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*Published in:*  
Journal of Affective Disorders

*DOI:*  
[10.1016/j.jad.2019.08.013](https://doi.org/10.1016/j.jad.2019.08.013)

*Publication date:*  
2019

*Document Version*  
Peer reviewed version

[Link to publication in Discovery Research Portal](#)

*Citation for published version (APA):*  
Gilchrist, E. E. A., & Sadler, D. W. (2019). The role of depression in unnatural death: A case-based retrospective study. *Journal of Affective Disorders*, 259, 7-14. <https://doi.org/10.1016/j.jad.2019.08.013>

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# The Role of Depression in Unnatural Death: A Case-Based Retrospective Study

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- A clear relationship between depression and unnatural death exists.
- People who use substances are more likely to have a diagnosis of depression.
- People who use substances are more likely to die due to suicides and drugs.
- People who misuse alcohol (PWMA) are less likely to have a diagnosis of depression.
- PWMA are more likely to die by suicide than any other cause of unnatural death.

Background: Depression affects the life of millions around the globe and perhaps also the manner of death. This study examined the role of depression in specific causes of unnatural death ~~whether there was a relationship between unnatural death and depression~~ and whether alcohol and substance use affect this relationship, in one locality in Scotland.

Methods: The research used a retrospective case-based study approach to analyse 168 cases, quantifying data reported in mortuary files to allow for quantitative statistical analysis of associations and differences amongst the variables.

Results: A diagnosis of depression was associated with a higher likelihood of unnatural death, specifically from due to suicide, drugs or homicide. A diagnosis of substance abuse was associated with a diagnosis of depression and with an increased likelihood of death due to suicide or drugs. A diagnosis of alcohol abuse was associated with a reduced likelihood of a diagnosis of depression but was associated with an increased likelihood of suicide.

Limitations: This study relied on a small sample from one locality in Scotland which limited the ability to generalise the results and the retrospective case-based design also limited the potential for checking data accuracy or to consider temporal relationships, which limited the ability to interpret causality.

Conclusions: This study found that there was a relationship between depression and unnatural death, which was mediated by alcohol and substance use. The importance of this study lies within the recognition of these relationships which identified the complexities of these relationships but suggested that some unnatural deaths within this population could be prevented.

## Keywords

Unnatural death, depression, mortality in depression, substance use, file-based study, cause of death

# 1. Introduction

Depression is a common and serious mood disorder which can negatively affect the way a person feels, thinks and acts. (Health, 2017)(Association, 2017) According to the World Health Organisation (WHO) depression affects 300 million people globally, including children, adults and the elderly across all social and economic backgrounds.(WHO, n.d.)

Although depression is a very treatable disease, there are barriers to this treatment. Under-reporting of the disease perhaps linked to social stigma and likely exacerbated by a lack of resources, a lack of trained healthcare providers and inaccurate assessment can prevent effective treatment of individuals with depression.(WHO, n.d.) This can lead to individuals continuing to suffer and facing a limited life expectancy. ~~This can lead to individuals continuing to suffer and facing a limited life expectancy.~~

The negative feelings and isolation experienced by those suffering from depression can lead to tragic outcomes, such as an individual committing suicide~~The negative feelings and isolation experienced by those suffering from depression can lead to tragic outcomes, such as an individual committing suicide.~~(WHO, 2016) Unnatural death is defined as a “death resulting from an external cause such as intentional injury (homicide or suicide) or unintentional injury (accident)”.(Dictionary, 2017)The association between severe depression and suicide is the most obvious, and direct, link between depression and unnatural death. However, this is not the only theorised link, for example, the dissociative elements of depression(WHO, 2016) can lead to poorer situational judgement and decision making which could increase the risk of both accidental death and being a victim of homicide and other violent crimes. Depression can also lower self-worth(WHO, 2016) which has also been theorised to lead to increased risk-taking behaviours.

A number of studies have established that a diagnosis of a mental illness decreases life expectancy. Chesney et al. found that life expectancy was decreased by 10 to 20 years(Chesney et al., 2014), Laursen et al linked reduced life expectancy to severe depression(Laursen et al., 2016) and Cheng et al. used case-control psychological autopsies to establish a link between depression and early death by suicide.(Cheng et al., 1997) However, whilst these studies have found a relationship between depression and suicide, ~~only two~~ studies conducted by Gau et al(Gau and Cheng, 1995) and Crump et al(Crump et al., 2013) examined mental health disorders and accidental death. Both of these studies established that a mental disorder significantly increased the risk of accidental death. However, Gau et al. did not specifically examine depression and Crump et al. determined that although depression increased the risk of accidental death, it was not the mental disorder with the greatest impact.(Crump et al., 2013; Gau and Cheng, 1995) Many of these studies did not examine the factors which affected this relationship such as gender and common comorbidities.

In the studies which have included some consideration of gender, they do identify a gender difference. For example, Dombrovski et al. considered the effect of gender on the relationship between depression and suicide(Dombrovski et al., 2008) and found that men were more lethal in their suicide attempts than women. This finding was supported by the

higher mortality ratio being found in studies such as Laursen et al.(Laursen et al., 2016) and Callanan and Davis who established that gender differences in suicide could be attributed to differences in suicide method.(Callanan and Davis, 2012) A study conducted within Tayside which showed that there was a rising suicide in males specifically by hanging, but this was not reflected in females. This study attributed choice of suicide method to perceived acceptability, availability and lethality.(Pounder, 1993) The limitations of these studies were the failure to consider other causes of unnatural death and links to gender and depression and that some are now outdated.

Alcohol and substance misuse commonly occur as comorbidities with depression,(Williams, n.d.) and are often seen as a form of self-medication to manage the symptoms of the disease. Yoon et al. undertook analysis to quantify the association between alcohol and substance misuse and premature death in depressed individuals.(Yoon et al., 2011) They established strong associations between substance and alcohol misuse and depression and identified that there were elevated risks of suicide and other causes of unnatural death when substance misuse and alcohol misuse were present with depression.(Yoon et al., 2011) Archie et al also found that there was a higher increase in mortality in individuals suffering from both alcohol misuse and depression than in just depressed individuals.(Archie et al., 2012) However, a study conducted by Britton et al. contradicted this and suggested the increased mortality was equal in those solely suffering from depression and those suffering from depression and alcohol misuse concurrently.(Britton et al., 2015) Given the methodological limitations, and narrow focus of previous studies, there is an ongoing need for further research exploring the associations between alcohol, depression and all unnatural deaths.

Substance misuse has been more extensively researched than alcohol misuse in relation to depression and unnatural death. Grattan et al. examined opioid use in the context of depression and found that the presence of depression increased the likelihood of an individual misusing their own opioid prescription.(Grattan et al., 2012) Maloney et al. found that individuals who had attempted suicide were more likely to have a diagnosis of mental disorder but they did not attribute this specifically to depression.(Maloney et al., 2009) Aharonovich et al. found that depression before the onset of substance misuse predicted the severity of an individual's suicide attempt whereas a depressive episode during a period of abstinence from substances predicted the number of times an individual would attempt to commit suicide.(Aharonovich et al., 2002) Bohnert et al. also explored the relationship between co-existing depression and substance abuse with unnatural death and found that the presence of both conditions increased the likelihood of an individual dying due to an accident more than the presence of only one of the conditions.(Bohnert et al., 2012)

The studies reviewed indicate that depression increases the overall mortality of an individual and appears to contribute to the risk of unnatural death. However, evidence concerning which factors contribute to these links remain inconclusive.

This current study is unique in that ~~it sought to establish the relationship between depression and unnatural death~~it sought to determine the role of depression in unnatural deaths-based on data collected in one Scottish city and to explore factors that contributed to both conditions including substance misuse and alcohol misuse.

The aims of this study were to investigate whether there was a relationship between the diagnosis of depression and specific causes of unnatural ~~causes of~~ death in Tayside; ~~to investigate which specific causes of unnatural death were associated with depression~~ and to investigate the contribution of substance and alcohol misuse to the relationship between a diagnosis of depression and unnatural death. It was hypothesised that

~~1. a diagnosis of depression would increase the risk of dying due to any unnatural cause.~~

1. a diagnosis of depression would be associated with an increased risk of suicide.

2. A diagnosis of depression would be associated with substance and alcohol misuse.

3. substance and alcohol misuse would be associated with a further increase in risk of ~~unnatural death.~~ suicide.

# 1. Methods

## 1.1 Literature Review

The studies used as evidence throughout this study were identified using a systematic literature review.

A computer search was conducted across two databases; PubMed and Google Scholar. In both of these data bases the following search terms were used in a variety of combinations:

'depression', 'mortality', 'death', 'alcohol', 'suicide', 'accidental death', 'homicide', 'substance misuse', 'drugs'

The abstracts were collected, and the full text was obtained for any article available for free under the University of Dundee licence. The references of these articles were then review, looking for any title directly related to the current study. The initial inclusion criteria for each article to fulfil was wither literature covering unnatural death in depression or an original investigation into causes of unnatural death in depression. A broad inclusion criterion was initially used to avoid dismissing any articles prematurely.

The abstracts produced by the computer search and review of references were collated and a process of review was performed using an already written exclusion criteria. The first exclusion criterion was that the article could not be a literature review, meta-analysis, case-study or case presentation. This exclusion was written so that all the data from the chosen articles were from original studies in order to asses a review of the current empirical evidence surrounding the research aims. Case-studies and case presentations were excluded to ensure that the sample sizes being used were large and to avoid articles concerning rare cases.

The studies were to be published in English or an English version was to be available to avoid any translation errors in the reading of them by the author.

As previously stated, the full text version had to be available or able to be obtained under University of Dundee Licensing at no cost.

Finally, it was decided that the studies had to be less than 50 years old at the time of the review, meaning that they were to be published during or after January 1957. The broad date range was chosen as it was not expected that much specific literature would be found on the research subject. Furthermore, the research in this field has not advanced particularly quickly to the author's knowledge so it was felt that articles as old as 50 years could still be relevant today. st.

### 1.1.2 Database

The Police Mortuary in Dundee collects all information from autopsies performed by forensic pathologists within a computer database. This database contains information concerning cause of death, the category the death has been assigned to and the case file number, which is linked



to a paper file stored within the police mortuary. The paper file contains the medicolegal autopsy report, the police report and a summary of medical notes from the individual's general practice (GP).

In Scotland, death investigation is initiated by the police who collate evidence from witnesses, family and medical sources such as GPs and hospital doctors. The police report is passed to the Procurator Fiscal. The GP records and hospital notes are also routinely made available to pathologists. The Procurator Fiscal passes all available information on to the pathologist, together with instructions of autopsy. Illicit drug deaths require instruction of a corroborated two doctor autopsy. This means that the two pathologists most involved in unnatural deaths in Tayside work together very closely and have developed similar investigative thought processes with respect to the interpretation of events and the final wording of the medical cause of death. Consistent terminology is employed.

The database can be searched using keywords, cause or category of death. The categories used by the Police Mortuary in Dundee are as follows;

1. Natural
2. Accident
3. Suicide
4. Homicide
5. Unclassified
6. Undetermined

The category of death and cause of death is decided by the forensic pathologist after an autopsy and relevant histology and if relevant toxicology has been performed.

#### 1.21.3 Sample Design

The sample included all medicolegal autopsies which were not categorised as a 'natural' case within 2017 for which the paper files were available to be examined within the police mortuary. This time frame was chosen to allow for unbiased selection of a large enough sample for basic exploratory data analysis. (Allan Hackshaw, 2015)

The database search initially identified 213 cases of which a further 45 had no assigned category so were excluded. In total the paper files of 168 medicolegal autopsy reports were examined from January 2017 to November 2017.

#### 1.31.4 Information on Deaths

Each case file was examined, and factors identified as important from the literature were entered into an Excel spreadsheet. Due to the variation in the classification of causes of death for similar cases between different forensic pathologists, the cases were recoded to ensure there was as much continuity in the cause and category of death as possible (see Figure 1). This method of recoding cases has been done in similar study designs. (Sjogren et al., 2000) The causes of death that were placed within the "Unknown" category were those that an intent could not be determined so it is not possible to comment on whether or not the individual intended to commit suicide.

[INSERT FIGURE 1 HERE]

*Figure 1: Figure showing which recoded causes of death were placed in which recoded category of death for the purposes of analysis within this study.*

The following factors were identified as important from the literature and had enough data within the excel file to be analysed within this study:

1. *Recoded Cause of Death*, 2. *Recoded Category of Death*, 3. *Sex*, 4. *Age*, 5. *Diagnosis of Depression within GP notes*, 6. *Diagnosis of Alcohol Abuse within GP notes*, 7. *Diagnosis of Substance Use within GP notes*, 8. *Presence of Substances on Toxicology at Autopsy*

The Excel spreadsheet was then recoded into numerical data and transported to SPSS for analysis.

#### 1.41.5 Ethics

This study did not perform any experimentation on humans or animals. All approval for access to the database was granted by the police mortuary and data collection and confidentiality regulations, as set by the police mortuary were adhered to. The research is compliant with the Declaration of Helsinki.(WHO, 2001)

#### 1.51.6 Statistics

Initial descriptive analysis was undertaken followed by inferential statistical analysis. The Pearson product-moment correlation coefficients were calculated to establish the statistical significance of observed associations for parametric data and chi-squared tests were calculated for non-parametric data.(Pallant, 2010) Next, binary logistic regressions were performed to assess which variables contributed to outcomes when more than one potential contributor were considered together.(Pallant, 2010) All statistical analysis was conducted using SPSS.

## 2. Results

Of the autopsies performed in 2017, 36.3% were cases of unnatural death. There was a diagnosis of depression, in 50.6% of the unnatural death cases.

Overall, the mean age of the 168 cases was 45.5 years, with an age range from 13 years to 94 years. For those with a diagnosis of depression the mean was 43.89 and the age range was from 13 to 80 years. Within the cases without a diagnosis of depression the mean was 46.52 years old. The majority of the cases, 79.8%, were male and this was slightly higher in those with a diagnosis of depression where 81.2% were male.

[INSERT FIGURE 2 HERE]

*Figure 2: Percentage of individuals within each age group in those with a diagnosis of depression, those without a diagnosis of depression and across all cases combined.*

[INSERT TABLE 1 HERE]

*Table 1: Mode of death by presence or absence of a diagnosis of depression.*

In those with a diagnosis of depression, just over thirty percent (30.6%) died due to suicide, 7.1% died as a result of accidents and for the remainder the intention behind the cause of death was unknown. In those without a diagnosis of depression, 18.1% died due to accidents, 15.7% of cases died due to suicide and the rest died with unknown intentions. Inferential analysis identified that the association between depression and cause of death was significant ( $X^2=8.205$ ,  $p=0.017$ ).

[INSERT FIGURE 3 HERE]

*Figure 3: Percentage of individuals who died due to each cause of death in those with a diagnosis of depression and those without a diagnosis of depression.*

The “cause of death” varied between those with a diagnosis of depression and those without. “Drugs” was the leading cause of death for those with a diagnosis of depression whilst “Vehicular Collision” was the leading cause of death in those without a diagnosis of depression. This was found to be statistically significant ( $X^2=45.445$ ,  $p= 0.000$ ).

In relation to substances, 30.1% of the cases had a recorded history of substance use and 24.4% of the cases had a recorded history of alcohol abuse. Whilst, the majority of cases did not have any documentation saying whether or not they abused substances or what type of substances were abused, where it was recorded this was explored.

Opiates were most commonly used across all three populations. The percentage of individuals abusing substances was higher for those with a diagnosis of depression than those without a diagnosis of depression across all forms of substance abuse, apart from cannabis abuse and polysubstance abuse.

Significantly more individuals who died by suicide had a history of substance abuse ( $X^2= 19.355$ ,  $p= 0.000$ )

There was a significantly higher number of individuals with a history of substance abuse in those who died due to suicide ( $X^2= 19.355$ ,  $p= 0.000$ ). A correlation was found between a

diagnosis of depression and substances being present on toxicology at time of death ( $r=0.164$ ,  $p=0.046$ ). ~~On further analysis, further analysis identified that substances were present on toxicology at death in this was found to be~~ a significantly higher number of individuals with a diagnosis of depression than in those without a diagnosis of depression ( $X^2=3.993$ ,  $p=0.046$ ).

A logistic binary regression indicated that a history of alcohol abuse was associated with an increased likelihood of having died due to suicide (OR= 1.006, 95% CI 1.002 – 1.010,  $p=0.006$ ) but ~~a diagnosis of alcohol abuse was associated was associated with~~ a decreased likelihood of having a diagnosis of depression (OR= 0.004, 95% CI 0.000 – 0.294,  $p=0.012$ ).

### 3. Discussion

This study set out to examine whether a diagnosis of depression increased the risk of death due to any unnatural cause, and specifically to consider the risk of suicide, and to explore whether substance and alcohol misuse would be associated with a diagnosis of depression and a further increase in risk of unnatural death.

Over half of the cases of unnatural deaths had a diagnosis of depression documented within medical notes, which is almost ten times higher than the local rate in Dundee, where only 5.35% of the population have a diagnosis of depression (Dundee, 2015) and -similarly higher compared to tThe national rate, as of depression across Scotland the rate of depression is is 6.28%. (Dundee, 2015) This supports the hypothesis that there may be some of a positive association between depression and unnatural death and supports the empirical evidence found within the studies of Gilman et al., Laursen et al. and Angst et al., (Angst et al., 2013; Gilman et al., 2017; Laursen et al., 2016) who all suggested that there was an increased mortality due to an increased risk of unnatural death.

It was found that statistically more individuals with a diagnosis of depression died due to suicide whilst statistically more individuals without a diagnosis of depression died due to accidents. This could indicate that within Tayside death by suicide is more likely for those with a prior diagnosis of depression than those without. This study found that there was a significantly higher numbers of individuals with a diagnosis of depression who died due to suicide than those without a diagnosis of depression. This supports the hypothesis that a diagnosis of depression would be associated with an increased risk of suicide and echoes findings of studies conducted elsewhere in the world. (Cheng et al., 1997) The links between depression and suicidal thinking are well recognised. In fact, suicidal thinking is part of the criteria for diagnosing depression. (WHO, 2016). This study provides empirical support for theories that suggest that negative feelings experienced as part of depression may become part of the daily thinking (WHO, 2016) which could result in suicidal thinking.

This also study found a significant link between a diagnosis of depression and a diagnosis of substance abuse. This would support a theory suggesting drug use could be driven by a need for self-medication and self-numbing to cope with the symptoms and thoughts associated with depression. (Kecojevic et al., 2015; Quello et al., 2005) According to the National Records of Scotland there were 934 drug-related deaths in Scotland (Board, 2018) and 4,508 unnatural deaths registered in Scotland overall, ("Vital Events Reference Tables 2017," 2018) meaning 20.7% of the national unnatural deaths were due to drugs. However, within this study almost half (45.9%) of the individuals with a diagnosis of depression died due to drugs. Given the rates observed, it may be that the help being offered to those with depression may not address their substance abuse needs or vice versa, with substance abuse treatment not addressing the needs of depression.

Substance abuse is identified in the literature as a predictive factor in unnatural death (MentalHealth.Gov, 2017) (Quello et al., 2005) (Hasin et al., 2002) and within this study, correlations were found between substances being present on toxicology and a diagnosis of depression. These results are consistent with studies that have identified that drugs increased the likelihood of accidents, suicides and homicides (Aharonovich et al., 2002;

Brådvik et al., 2017; Kamali et al., 2000; Ortíz-Gómez et al., 2014) impulsivity and decreased rational thinking.(Ortíz-Gómez et al., 2014; WHO, 2017)

There was a higher proportion of individuals with a diagnosis of depression who specifically had a history of taking Cocaine and Opiates. These are widely seen as “harder” drugs due to more obvious physical effects, increased likelihood of addiction and death, more severe side effects and greater penalties in terms of criminal justice.(Frank, 2017a, 2017b, 2017c) (GOV.UK, 2018)

[INSERT FIGURE 4 HERE]

*Figure 4: Global regional deaths due to specific substances according WHO in 2015.(World Health Organization, 2016)*

This choice of drugs in individuals with depression could reflect a preference for drugs with a more dissociative effect to counteract the negative thoughts and feelings of depression, and an increased willingness to take risks.

An alternative form of self-medication is the misuse of alcohol. Within this study a diagnosis of alcohol abuse to be a factor associated with a lower likelihood of depression. This was in contrast to common theories of coexisting alcohol abuse and depression, and more severe depression existing alongside alcohol abuse.(Zhabenko et al., 2013) It could be that this higher use of alcohol was indicative of a to some extent effective, coping strategy. Alternatively, these results could be a result of restricted reporting of depression and low mood to GPs, perhaps as a result of the perceived stigma associated with alcohol abuse and biases of the healthcare professions.(Keyes et al., 2010; Saunders et al., 2006; Schuler et al., 2015) This could also be due to co-existing alcohol abuse and depression that is not being diagnosed due to reduced engagement with healthcare providers due to the perceived stigma.(Saunders et al., 2006; Schuler et al., 2015) This would then allow both the addiction to alcohol, which can cause suicidal thoughts and disinhibition,(Choi et al., 2017)(Brady, 2006) and the depression to remain untreated and therefore increase in severity(Orenstein and Marcellin, 2012) without monitoring by healthcare providers and result in an individual committing suicide. As this study found that a diagnosis of alcohol abuse was linked to increasing the likelihood of a death being a suicide it would seem that the latter explanation would be more likely.

This study aimed not only to examine depression in relation to unnatural death and the specific causes of death but also to study the factors contributing to this relationship. The vast majority of the unnatural deaths from 2017 were male. It has been shown that males are more likely to engage in high risk behaviour and are more likely to be involved in higher risk situations, that could lead to being the victim of a homicide or of an accident.(C and R, 2003; Omar, 2011) One possible theoretical explanation would be that the social concept of masculinity might promote an acceptance of violence and therefore an increased likelihood of involvement in violence.(Omar, 2011)(Bozkurt et al., 2015) In turn, this acceptance of violence within the male population could lead men to be more likely to endorse and encourage violence, and also increasing the chances of being the victim of homicide.

Furthermore, it is widely suggested that men could be at a higher risk of suicide than women. This might be explained by societal constructs and attitudes in the Western

societies which could promote the internalisation of negative feelings in the male population(Omar, 2011)(Hawton et al., 2013)(Parker, 2017), limit free expression of emotions by men, and perhaps also block men from seeking help from healthcare providers concerning negative feelings and depression. Also, a lack of input from healthcare providers and lack of support through the illness could lead to a minor case of depression becoming more severe perhaps leading to suicidal ideation and an increased risk of suicide. The high proportion of males within this study and the theoretical interpretations suggests there could be a need for change in society in attitudes towards men and the opportunities they are given to voice their emotions and emphasises a need for healthcare initiatives that are directed towards specific groups to prevent suicides, accidents and homicides.

#### 4.1 Strengths

This study's strengths lie within its unique approach which was to explore the common comorbidities associated with a diagnosis of depression within a population which died due to unnatural deaths. Other studies have explored causes of death within a depressed population and have often utilised prospective studies so introducing some bias. Alternatively, studies have sought to measure the presence of depression across populations who experienced both natural and unnatural deaths focusing on the differences between the two different populations and identifying differences based on quantitative data. This study sought instead to use a case based design and sought to engage in a more detailed analysis of the range of factors impacting on the association between depression and unnatural death within the population of unnatural deaths. The study coded data from routinely collected file based information to create a unique data source. This avoided the potential bias that could have been created had the study been undertaken using a prospective format creating data for research alone. A significant strength of this work is that it is one of the few studies within Scotland to explore depression and unnatural deaths.

#### 4.2 Limitations

Limitations of this study include the fact that this study was based on a relatively small sample size, covering a short period. Also, the data was collected only from within Tayside, so it is difficult to make comparisons between this population and others around the country or nationwide. The study could have been improved by including cases from the "natural" deaths which would have allowed for analysis of depression across the population as a whole and a comparison between unnatural and natural death.

Also, this study was a retrospective review of cases of unnatural deaths that had already occurred which meant that there was no ability to collect further data from the patient, or family and friends to explore mental state of the individuals around the time of death. This meant that the true intentions of an individual prior to their death could not be determined, meaning certain causes of death, for example "drugs" could not be further subcategorised into an accident or suicide. -The study was reliant on file-based information, and on accurate assessment and documentation of depression by doctors within GP practices which presents problems due to the varying criteria amongst GP practices to diagnose depression and the under-reporting of the disease by those suffering from it.

## 4.2 Future Research

Further studies need to be conducted on a larger scale so that more unusual causes of death such as homicides are present on a large enough scale to be significant. Future research concerning the relationship and links between depression and unnatural death should include matching depressed and non-depressed individuals as controls and using data from a range of sources alongside cases from the police mortuary, for example, information could be investigated using NHS databases, to allow identification of further, ideally dynamic risk factors to be identified. Prospective strategies which could include monitoring of individuals with depression for these risk factors could then be put in place.

## 4.3 Future Practice

In terms of future practice, forensic medical examiners could search for a diagnosis of depression more routinely and include it within reports more frequently as it has been shown to be relevant in all causes of unnatural death, not just suicides.

Within the Alcohol and Drug Services of Dundee's strategic and commissioning plan 2017-2020, one of the key actions stated is to "Improve harm reduction services and responses to non-fatal overdoses" (Services and Plan, 2017) which suggests that the need for better drug services has been recognised by Dundee Council but this study has highlighted that there is a particular need to improve these services within the depressed population.

Finally, healthcare initiatives could encourage individuals to seek help and report their negative feelings to doctors as it is suspected that depression is still widely under-reported and therefore, under-treated. Higher rates of treatment could help to prevent substance or alcohol abuse from occurring as a comorbidity or tackle existing substance or alcohol abuse, thus helping to reduce the very high rates of drug deaths within the depressed population and reduce suicides within those who misuse alcohol in Tayside.



|

## 4. Conclusion

This study has shown that the association widely found and theorised between depression and specific causes of unnatural death, such as unnatural deaths, specifically suicide, does in fact exist within Tayside. Furthermore, many factors contribute to this relationship, but the effects of the variables overlap. However, some simple psychological explanations can help to understand some of the complex relationships seen. The importance of this study lies within the recognition of these relationships and prompting a focus on the complexities an area of research required within the United Kingdom so that many of the unnatural deaths can be prevented within this population.

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<b>Accidents</b>	Alcohol
	Choking on Food
	Stabbed
	Fall Not From Height
<b>Suicides</b>	Hanging
	Incisions to Wrists and Arms
	Inhalation of Carbon Monoxide
	Plastic Bag Asphyxia
	Poisoning
<b>Unknown</b>	Drowning
	Fall From Height
	Drugs
	Vehicular Collision
	No Anatomical Cause

Figure 1: Figure showing which recoded causes of death were placed in which recoded category of death for the purposes of analysis within this study.

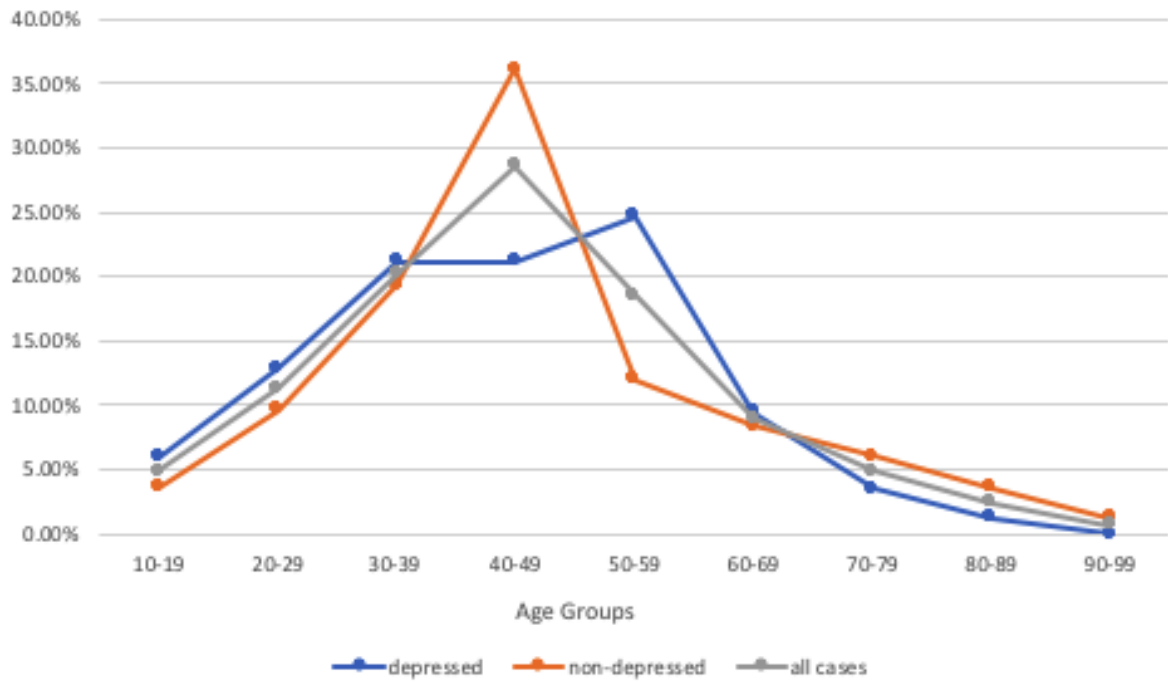


Figure 2: Percentage of individuals within each age group in those with a diagnosis of depression, those without a diagnosis of depression and across all cases combined.

FIGURE 2 FOR COLOUR PRINT.



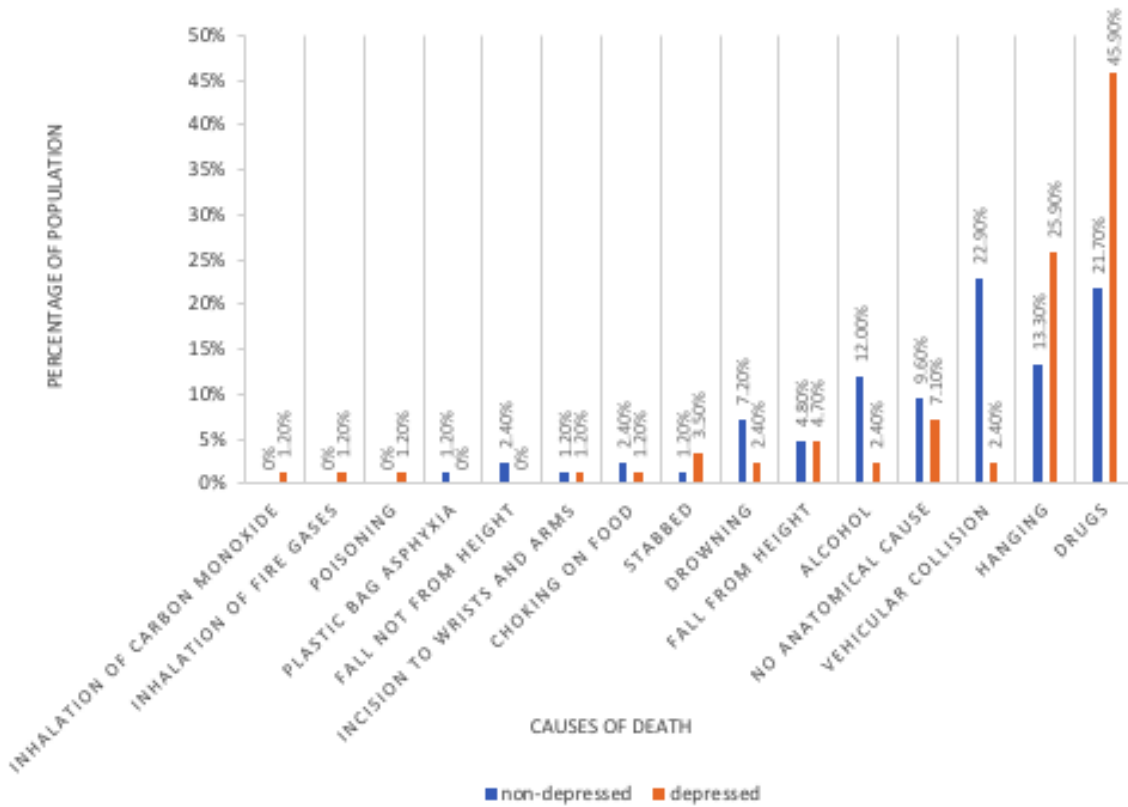


Figure 3: Percentage of individuals who died due to each cause of death in those with a diagnosis of depression and those without a diagnosis of depression.

FIGURE 3 FOR COLOUR PRINT.

### Regional Deaths Due to Drugs

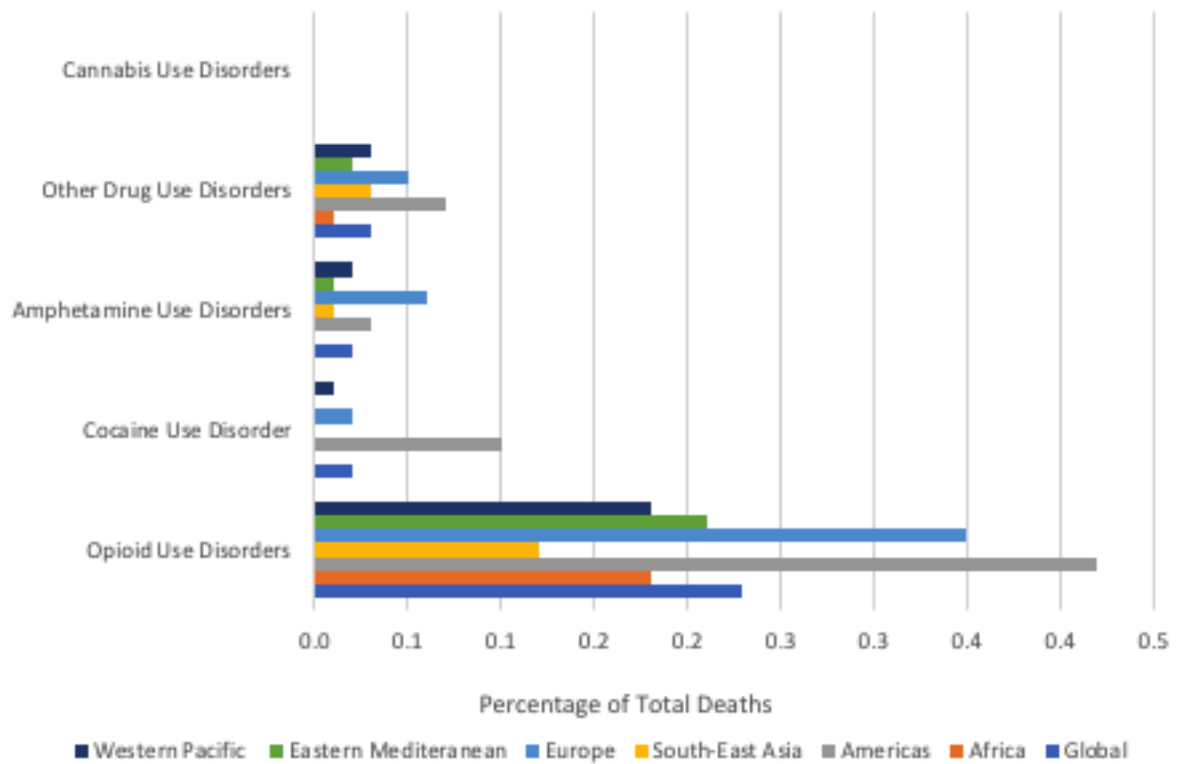


Figure 4: Global regional deaths due to specific substances according WHO in 2015.(World Health Organization, 2016)

FIGURE 4 FOR COLOUR PRINT.

			Accident	Suicide	Unknown	Total
Depression Y/N	Y	Count	6	26	53	85
		% within Depression Y	7.1%	30.6%	62.4%	100.0%
	N	Count	15	13	55	83
		% within Depression N	18.1%	15.7%	66.3%	100.0%
Total		Count	21	39	108	168
		% within Depression Y/N	12.5%	23.2%	64.3%	100.0%

Table 1: Mode of death by presence or absence of a diagnosis of depression.

## Conflicts of Interest

All authors declare no conflicts of interest with this study.

## Ethics Statement

This study is compliant with the Declaration of Helsinki (1989).

## Contributors

Miss Eilidh Gilchrist took the lead for the study concept, collection and analysis of data and drafting and revising the manuscript. Dr. David Sadler had a key role in the study design and provided critical commentary and revision of the manuscript for important intellectual content. All authors take responsibility for the integrity of data and the accuracy the data analysis. All authors contributed to and have approved the final manuscript.

## Acknowledgments

Thank you to all of the staff at the police mortuary for helping to facilitate the research.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.