. As such, this report carries the risk of an under estimation of health disorders, related risk factors and history of service use. This key limitation highlights the need for improvement in the consistency of data collected following a death by suicide and where possible, clear protocols for the collection of information following a death by probable suicide. In NI, as with other parts of the UK, out-of-hours suicide prevention initiatives are also provided by counselling organisations such as "Lifeline" and support organisations, such as the Samaritans. Contact with these organisations was not routinely included in the records of the deceased and as such we have no consistent information on levels of contact with these services prior to death.

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## Part 2. Geographical Characteristics

### Empirical Bayes Standardised Mortality Ratios for Geographically Aggregated Deaths by Suicide

“There is but one truly serious philosophical problem, and that is suicide. Judging whether life is or is not worth living amounts to answering the fundamental question of philosophy. All the rest -- whether or not the world has three dimensions, whether the mind has nine or twelve categories -- comes afterwards. ... These are facts the heart can feel; yet they call for careful study before they become clear to the intellect.”

ALBERT CAMUS, *An Absurd Reasoning*

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## 5. Deaths by suicide from 1971 – 2011

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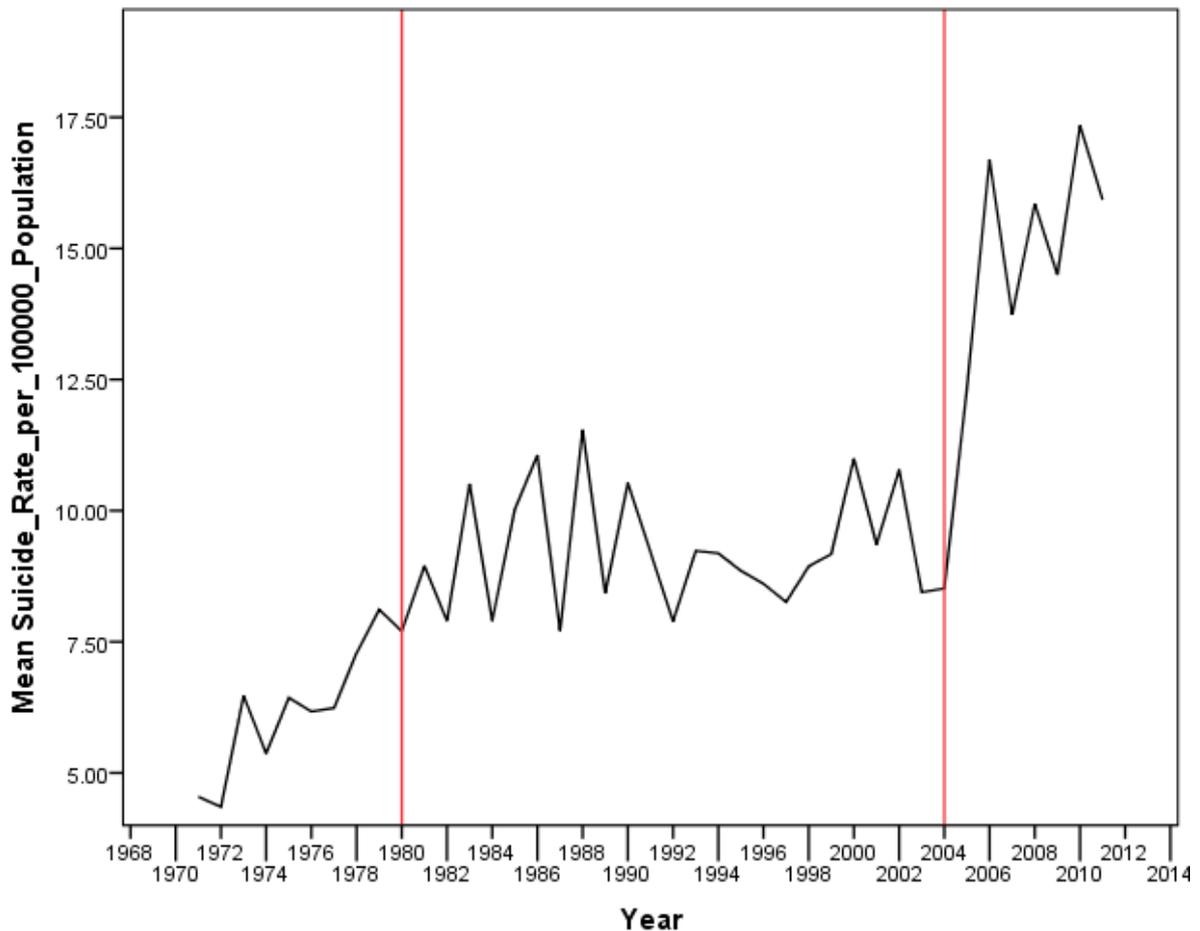
### Quick read

During a period of administrative change within the Coronial Service 2003 -2005, reported deaths increased by approximately one-third; in addition there appears to be a greater fluctuation in the number of deaths from year to year since this change. In the years from 2005 – 2011 inclusive, 15.7 deaths (SD = 1.35) were recorded, on average, for every 100,000 citizens. Amongst the adult population, over the seven years of the data examined in this report, approximately to 1 in every 1000 citizens has taken his or her own life.

Suicides in Northern Ireland have been increasing since at least 1971, and in general showed an increase across the years of the conflict. This is further compounded by the possibility that the number of deaths attributed to suicide before 2004 may have been substantially understated. In 2004, with the reorganisation of the Coronal Service in Northern Ireland, a substantial increase is apparent in the number of deaths per 100,000 of the population.

Deaths from suicide in Northern Ireland have tended to fluctuate by around 2 deaths per 100,000 between consecutive years, at least between the years 1980 to 2004 and 2005 to 2011. The overall UK figure for deaths from suicide is 11.6 deaths per 100,000 population (2012), and the area with the highest rate of deaths in England had a rate of 12.4 deaths per 100,000 in 2012. However, in certain age groups the figure was much higher with a suicide rate among men aged 40 to 44, at 25.9 deaths per 100,000 population. The 2011 figure for Northern Ireland, based on the figures in the current dataset, would indicate that the

Northern Ireland rate per 100,000 of the population was close to 16 deaths. The comparisons are difficult unless we adjust for the number of individuals in comparable age groups.



**Figure 5.1. Mean Suicide Rate per 100,000 of the population in Northern Ireland over the years 1971 to 2011**

In Northern Ireland the sudden increase in deaths through suicide between 2004 and 2005 occurred across all age groups. Because of data reported by NISRA it is possible to show that this was the case for where age was categorized within decades. Proportionately this increase was also present for both female and males. It is obvious that data can vary substantially between years by as much as 2 standard deviations.

There are many ways to measure morbidity. In the above, the numerator consisted of the number of deaths during a given year, and the denominator was the approximate population for that year. This rate was then calculated per 100,000 of the population. In this way comparisons across the years could be made. This is a high level of analysis, but even at this level it shows interesting societal changes and the potential influence of changes in administrative structures, especially between the years 2004 and 2005; not least by the influence of centralisation of Coronial reporting with a reduction from six area Coroners to one Office located in Belfast.

Within Northern Ireland the overall population data is further divided into LGDs and Wards (amongst others), and these can be further subdivided usually by gender and age. A key advantage of using these administrative data structures is that the number of individuals within a designated area can be approximated. This is important, especially where comparisons are going to be made, as the number of those living in a designated area needs to be taken into consideration. The current dataset contains deaths by suicide over a 7 year period (2005 to 2011), and in order to conduct analysis at smaller area levels of aggregation, these figures for deaths by suicide were combined at the various levels and the population figures, as supplied by NISRA, for 2010 were used to control for the number of individuals living within a given area.

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## 6. Administrative areas ( LGDs), gender and recorded deaths from suicide

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### Quick read

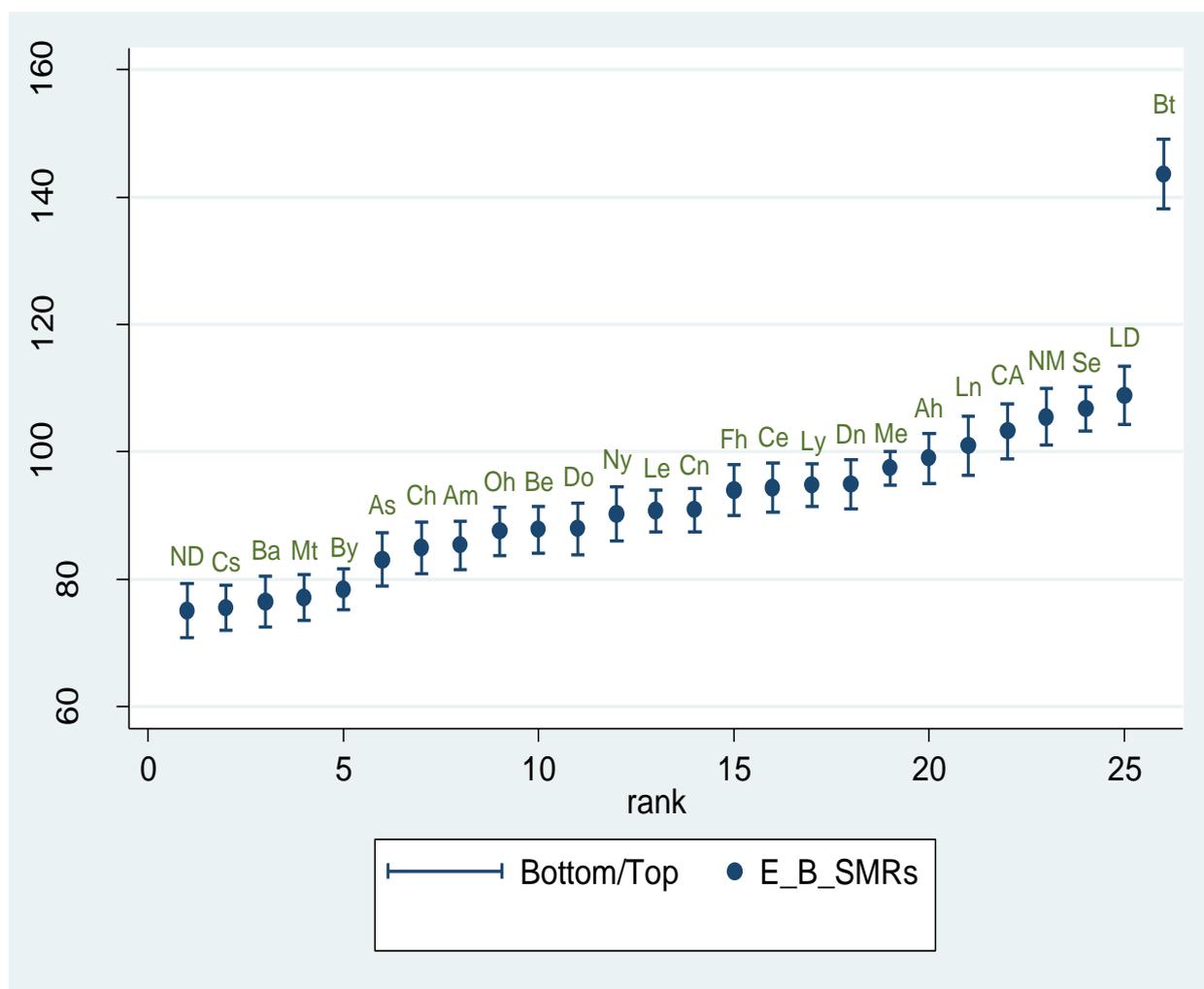
After adjusting for the residential population within each LGD, deaths from suicide are 40% higher in Belfast than the Northern Ireland average. There is little difference (taking into account the standard errors) between the other LGDs where the average is about 5% above the societal norm for LGDs. However, there is a cluster of around 5 LGDs where deaths by suicide are some 20% below the societal norm. Deaths amongst females show a greater disparity between LGDs, and deprivation is closely related to the recorded number of deaths within a LGD.

### Deaths by LGDs (adjusted for population size)

A standardised mortality ratio represents the number of deaths by suicide in a LGD divided by the expected of deaths that might be expected given the population of the LGD. This has the advantage that if the observed and expected number of deaths in a given LGD are the same, then the SMR would be set at 100% (1.0), which would indicate that within a given LGD the death rate is not unusual, given the number of deaths by suicide that have occurred within the society. In other words, if deaths by suicide were equally distributed across the different LGDs, then the recorded number for each district would be 100. In the current data the Northern Ireland population figures for 2010 have been used as the standard population. The number of deaths over a period of 7 years (years) was 1653, and the population was taken as 1,773,800. In the current analysis the SMRs are based on empirical Bayes prediction, which will allow for an adjustment to be made for the reliability of the data within

each cluster. The correlation between the crude SMRs and those based on an empirical Bayes approach is 0.97 (LGD level).

The fraction of the population who died over a 7 year period, given the 2010 population size, was close to 1 in every 1000 individuals in the society. The population fraction (0.000931897) was used to obtain the expected ( $E_i$ ) number of deaths by suicide within each LGD. The crude SMR can then be obtained  $(O_i/E_i) \times 100$ .



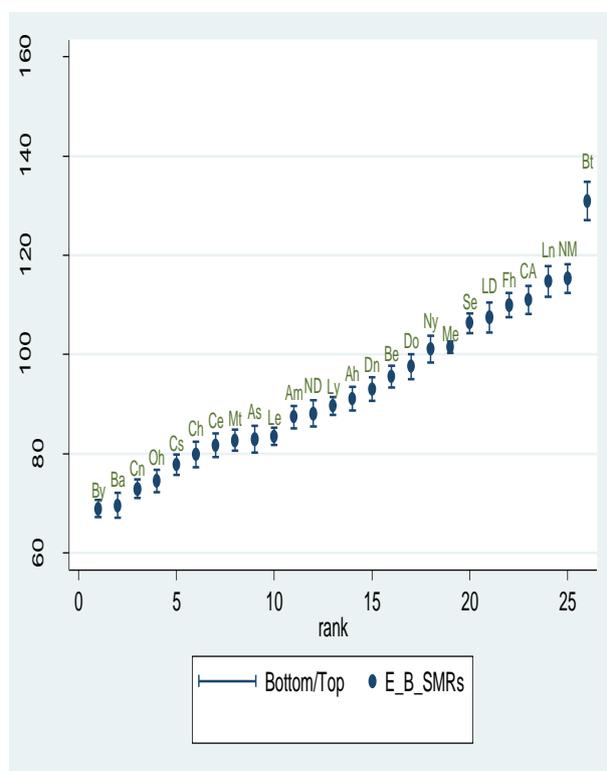
**Figure 6.1. Empirical Bayes Standardised Mortality Ratios for the 26 Local Government Districts in Northern Ireland**

Notes: LGD names are as follows. North Down (Nd), Carrickfergus (Cs), Ballymena (Ba), Magherafelt (Mt), Ballymoney (By), Ards (As), Castlereagh (Ch), Antrim (Am), Omagh (Oh), Banbridge (Be), Down (Do), Newtownabbey (Ny), Larne (Le), Cookstown (Cn), Fermanagh (Fh), Coleraine (Ce), Limavady (Ly), Dungannon (Dn), Moyle (Me), Armagh (Ah), Lisburn (Ln), Craigavon (CA), Newry&Mourne (NM), Strabane (Se), Derry/Londonderry (LD) and Belfast (Bt).

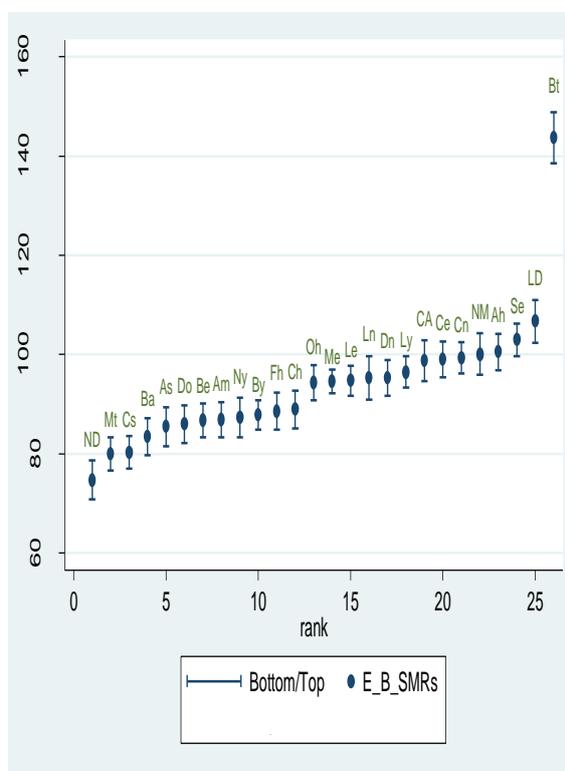
There is a discernible pattern of deaths when the analysis is at the level of the LGD. A number of LGDs can be seen to have 20 percent less deaths by suicide than the overall average; i.e., those below the value of 80 on the horizontal axis. For every 5 deaths by suicide (during the past 7 years), one less occurred within this cluster of areas than the Northern Ireland average. If the figures from these areas were generalised to the average number of deaths within a LGD then some 330 fewer deaths would have occurred, over this 7 year period. At the other end of the continuum, Belfast has over 40% more deaths by suicide than the Northern Ireland average (calculations based on LGDs). If during the past 7 years the Belfast rate had occurred across Northern Ireland, the society would have been faced with over 660 more deaths by suicide, approaching an extra 100 deaths per year.

## Deaths by gender and LGD (adjusted for population size)

Females



Males



**Figures 6.2. and 6.3. Empirical Bayes Standardised Mortality Ratios for females and males within the 26 Local Government Districts in Northern Ireland**

LGD. Ballymoney, Ballymena, Cookstown, Omagh, Carrickfergus, Castlereagh, Coleraine, Magherafelt, Ards, Larne, Antrim, North Down, Limavady, Armagh, Dungannon, Banbridge, Down, Newtownabbey, Moyle, Strabane, Derry, Fermanagh, Craigavon, Lisburn, Newry&Mourne and Belfast

LGD. North Down, Magherafelt, Carrickfergus, Ballymena, Ards, Down, Banbridge, Antrim, Newtownabbey, Ballymoney, Fermanagh, Castlereagh, Omagh, Moyle, Larne, Lisburn, Dungannon, Limavady, Cookstown, Coleraine, Craigavon, Newry&Mourne, Armagh, Strabane, Derry and Belfast

In general the SMRs for males look very like those from Figure 6.1, and this is not unexpected since over 70% of the deaths by suicide, during the years 2005 to 2011, have occurred amongst males. Amongst females it is apparent that deaths from suicide across the different LGDs are more equal across the various areas. The SMRs for females show a much steeper gradient between LGDs, thus differentiating between the number of deaths

occurring between LGDs to a greater extent. However, Belfast again stands out as having a much higher rate of deaths from suicide for both males and females.

The number of deaths that will occur in any area will be subject to a large number of factors, such as the age profile of an area, and the number of individuals living within the designated area. In the present analysis the SMRs have been adjusted for the number of individuals living in each of the LGDs. In later analyses Wards within the LGDs will be examined in order to look at SMRs within smaller designated areas. Again the respective population size is available and hence adjustments for the number of individuals within an area (LGDs, Wards) can be made. Within Northern Ireland there were, at the time of the study, 26 LGDs. These LGDs consisted of some 582 Wards, but first let us look at the effects of deaths by suicide by gender within LGDs.

## Neighbourhood effect on Suicide

In the current analysis the focus is on area effects. Generalising the results from an area level to the death of an individual is fraught with difficulty, not least the fact that area level characteristics, e.g., deprivation, may not be a relevant factor in a death. The intention within the current analysis is to address area effects, where a number of research studies have reported no association between suicides and area. There is nevertheless a persistent insistence, frequently from individuals living within what they perceive to be a local area, that deaths from suicide are higher in their location than would be expected. The argument is not that the area is toxic to health, but usually that some characteristic of the area is the reason for this co-existence between deaths from suicide and area. Nevertheless such comparisons cannot be made on the basis of the raw figures, striking though they often are, because the comparison may not be from a similar base, especially in terms of population

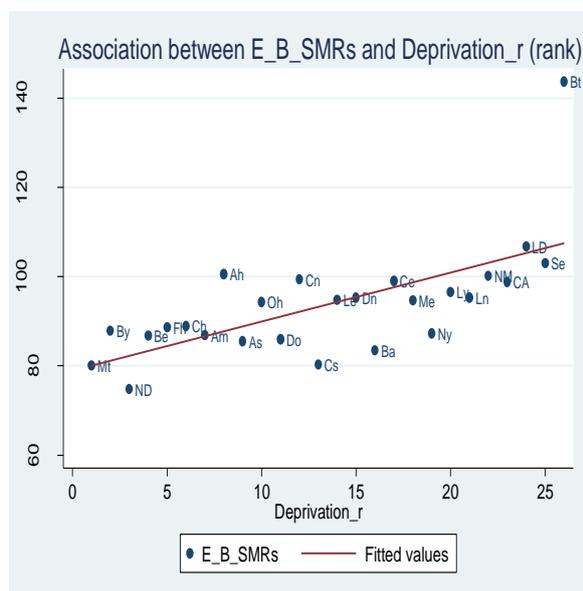
size. Nevertheless, if an area level variable is consistently present, then it would be ill advised to ignore such information.

In the current analysis, data for seven years of deaths by suicide have been combined in order to represent the predicted values in a stable manner. Deaths based on a single year's results are likely to be subject to a greater level of fluctuation from one year to another; as indeed was seen when the yearly rate of suicide was reported, per 100,000 individuals, for the years 1971 to 2011. The combination of deaths over a number of years is likely to present a more stable picture and hence a narrower confidence interval. Deaths occurring in a given area are best seen as evidence of an overall trend rather than as a score sheet based on rankings. In many cases, one area may not be that different from another in terms of the number of deaths, even though it may have an apparently higher number of deaths in terms of the SMRs (point estimate), as most of the reported figures have been adjusted for the number of individuals within the administrative area. It is also important to look at the standard errors as a higher SMR may be within the sampling bounds of other areas with a SMR value with a similar value and hence comparative rankings require nuanced interpretations. It must also be kept in mind that areas may change their ranking depending on the variables that have been included within the analysis.

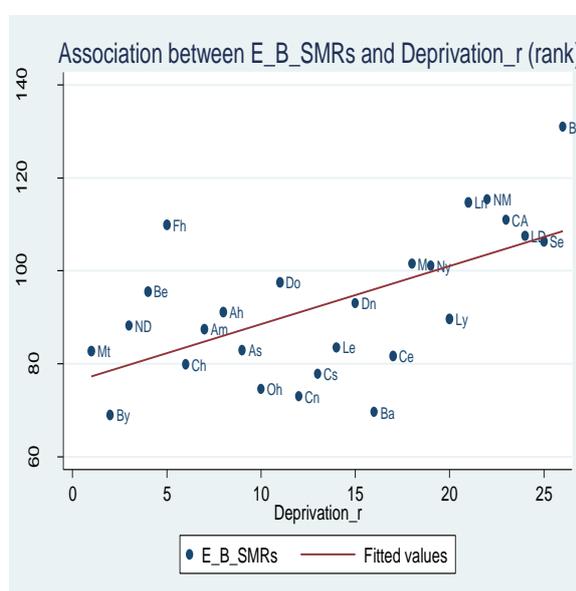
Nevertheless general trends may be usefully discerned by looking at clusters of areas where the reported predictions or estimates are comparable. Further, the numeric magnitude of the SMR will depend on the population of interest. In the present analysis SMRs are reported for (1) LGDs (2) Wards and (3) age structure within Ward. This provides different adjusted rates and as such comparisons may not be meaningful. Further, many designated areas may have a small number of deaths, or maybe none. Where units have few observations Bayes estimates may not be optimal (Kreft & de Leeuw, 1998).

## LGD and Deprivation

Males



Females



**Figure 6.4. Empirical Bayes Standardised Mortality Ratios for the 26 Local Government Districts in Northern Ireland correlated with order of deprivation**

Notes: LGD names are as follows. North Down (Nd), Carrickfergus (Cs), Ballymena (Ba), Magherafelt (Mt), Ballymoney (By), Ards (As), Castlereagh (Ch), Antrim (Am), Omagh (Oh), Banbridge (Be), Down (Do), Newtownabbey (Ny), Larne (Le), Cookstown (Cn), Fermanagh (Fh), Coleraine (Ce), Limavady (Ly), Dungannon (Dn), Moyle (Me), Armagh (Ah), Lisburn (Ln), Craigavon (CA), Newry&Mourne (NM), Strabane (Se), Derry/Londonderry (LD) and Belfast (Bt).

Deprivation appears to have an association with the number of deaths within a LGD. This can be more clearly seen amongst males. The diagonal line represents the correlation between the two measures; though this should be used cautiously as the effect of Belfast will tend to increase the slope of the line, but it has been left in for heuristic purposes. An increase in the level of deprivation within a LGD appears to be related to the number of deaths, but the relationship between the two is problematic. For example, the Fermanagh LGD appears to have an excess of deaths amongst women given the level of deprivation. However, it is also evident that LGDs with high levels of deprivation have a high level of deaths by suicide regardless of gender, and that these areas tend to be those with larger urban populations.

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## 7. Administrative areas (Wards and LGDs), deprivation and recorded deaths from suicide

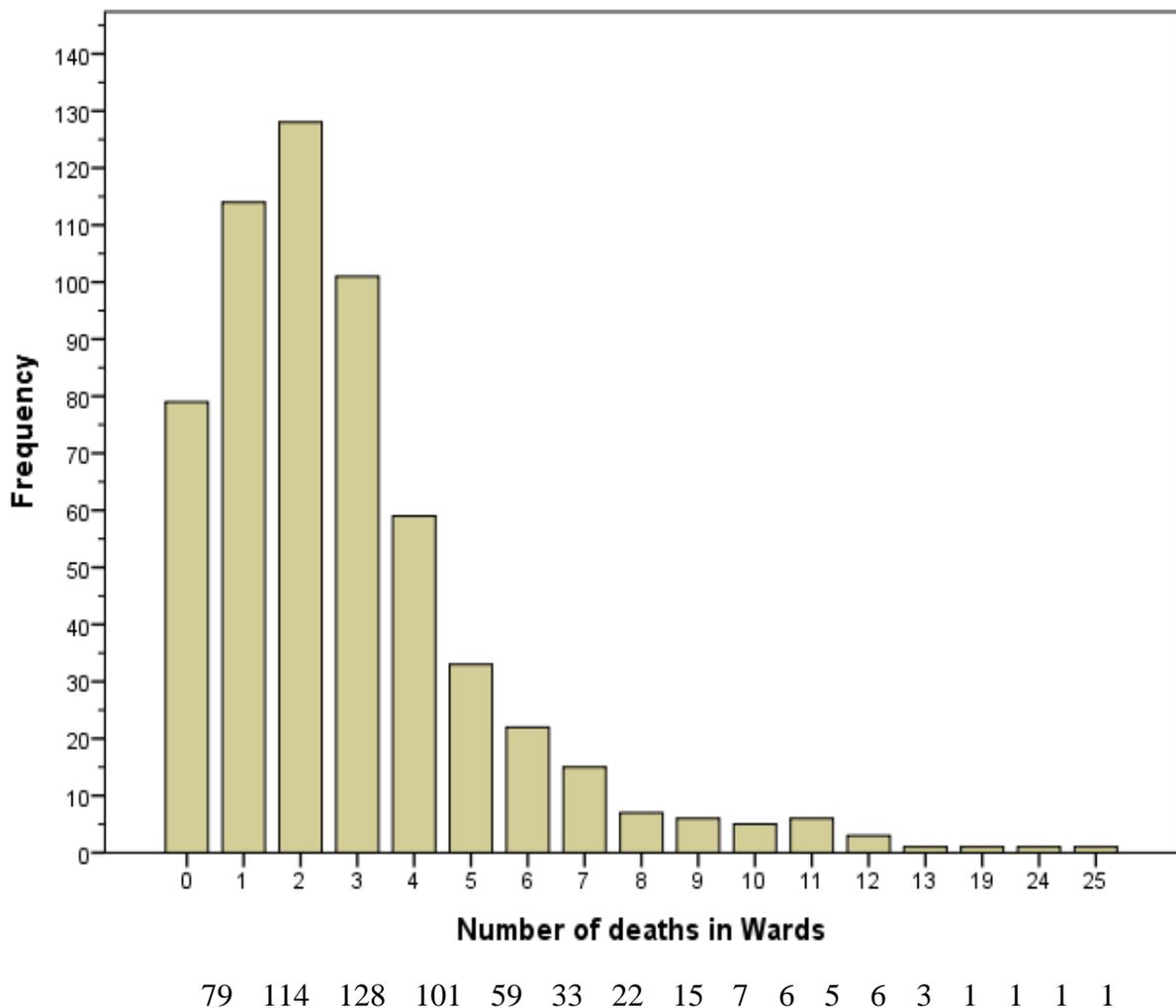
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### Quick read

Deaths within Wards are clustered within LGDs, and once the effect of deprivation has been included at the Ward level, and population size adjusted, the differences between the LGDs are no longer statistically significant at the 0.05 level. Differences between Wards indicate that a significant number of Wards have between two and four times the number of deaths, and an association with deprivation is evident.

### Deaths by Wards (unadjusted for population size)

Before making any adjustment for the population numbers within a Ward, the number of recorded deaths within each of the 582 Wards was examined (Figure below) over a seven year period. In 79 Wards no deaths were reported, and in 422 Wards (73%) less than 3 deaths were recorded. The remaining 160 Wards (27%) had deaths ranging from 4 to 25.



**Figure 7.1. Histogram representing the number of Wards reporting between zero and twenty-five deaths, with the frequencies reported on both the vertical (y) and horizontal axis**

Obviously the personal toll of deaths in some Wards is high, though at this point it is unclear if this is due to the number of individuals living in a Ward, or some other characteristic of the Ward. In order to get an idea of the range of Wards with a high level of suicides, those Wards with 7 or more deaths during the past 7 years are listed from lowest number of deaths to the highest. They are as follows: (1)Chichester Park (2) Ballycolman (3) Poleglass (4) Jordanstown (5) Shantallow West (6) West (7) Brandywell (8) Drumgask (9) St Patrick's (10) Taghnevan (11) Atlantic (12) Parklake (13) Old Warren (14) Annagh (15) Woodville (16)

Knock (17) Woodstock (18) Ardoyne (19) Enagh (20) Callan Bridge (21) The Mount (22) Ladybrook (23) Duncairn (24) Shankill (25) Ballynafeigh (26) Blackstaff (27) Ballyhackamore (28) Kilkeel South (29) Bellevue (30) Legoniel (31) Glen Road (32) Culmore (33) The Diamond (34) Twinbrook (35) Glencolin (36) Crumlin (37) Derryaghy (38) Collin Glen (39) Cliftonville (40) Strand (41) Falls (42) Clonard (43) Whiterock (44) Shaftesbury (45) Waterworks and (46) New Lodge. This shows evidence that Belfast is strongly represented in the overall total number of deaths, especially in areas with a higher number of deaths. However, as already pointed out, while the number of deaths within an area represents a personal and social disaster, and potentially represents an emotional burden on individuals within an area, the extent to which one can generalise from raw data from within an area is debatable, given the variability in the population size within Wards, or in terms of other designated boundaries. In the next part of the analysis an adjustment will be made for the population within each of the 582 Wards in Northern Ireland.

### Empirical Bayes Standardized Mortality Ratios (adjusted for population size)

According to the NISRA website: "...Northern Ireland, Wards vary greatly in population size (Census 2001) from fewer than 800 residents to more than 9,000." ([http://www.nisra.gov.uk/deprivation/super\\_output\\_areas.htm](http://www.nisra.gov.uk/deprivation/super_output_areas.htm)). Of course, within any such analysis the boundaries representing an area may not best represent perceived solidarity groups, or area locations. However, there does appear to be a significant attempt to have boundaries that have some correspondence to perceived group identity. In addition to perceived identity, Wards have been used because the population within these areas can be

approximated. For this purpose the NISRA 2010 Northern Ireland population figures have been used.

The recorded number of deaths within an area, from any cause, will be influenced by a number of factors, and not least amongst these will be the number of individuals living in the designated area. Within this analysis an adjustment has been made for the number of individuals within a specified Ward. Standardised mortality ratios were calculated for each Ward: where the SMR is defined as the ratio of the number of suicides to the expected number, and in the current analysis this is based on the premise that the expected number of deaths in any Ward is equal to that in the general population (Northern Ireland). In other words, that death through suicide occurs at random within the society. The crude SMR is therefore  $\text{deaths}_j / \text{expected\_number}_j$ , where  $\text{deaths}_j$  represent the observed number of cases within each Ward, and  $\text{expected\_number}_j$  is the expected number of deaths in Northern Ireland over a period of seven years. However, the crude SMR figures have a number of limitations such as a greater level of imprecision in areas where few deaths are recorded (an issue with the present data), and further the ratio values do not take into account the proximity of geographical area where it might be anticipated that the reported number of deaths would be higher than would be expected if the areas were selected at random. In the present analysis these issues have been addressed through the use of empirical Bayes predictions when reporting SMRs, and then by the use of random intercepts to control for spatial correlation.

**Table 7.1. Empirical Bayes Standardised Mortality Ratios for the 582 Wards in Northern Ireland**

tot_suicides	exp(b)	Std. Err.	z	P> z	[95% Conf. Interval]	
_cons	.8549715	.0336453	-3.98	0.000	.7915068	.9235248
lne	1	(offset)				

Variiances and covariances of random effects

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***level 2 (Ward_id)

var(1): .1770996 (.03787968)

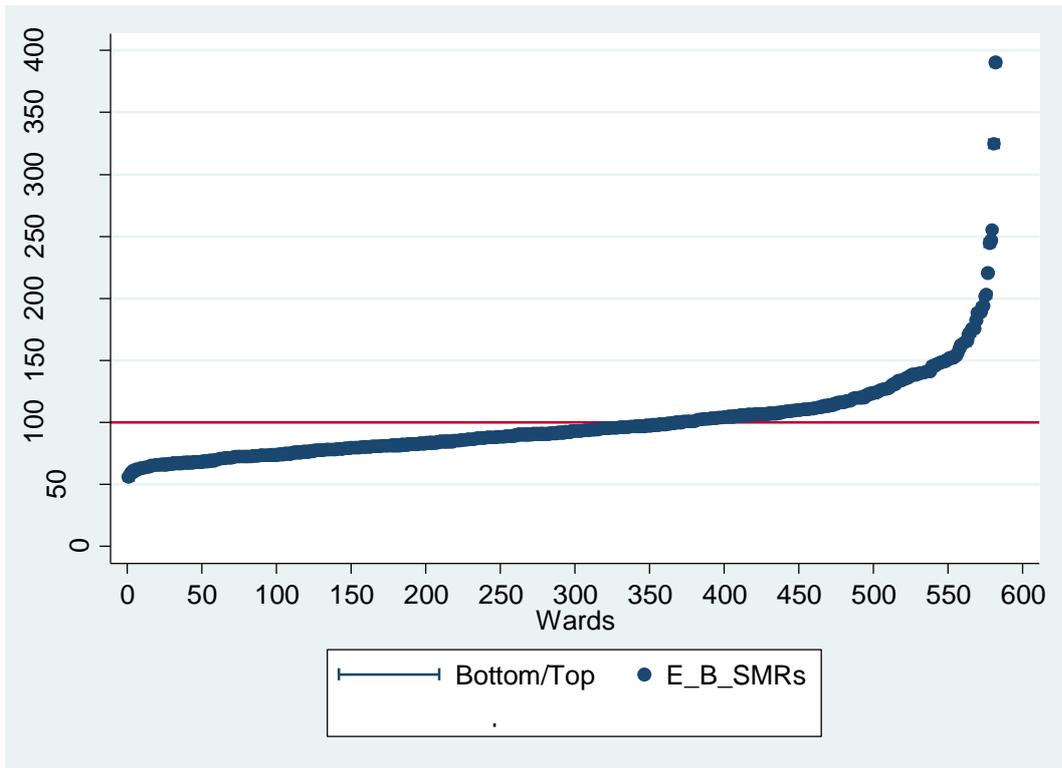
***level 3 (LGD_Code)

var(1): .02316367 (.01180958)

```

The exponent of the intercept (cons) value indicates that the average number of deaths by suicide within Wards, over this seven year period has been 2.35. The random coefficient for the LGD shows that once the effect of the Wards has been taken in to account, here as a random coefficient, that the variance between the LGD is small when compared with the standard error. In previous analyses the discrepancy between deaths within LGDs has been very marked, but it appears that most of this difference can be explained in terms of Wards.

Figure 7.2. shows a plot of the SMRs for all 582 Wards. From this plot it is apparent that predicted values show a rapid increase in the SMR within a relatively small number of Wards, at least when compared with the societal norms.



**Figure 7.2. Empirical Bayes Standardized Mortality Ratios based on a random intercept Poisson regression**

After adjusting for the population within each Ward, Figure (7.2) above indicates that for some Wards the number of deaths is higher than expected, given the rate of deaths from suicide in Northern Ireland. In the case of one Ward (New Lodge) deaths from suicide were 4 times higher than the average across Wards (value set at 100). A number of other Wards had over twice the number of deaths. These include: Kilkeel South, Clonard, Strand, Shaftesbury, The Diamond, Twinbrook, Waterworks and New Lodge. It is good to be cautious when comparing Wards since we are dealing with small numbers, but nevertheless, some Wards do clearly indicate a much higher than expected number of deaths, at least when compared with the expected average number of deaths in the overall population.

**Table 7.2. Empirical Bayes standardised mortality ratios for Wards where the predicted value exceeded a 50% increase in deaths over the average expected rate in Northern Ireland**

Ward Name	E_B_SMRs	Ward Name	E_B_SMRs
Taghnevan	150.1153	Blackstaff	175.5638
Whitehouse	151.5619	Brandywell	175.8601
Glen Road	151.9667	Atlantic	182.6018
Annagh	152.1473	Falls	188.237
Parklake	152.5901	Crumlin	188.2591
Caw	153.7982	Callan Bridge	188.4468
Drumragh	154.2816	Whiterock	192.7861
Dufferin	156.1439	Ballycolman	193.5144
The Cuts	159.6616	Kilkeel South	201.5271
Quilly	162.5285	Clonard	203.0535
Armoy	162.9908	Strand	220.6672
Tullagh	163.9322	Shaftesbury	244.7299
Bellevue	164.6018	The Diamond	246.7099
Duncairn	165.8928	Twinbrook	255.254
Cliftonville	170.7362	Waterworks	324.7393
Shankill	171.8981	New Lodge	390.2299
Old Warren	175.2934		

The Wards shown in Table 7.2 (above) all had a standardized mortality ratio of 150 or above. In other words, they had at least a 50% higher rate of deaths than the overall Northern Ireland average. These are all Wards with high numbers of deaths; however, as might be expected, the rank ordering has somewhat changed once the area has been adjusted for population size. It would nevertheless seem worth noting that out of the 582 Wards only 5-6% of the total have a death rate much above the expected average (though it is debatable where this cut off point should be). However, it is likely that most people believe that the background expected rate of deaths from suicide in the society is already too high, and that any Ward with a death from suicide, is a death too many.

## Pictorial representation of Ward Standardized Mortality Ratios (adjusted for population size)

A value of 100 is the societal Standardised Mortality Ratio (SMR) average. Values in red represent SMRs in excess of 112. Each area has a different population density, so a large area could well be one with a sparse population. In the current context population size has been taken into account so we are here examining deaths by suicide in excess of the expected average number.

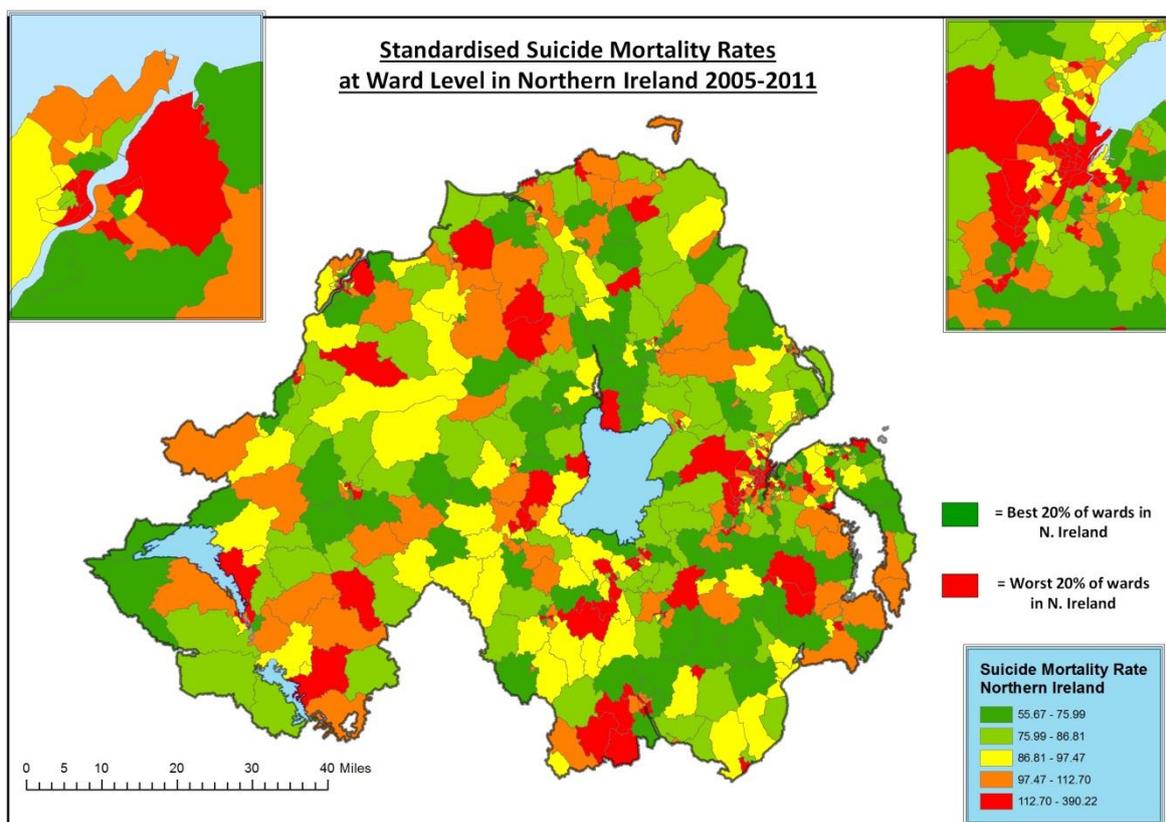


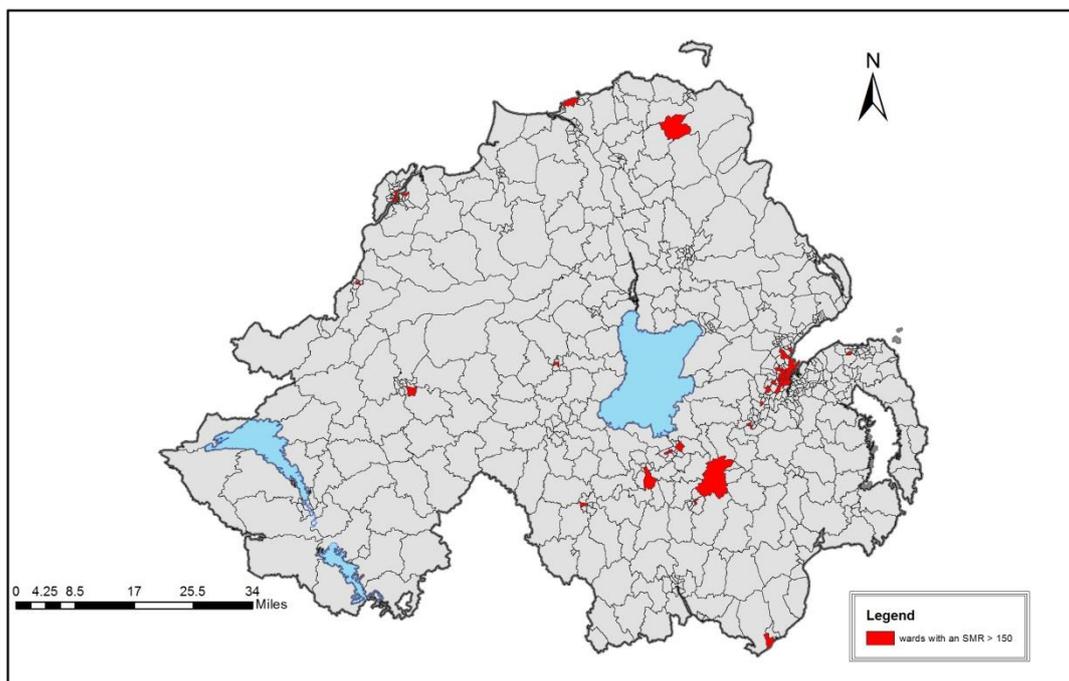
Figure 7.3. Empirical Bayes standardised mortality ratios, for Wards, in five categories

We are dealing with small numbers, so substantial fluctuations may be expected. However, if the SMR boundary is changed to incorporate only areas where deaths are 50% in excess

of the expected number in the general population, it is then evident just how concentrated are the areas within which an excess in deaths has occurred. Further, it is also evident that the designated red areas in both Table 7.3. and Table 7.4. show a fair degree of consistency.

The grey areas shown in Figure 7.4. (below) indicate Wards where the expected number of deaths by suicide, once the population size has been adjusted, is below a SMR of 150. There are 582 Wards in Northern Ireland, and in Table 7.2 it is evident that 33 of these Wards have a ratio of observed to expected deaths in excess of 150. However, in the diagram below it is evident just how concentrated these areas are within the geography of Northern Ireland.

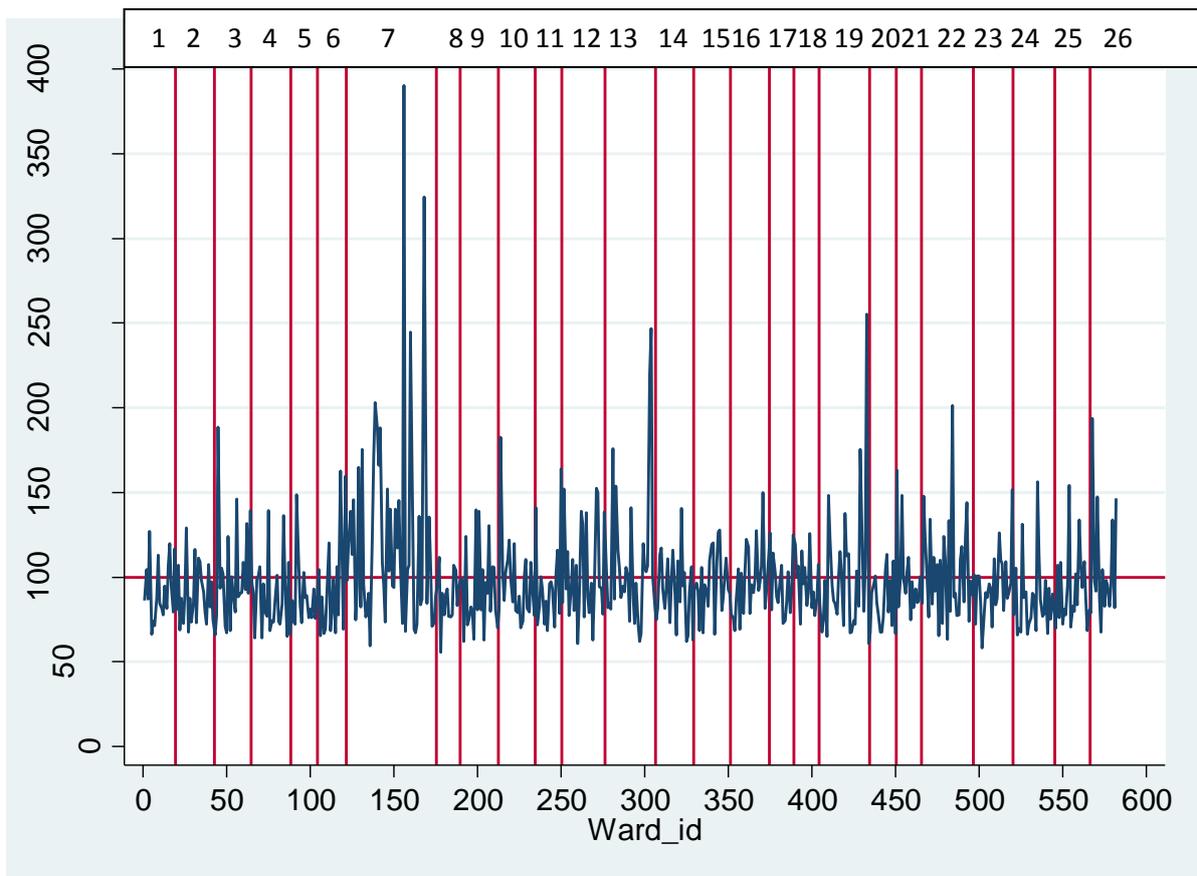
**Northern Ireland Wards with a Standardised Suicide Mortality Rate (2005-2011) greater than 150 (n=33)**



**Figure 7.4. Empirical Bayes standardised mortality ratios, for Wards, with a value in excess of 150 (SMR)**

## Wards within Local Government Districts (LGDs)

From the previous analysis it was evident that deaths from suicide within LGDs differed substantially. In this analysis, since the Wards are nested within LGDs, it is likely that the correlation between Wards within a LGD district will be clustered, and to adjust for this effect LGDs were included within the analysis as a random intercept. To explore the issue of clustering of Wards within LGDs, a plot has been created of the SMRs for each Ward within a LGD. In Figure 7.5 (below) the empirical Bayes standardized predictions are displayed by an alphabetical order of Ward names within Local Government Districts, and vertical lines have been used to separate the LGDs.



**Figure 7.5. Empirical Bayes standardized estimates displayed in alphabetical order within Wards and grouped by Local Government Districts**

LGDs are as follows: (1) Antrim (2) Ards (3) Armagh (4) Ballymena (5) Ballymoney (6) Banbridge (7) Belfast (8) Carrickfergus (9) Castlereagh (10) Coleraine (11) Cookstown (12) Craigavon (13) Derry (14) Down (15) Dunganon STyrone (16) Fermanagh (17) Larne (18) Limavady (19) Lisburn (20) Magherafelt (21) Moyle (22) Newry and Mourne (23) Newtownabbey (24) North Down (25) Omagh and (26) Strabane

From Figure 7.5, a rough idea can be obtained of the LGD within which most of the deaths within Wards have taken place. The higher the spikes the greater the predicted number of deaths based on the E\_B\_SMRs for each of the 582 Wards. It is apparent from the above figures that in many Wards where a high number of deaths occurred, these Wards were themselves nested within certain LGDs. All of the city areas in Northern Ireland (Belfast, Derry, Lisburn and Newry) have Wards with high standardized mortality ratios, even when

an adjustment has been made for population. However, at this point in the process, even though LGDs have been included within the analysis as a random intercept, it is not possible to conclude that the apparent association between Wards and the number of deaths also holds for LGDs.

In the next part of the analysis an examination will be made of the factors that may be associated with higher death rates from suicide, and in particular the potential influence of area deprivation - additionally, Wards and LGDs will also be included within the analysis. It should be observed that any area effect should not be viewed as a causal explanation for the death. For, as is obvious, each of those whom we have here reported as a statistic had their own unique history, and we do not pretend to come close to an understanding of what for them was the reason, amongst others, for ending their life. It is dangerous to generalise from an area effect, or even from personal characteristics, regarding the motivation behind an act. However, few would wish to ignore personal, social or societal level information that is associated with personal choices, for such choices do not occur in a vacuum detached from wider societal factors.

### Ward deaths controlling for deprivation

In the first part of this analysis an examination will again be made of the E\_B\_SMRs within the context of Wards, with deprivation included within the model as a covariate, i.e., an 'explanatory' measure. In second part of the analysis LGD will be introduced as a second covariate. LGD is included within the model as a fixed effect, in order to examine the possibility that deaths are also related to the 26 LGDs over and above the adjustments for population size, Ward and deprivation.

For the purpose of this analysis Belfast will be used as the reference (comparison) LGD. As with the previous analysis where population size was adjusted, a model based on empirical Bayes prediction within a multilevel analysis was again used, with each Ward having its own random intercept. This model accommodates dependence within Wards; however, it is assumed that the slope relating to covariates is the same for all Wards. The number of deaths within Wards is the level-1 measure, and deprivation was at level 2. The  $\exp (.5856762 + 1.020556) = 4.984$ , indicates that one unit shift in deprivation was associated with a change in the standardized mortality ratio of 5 units. The multiple deprivation scores ranged from 1.43 to 83.33, with a mean value = 21.59 and standard deviation = 19.95. Because of the potential distorting effects of clustering within the data the standard errors are based on the use of a sandwich estimator to take account of any dependence within the repeated counts.

Overdispersion (the population variance in the data is not similar to the population mean) within the model has been taken account of, through the introduction of a random intercept at level-2 (deprivation). From the variance at level-2 it is evident that this is statistically significant, and it would be an option to consider factors that might explain this source of variance. This has not been done in part because the amount of variance, at the second level, is not large.

**Table 7.3. A two-level random intercept Poisson regression for the estimation of standardised mortality ratios**

tot_suicides	exp(b)	Std. Err.	z	P> z	[95% Conf. Interval]	
MDM_score	1.020556	.0015461	13.43	0.000	1.01753	1.023591
_cons	.5856762	.0286375	-10.94	0.000	.5321533	.6445822
_lne	1	(offset)				

Variiances and covariances of random effects

\*\*\*level 2 (Ward\_id)

var(1): .05112364 (.0183877)

Note. A quadratic and cubic relationship between SMR and deprivation was also examined. These were not statistically significant, and the results have not been reported.

Within the current analysis, deprivation has been included as a covariate, and the Ward as a random effect. However, the potential effect of LGD on the number of deaths was evident in some of the initial analyses, and it was also evident that the number of deaths within Wards was clustered within a number of LGDs. Rather than using the LGDs as a random intercept in order to control for the potential distorting effect of clustering a test was made for differences between the 26 LGDs, through the inclusion of these as covariates within the model. In other words, is there an association between certain LGDs and the number of deaths, having controlled for population size, Ward and deprivation?

**Table 7.4. A two-level random intercept Poisson regression for a test of differences between LGDs**

tot_suicides	exp(b)	Std. Err.	z	P> z	[95% Conf. Interval]	
MDM_score	1.019997	.0017258	11.70	0.000	1.01662	1.023385
Aldergrove	.9486861	.1473747	-0.34	0.735	.6996675	1.286333
Ards	.9005264	.1219265	-0.77	0.439	.6906345	1.174207
Armagh	1.131944	.2008976	0.70	0.485	.7993803	1.602862
Ballymena	.7421275	.1352308	-1.64	0.102	.5192448	1.060681
Ballymoney	.6490462	.2026124	-1.38	0.166	.3520113	1.196726
Banbridge	.9555191	.2215714	-0.20	0.844	.6065375	1.505293
Carrickfergus	.7003475	.1600055	-1.56	0.119	.4475516	1.095933
Castlereagh	.9925424	.1724881	-0.04	0.966	.706031	1.395322
Coleraine	1.010704	.1528902	0.07	0.944	.7513843	1.359522
Cookstown	.8585355	.1976735	-0.66	0.508	.5467305	1.348165
Craigavon	1.037667	.1403865	0.27	0.785	.7959736	1.35275
Derry	.8725773	.1163983	-1.02	0.307	.6718264	1.133315
Down	.8910442	.1444612	-0.71	0.477	.6484814	1.224337
DunganonST	.9760888	.1289645	-0.18	0.855	.7533996	1.2646
Fermanagh	1.03576	.1495303	0.24	0.808	.7805002	1.374501
Larne	.9482511	.1443411	-0.35	0.727	.7036473	1.277885
Limavady	.925623	.1495215	-0.48	0.632	.6744261	1.270381
Lisburn	1.013175	.1171126	0.11	0.910	.8077824	1.270793
Magherafelt	.7347531	.1485657	-1.52	0.127	.4943449	1.092076
Moyle	1.051373	.2939773	0.18	0.858	.6077849	1.81871
Newry_Mourne	1.041402	.1302709	0.32	0.746	.8149668	1.330751
Newtownabbey	1.003023	.1245042	0.02	0.981	.7864153	1.279292
North_Down	.8645862	.1498176	-0.84	0.401	.6156162	1.214246
Omagh	.8152597	.1527907	-1.09	0.276	.5646369	1.177125
Strabane	.8604308	.1703734	-0.76	0.448	.5836736	1.268416
_cons	.6308198	.0613236	-4.74	0.000	.5213843	.7632253
lne	1	(offset)				

Variiances and covariances of random effects

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***level 2 (Ward_id)
var(1): .04445398 (.01767009)

```

In the current model, once deprivation is controlled, it becomes apparent that there are no differences between the LGDs of Belfast, which always looked like having the greatest number of deaths, at a descriptive level, when compared with other LGDs in terms of the number of reported deaths, at least not once information regarding the number of deaths within Wards has been included within the model (deaths within Wards is the outcome measure in this analysis). In this model Wards have been allowed to vary in terms of the number of deaths, through the introduction of a random intercept, and this is statistically

significant. ( $.0445/.0177 = 2.51$ ). The introduction of LGD into the model had little impact on the overall explanatory power of deprivation, indeed the parameter estimates remained essentially unchanged, when compared with the previous analysis where LGD was excluded.

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## 8. Administrative areas ( Wards), adjusted for LGDs, Wards and Age

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### Quick read

In terms of the raw statistics, 82% of deaths which occurred in the 16 to 39 year age group were amongst males. Seventy-four percent of the deaths within the age group 40 to 64+ were males. In the oldest age group (65+) 75% of the deaths were male, while in the youngest age group (0 – 15yrs) the male percentage of deaths was 70%.

### Age, Gender, and Ward (descriptive statistics)

The total number of male deaths recorded in this dataset was 1286. In this section of the analysis the deaths were recorded by Wards. In 113 out of a total of 582 Wards there were no male deaths from suicide recorded, i.e., 19.4% of all wards in Northern Ireland; and in a further 145 (24.9%) of Wards one death was recorded. The comparable female figures indicate that deaths occurred in many fewer Wards, with 56.4% of Wards reporting no deaths, and with 30.2% of all deaths having occurred in a Ward where only 1 reported female death from suicide was recorded. Fifty-two point eight percent (n=678) of the reported male deaths were in Wards where the recorded number of deaths were between 1 and 3. Amongst females, the corresponding numbers were 90.2% (n=333).

However, 606 (47.1%) of the deaths from suicide amongst males occurred in Wards (n=103) where the number of deaths recorded was 4 or more. Six Wards accounted for 87 (6.8%) of the recorded deaths, with an average of more than 10 deaths in each of these 6 Wards. Amongst females 8 Wards had more than 4 deaths recorded. (No mention has

been made of any Wards at this point as we need to adjust for the number of individuals likely to be present within a Ward.)

**Table 8.1. Age\_Gender\_Ward\_1\_revised\_restructured\_deaths for Age\_category**

Age categories in years	Deaths within the 4 age categories	Number in subpopulation (% of the total pop shown in brackets)
0 - 15	27 (1.63%) 70% male	381068 (21%)
16 - 35	805 (48.64%) 82% male	595639 (34%)
36 - 64	675 (40.79%) 74% male	502479 (28%)
65+	151 (9.12%) 75% male	295813 (17%)
Total Number	1655	1774999

The current age categories have been used because we can obtain societal level figures for the population. Of course, any arbitrary division of a continuous variable such as age carries problems, because as the age boundaries are changed, the results will differ. However, based on the current categorisation it is evident that few, though still an alarming number, very young people die by suicide, and used in the current context of correct for populations size. Deaths from suicide are much more common amongst those in the 16 – 35 year old, especially amongst males, with 1.35 individuals in every 1000 individuals having taken their life during the 7 year period of the study. Those in this age category account for nearly 50% of all such deaths, even though those in this age group make up 34% of the population. Also overrepresented in terms of deaths are those in the 36 to 64 age category, with over 40% of deaths being attributed to those in this age group, even though they make up 28% of the population. This represents 1.34 deaths per 1000 individuals during the period of this study. Those in the older age group (65+) represented just less than 10% of all deaths by

suicide, but 17% of the overall population, and account for 0.51 deaths in every 1000 over the period of the study.

### Adjusted and unadjusted figures when making group comparisons

There is a strong relationship between SMR values and the number of deaths that occurred in a Ward, having controlled for age (in categories).

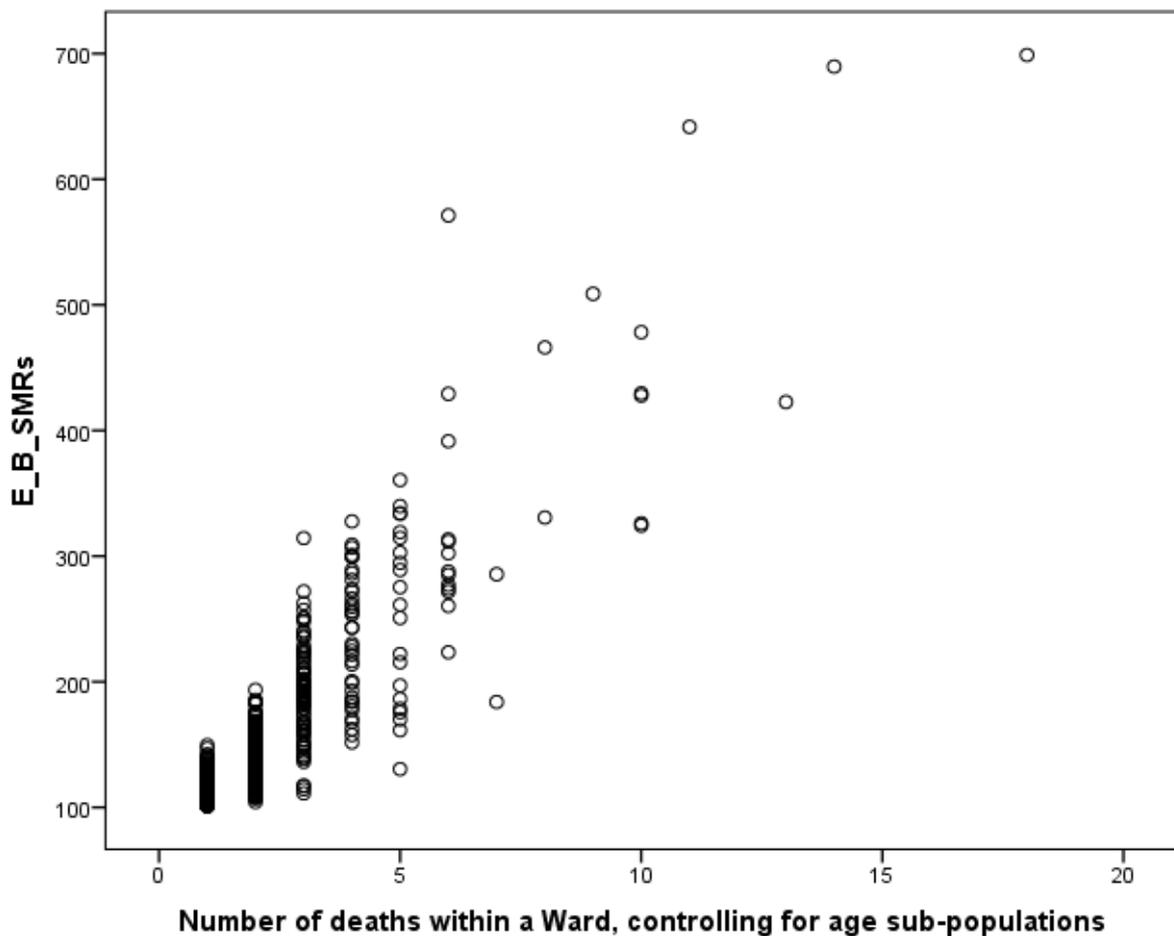


Figure 8.1. This indicates the relationship between the raw number of deaths and the predicted Standardised Mortality Ratios

It is also evident, and to be expected, that in Wards where a high number of deaths from suicide have occurred that the SMR rate is high, having controlled for population size, Ward

deprivation and age grouping of the deceased. The raw number of deaths can be the same in different administrative areas, but the SMR can vary substantially between the Wards. This can be seen within the age groups in Wards, especially when the number of deaths was five or less, and hence more information was available. Deaths are obviously important, but when comparing deaths between Wards, it is crucial to take into account the number of individuals within an area within the population of interest. It is therefore not generally useful to compare raw deaths rates between areas, without adjusting especially for population/subpopulation size.

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## 9. Deaths within age categories (0-15, 16-39, 40-64 and 65+) controlling for size of respective populations and the clustering effects of Wards and LGDs

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### Quick read

Stratified age structure (four age groups) within Wards, when adjusted for number of individuals, indicated no difference in the expected number of deaths given the population, between those in the 16 – 39 year old age band and those within the 40 – 64 year old age group. However, in both age groups there was a relatively strong association with area social deprivation ranking, with deaths being higher than the average for the most deprived Wards. Deaths from suicide amongst those in the youngest (birth- 15 years) and oldest age group (65+ years of age) showed little if any area effect in terms of deprivation.

### Random intercepts (4-levels)

The statistical software programme gllamm (Generalized Linear latent and Mixed Models) ((Rabe-Hesketh & Skrondal, 2012; Skrondal & Rabe-Hesketh, 2004) was used to fit a Poisson model for the number of deaths by suicide within four broad age groupings, using the log expected value as an offset to control for the respective sub-population sizes, as this is likely to have an effect on the number of deaths. It is no surprise that in an area with a larger population there is also likely to be more deaths, and as such this needs to be adjusted for the purpose of making comparisons. A four-level random intercept model was used to describe the data in terms of deaths within each of the age groups (level-2), Ward (level-3) and LGD (level-4). The purpose of the offset is to enable the parameter estimates to be interpreted as age category specific SMRs. In the Poisson model it is assumed that

variance of the count is equal to the expectation, frequently the variance of the count is larger than the expectation as in the present data (1.78 vs 0.15), and to adjust for this a sandwich estimator (robust) was used to obtain the standard errors.

**Table 9.1. Empirical Bayes Standardised Mortality Ratios for Wards stratified by age**

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Age_deaths	exp(b)	Std. Err.	z	P> z	[95% Conf. Interval]	
_cons	.6710133	.0267914	-9.99	0.000	.6205052	.7256326
lne	1 (offset)					

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Variances and covariances of random effects

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\*\*\*level 2 (Index1; age-group)

var(1): .61256759 (.08216546)

\*\*\*level 3 (id; Wards)

var(1): 5.674e-15 (1.208e-13)

\*\*\*level 4 (LGD\_Code)

var(1): .01758583 (.00963021)

---

The reported results are based on a model containing only random effects and no covariates (fixed effects) in order to adjust for area population exposure (size) and the nested characteristics of the data.

The exponentiated value of the intercept (cons) indicates that around 2 deaths on average can be expected within each age category. From the variance it is evident that there is a statistically significant proportion of the variance that can be accounted for in terms of the clustering effects of Age grouping, Wards, and LGDs.

In many Wards there were no deaths within given age categories, thus the data consists of a substantial number of categories with a value of zero, hence it is to be expected that where deaths have occurred within a given age group that the percent difference will be changed, since our choice of the standard population has changed. The expected population is now based on one of four age categories and while it would be possible to conduct the analysis by gender, this has not been done because it would increase the number of cells with zero counts within the analysis, since there are now  $582 \times 4 = 2,328$  grouping and under 1,700 deaths. While the standardised rates have changed, in terms of scale, it is anticipated that this change will have little impact on area comparisons, at least in terms of Wards.

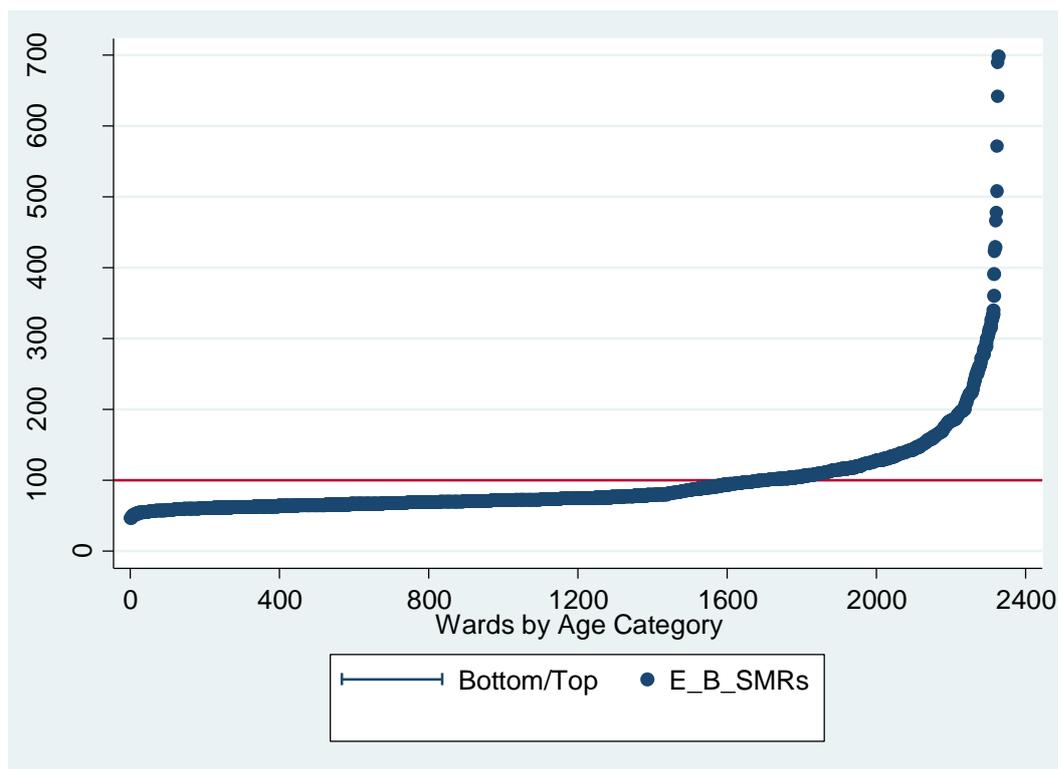


Figure 9.1. Empirical Bayes SMRs for Ward populations based on age group

As with previous SMR plots it is evident that there is a high concentration of deaths occurring within a relatively 'small' number of Wards, even though the Wards are now stratified by four age groupings; so out of a possible 2328 categories less than 300 of these appear from figure 9.2 to account for a large proportion of the deaths. Age groups within Wards with a very high mortality rate, say a value of 300 SMR, occurred in 28 Wards (out of 582), and two of these Wards have a higher than expected number of deaths in two different age categories. The names of these 28 Wards are given below.

**Table 9.2. Wards where the Standardised Mortality Ratios exceeded twice the Northern Ireland expected average rate**

Wards	Age Band		Wards	Age Band	
	2=16-34	E_B_SMRs		2=16-34	E_B_SMRs
	3=35-64			3=35-64	
Dunnamanagh	2	300.9	Portora	3	334.1
Annagh	2	302.3	Tullagh	2	339.8
Kilkeel South	2	302.8	Atlantic	3	360.6
Whitehouse	3	306.8	Twinbrook	2	391.4
The Diamond	3	309.1	Shaftesbury	2	422.7
Taghnevan	2	311.6	Whiterock	2	427.7
Waterworks	3	313.3 (B)	The Diamond	2	429.2
Armoy	3	314.3	Falls	2	429.6
Ardboe	2	314.5	Crumlin	2	466.1
Comber East	3	319.1	Clonard	2	478.2
Glencolin	2	324.4	Duncairn	2	508.8
Colin Glen	2	326.1	Ballycolman	3	571.2
Old Warren	3	327.6	New Lodge	3	641.7 (B)
Legoniel	2	330.7	New Lodge	2	689.7 (B)
Drumalane	3	333.6	Waterworks	2	698.9 (B)

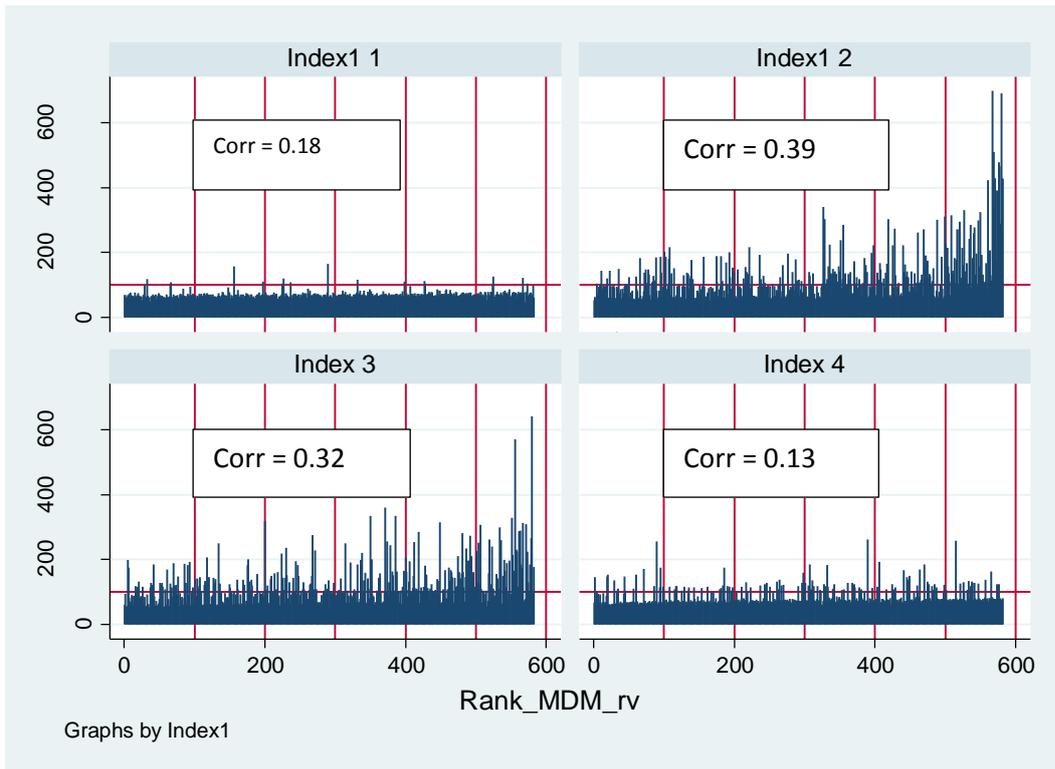
Note: (B) indicates that both age bands within the Ward contained a higher than expected number of deaths

As we have seen before, if you only examine the LGDs, then the LGD appears to play an important role in the number of suicides. When the analysis includes information regarding Wards, Wards take on an important role. Now that the examination is within the Wards it appears that the deaths are much more located in specific Wards within LGDs.

The analysis also indicates that deaths within Wards can be clustered within certain age groups. This is unlikely to be due to the age structure within the Ward, as the number of individuals within the different age categories has been controlled within analysis, but more data would certainly help to clarify the situation. Only in a few areas do we find deaths occurring at a higher than expected rate across age groups. As might be expected this occurs in a number of areas with a higher number of deaths, but it is also evident, from the results, that this does not carry over to many Wards with comparable numbers of deaths. This further illustrates that deaths within Wards appear to cluster on the basis of age, and this is over and above any population size effect, though the numbers on which these observations are based are small, and caution is advised.

### Deaths by age group, ranked by area deprivation

In the statistical model area deprivation was strongly related to the SMRs, and it was also evident that most deaths occurred amongst those in the 16 to 64 age group; there was no difference, in statistical terms (0.05 level), between the SMRs for the 16 -39 age group and the 40 – 64 age group. Approximately 90% of all suicides were in these categories, thus they were going to have a substantial impact on the aggregated results for deprivation. In order to explore this possibility, a series of plots was created to show the relationship between the SMRs and deprivation. This could also be explored as an interaction term in the model, i.e., the effect of deprivation on SMR will be determined by age category. It is simpler and provides an easier picture of what is happening if this association is presented in the form of 4 graphs.



Note: Index1 1 = birth to 15 years; Index1 2 = 16 to 39 years; Index 3 = 40 = 64 years; Index 4 = 65+ years

**Figure 9.2. Dropline graphs showing the relationship between deprivation and SMRs by age grouping**

The graphs indicate that there is a weak relationship between deprivation and SMR where the death occurred in either the youngest or oldest age group, and indicate a relatively flat profile of deaths in terms of area deprivation, though in the youngest age group this may also be due to the number of deaths being small. The higher correlations between SMRs and deprivation amongst those in the 16 to 39 age group and those in the 40 to 64 age group are influenced by a small number of outlying Wards, but nevertheless there is still a tendency for deaths by suicide in these age categories to be related to level of deprivation in the area, and this is especially marked where Ward deprivation is worst. It appears, from the

graphs, that nearly every Ward in the bottom 100 most deprived areas had a higher than average number of suicides.

### Random intercept model with covariates for age and deprivation

Given this lack of overlap within Wards in terms of SMRs, an alteration was made to the model in order explicitly to examine age clusters within Wards, through the introduction of age as a fixed effect rather than as a random effect, where we addressed the population of clusters. In addition, deprivation has been reintroduced into the analysis. The results indicated that the number of deaths recorded ( $\exp 1.02 = 2.77$ ), controlling for the other variables in the model, indicated that SMRs were increased by nearly 3 points for every one unit change in deprivation. The deprivation score ranged from 1.43 to 83.33 between Wards.

**Table 9.5. Empirical Bayes Standardised Mortality Ratios with fixed effects for deprivation and age categories**

Age_deaths	exp(b)	Std. Err.	z	P> z	[95% Conf. Interval]	
MDM_score	1.020344	.0011389	18.04	0.000	1.018114	1.022579
Age_0_15	.0521857	.0130986	-11.76	0.000	.0319081	.0853498
Age_16_39	.9389181	.0724417	-0.82	0.414	.8071489	1.092199
Age_65_plus	.3784778	.0352882	-10.42	0.000	.3152658	.4543641
_cons	.840227	.0434687	-3.36	0.001	.759207	.9298933
lne	1 (offset)					

Variiances and covariances of random effects

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-----
***level 2 (seq)Age group
    var(1): .1339248 (.02833138)
***level 3 (id)Ward
    var(1): 1.010e-17 (1.342e-14)
***level 4 (LGD_Code)
    var(1): 5.765e-22 (1.569e-17)

```

Those in the 40 to 64 age group were used as the reference category for the purpose of comparison. In terms of SMRs there was no difference in the prediction relating to the number of deaths in the 16 to 39 age group, once the population numbers were adjusted and Ward deprivation was included within the analysis. The comparison between the reference group and the two remaining age categories (birth-15yrs and 65+ age group) indicated substantially fewer deaths in these age categories.

## Conclusions based on geo-demographic characteristics

Based on the SMRs it is evident that deaths by suicide within Northern Ireland have been in an upward trajectory. In addition, there appears to have been a substantial effect on the classification of death with the re-organisation of the coronial services in Northern Ireland (Figure 5.1).

At the LGD level, once population size has been adjusted, it is evident that the larger conurbations have a higher number of deaths, and this is most noticeable in the Belfast LGD. It is also evident that deaths at the LGD level can be grouped into around 4 clusters or bands from a glance at the overlapping confidence interval (Figure 6.1). What is particularly striking is the excessive number of deaths by suicide in the Belfast Ward in comparison with other Wards (Figures 6.2 and 6.3), after population size has been adjusted.

When Wards are included within the analysis, the effect of LGD adds nothing to the explanations in terms of the number of deaths. In other words, there is a clustering of deaths within Wards, and Wards can be clearly differentiated from one another within LGDs. In Figure 7.1, 46 (7.9%) out of the 582 Wards have had seven or more deaths by suicide during the past seven years. In 79 (13.6%) Wards there were no recorded deaths by suicide and 422 (72.5%) Wards had recorded either no deaths or less than 4, over a period of seven years.

In order to compare the Wards, population size was statistically controlled. Once the population size within Wards was controlled so that Wards could be compared with an adjustment for the number of individuals living in the area, strong Ward effects are shown in Table 7.2 and Figure 7.4. (A further test of this is given in the results presented in Table 7.4) In Figure 7.4 it is evident that around 400 of the Wards have a SMR that is at or below the

average (100). Some 33 Wards, from across Northern Ireland, have SMRs that are some 50% above the societal norm. These 33 Wards are pictorially displayed in Figure 7.4. This figure and the associate table (7.2) illustrate the clustering of deaths in Northern Ireland with evidence of an urban preponderance of cases, where deaths have occurred within a Ward at a much higher level than the societal norm.

The variation between Wards, in the number of deaths by suicide within LGDs, is illustrated in Figure 7.5. In Belfast, L'Derry and Lisburn and a few other Wards in other LGDs it is evident that in one or more Wards the SMRs are high; however, in the LGD of Belfast it is apparent that in many Wards the SMR is high.

In addition to the population within each Ward and LGD it was also possible to adjust for the number of individuals who lived within a Ward (and LGD) stratified by age, within the bands (birth to 15 yrs; 16 to 35 yrs; 36 to 64 yrs; and 65+). These are fairly broad age bands, and obviously the number of deaths within Wards is now being sub-divided. Further, the creation of age bands is likely to be problematic because of potential effects created around the cut-point. Nevertheless, it is obvious that if there are more individuals within a certain age group then it is likely, if all else were equal, that there would be more reported cases of death by suicide in these circumstances. The particular interest was in the two middle age bands (16 – 34 yrs and 36 to 64 yrs).

This divides the data more thinly, but it introduces the interesting idea of what would happen if you controlled for the number of individuals within a particular age group/band. Would we see certain areas having a higher rate in both the 16 - 34 yrs and the 35 – 64 yrs age group, or does it appear that one of these age groups is the more likely to have been associated with those who died by suicide? Based on the produced SMRs it frequently appears that deaths within a given area are more likely to be associated with those in a

particular age group. Indeed few areas had higher than expected deaths in more than one age band; this is after adjusting for the number of such individuals in a given Ward.

However, this is very much an exploratory analysis, given the number of deaths by suicide, when age is stratified. Nevertheless, it illustrates what can be done.

A test was also made to find out if there were differences between those in the 16 to 39 age group and the 40 to 64 age group. This indicated that, once the sample size has been adjusted, no differences were found between these age groups in the number of deaths (Table 9.5.). In this model deprivation was also included as a covariate.

The association between the number of deaths in a Ward and deprivation was examined within 4 age bands. Given the smaller number of cases in the youngest and oldest age group, the estimated SMR across the Wards indicates a fairly flat profile, and these have been kept for completeness. The focus of the current analysis is on those in the 16 – 39 age group and the 40 to 64 age group in terms of the association between the number of deaths in a Ward and the deprivation rank of the Ward. It is evident that there is a strong association between deprivation and the number of deaths in Wards where deprivation is worst, and this association appears to be more marked for those in the 16 to 39 age group. Very high SMRs are certainly more evident in the most deprived areas; however, there are examples of higher than expected SMRs in a number of Wards along a good part of the deprivation continuum (Figure 9.2).

The number of deaths within a Ward and its predicted SMR (Figure 8.1) has a linear relationship, but the spread of points is substantial, indicating that one is not that good a predictor of the other, and illustrates the danger of relying on raw scores, at least for the purpose of comparison(s).

## Appendix

### Appendix 1. Publication

O'Neill, S, Corry, C.V., Murphy, S., Brady, S., Bunting, B.P., (2014). Characteristics of deaths by suicide in Northern Ireland from 2005 to 2011 and use of health services prior to death. *Journal of Affective Disorders*. Volume 168, 15 October 2014, Pages 466–471. doi:10.1016/j.jad.2014.07.028

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#### Abstract

#### Background

Service presentation may offer an opportunity for intervention prior to suicide. The study aimed to examine the characteristics, disorders and service use profiles of those who had died by suicide in Northern Ireland (NI) from 2005 to 2011.

#### Methods

An analysis of a database of deaths by suicide and undetermined intent based on data in the NI Coronial files from 2005 to 2011 ( $N=1667$ ).

#### Results

Males are three times as likely to die by suicide as females and suicide rates similar among those aged 20–60 years. Females have increased service use prior to suicide; males tend to disengage with services prior to death. Females are more likely to have recorded prior attempts, service use, diagnosis and referral. The most common health service used was primary care.

#### Limitations

Despite the inclusion of undetermined deaths (probable suicides) a proportion of deaths by suicide remain unrecorded as such. Data on marital status and mental and physical disorders were based on information recorded by police officers from relatives, other informants and medical records. The reliability of this data may therefore be questioned.

#### Conclusions

Primary care has an important role in suicide prevention. Gendered patterns in service use prior to death should be considered in suicide prevention programmes. It is important to strengthen clinicians' knowledge of the manifestations of suicidal ideation in males and ways

of encouraging service use in males. The NI population who were exposed to the height of the violence of the conflict appear to be at increased risk of suicide as they age.

## References (part 2)

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