A RETROSPECTIVE ANALYSIS OF SUSPECTED SUICIDES AND THEIR ASSOCIATED LINK TO VICTIM PROFILES AT THE JOHANNESBURG FORENSIC PATHOLOGY SERVICES

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DECLARATION

I Lorena Carelle declare that this Dissertation is my own, unaided work. It is being submitted for the degree of Masters' of Science (Medicine) in Forensic Medicine and Pathology at the University of Witwatersrand, Johannesburg.

This Dissertation has not been submitted before for any degree or any examination at any other university.

Lorena Carelle

March 2021 in Edenvale

ABSTRACT

The number of suicides globally has sparked much interest over the years, with many countries investing heavily in mental health education to reduce the risk of suicides. A considerable amount of research has been conducted into this phenomenon with researchers asking questions such as: why are some individuals more at risk of completing suicide, and what psychological functions, various mental disorders may serve those who are mostly affected by these psychopathologies, and what preventative measures could be put in place to reduce the risk of suicides. This study conducted a retrospective review of suspected suicides between 2012-2016, to determine the demographic profile (Sex, Race, Age) of all suspected suicide victims at the Johannesburg Forensic Pathology Service. The demographics were further analysed with respect to seasonal and temporal patterns. Body recovery location in terms of 'indoor' and 'outdoor' and with respect to the demographics were analysed. Demographical information and their relation to the methods of suicide (overdose, hanging, jump/fall from height, poisoning) was investigated in terms of 'more' and 'less' violent methods and were analysed. This retrospective study examined a total of 1019 suspected victims of suicide, and found that suicide was most prevalent within the male population across all race groups with hanging being the preferred method. Age affected the nature of suicides because deceased's who chose a more violent method of suicide (Hanging, Shooting) were within the age group of 31-40 years of age. The less violent method of suicide shared the same age group. Alcohol however did not play a significant role in suicides, however research remains to highlight that alcohol could be considered a suicidal risk. Seasonal and Temporal factors and trends in relation to the months of year and Race/Sex showed no real significant association in terms of consistency as the general trends showed inconsistency with increases and decreases throughout the study. It was suggested that perhaps the contributing factors could be related to Seasonal Affective Disorder and perhaps the missing link as to why individuals had completed suicide during certain months and seasons of the year. Two main peaks were reported, with March and June for all years combined. August was depended on the Year, which showed a peak in cases for the years 2012, 2014 and 2015 but not in 2013. Irrespective of Race, Sex and Age, findings from this research found that individuals preferred to commit suicide 'indoors' rather than 'outdoors', and suggested that the preference would be due to the delayed discovery of the body. Therefore, recommendations and future areas of research were identified, propose, that more information was needed to investigate the phenomenon of suicides and its risks on a global and national level.

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Lastly but not least, I would like to dedicate this research to those who have passed on, thank you for allowing me to be your voice, in the hope of helping others faced with challenges and sadness in their lives.

I leave you with this:

It is when you're going through the most difficult
Chapter of your life that your hero is revealed,
And how beautiful it is when you finally
Realize… You have the strength to save yourself.

Dodinsky

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LIST OF ACRONYMS

BAC= Blood Alcohol Concentration (g/100ml)

CO= Carbon Monoxide

JHB= Johannesburg

JHB FPS MLL= Johannesburg Forensic Pathology Services Medico-Legal Laboratory (Mortuary)

n= Sample size

NIMSS= National Injury Mortality Surveillance System

SD= Standard Deviation

WHO= World Health Organisation

DID= Dissociative Identity Disorder

SAD= Seasonal Affective Disorder

CBT= Cognitive Behavioural Therapy

SADAG= South African Depression and Anxiety Group

CHAPTER 1

'Did you really want to die? No one commits suicide because they want to die. Then why do they do it? Because they want to stop the pain'
(Tiffanie De Bartolo)

INTRODUCTION

According to the World Health Organization (2001, p.37) suicide is defined as the 'result of an act deliberately initiated and performed by a person in the full knowledge or expectation of its fatal outcome'. Suicide is one of the leading causes of unnatural deaths globally (Mashreky *et al.* , 2013), and as such is a significant problem. Suicide is often carried out in conjunction with a mental illness such as Depression, Bipolar Mood Disorder and Substance use and abuse (The World Health Organization, 2001; Burrows *et al.,* 2004). Mental health illness and the consumption of alcohol and drugs, either elicit or prescription are considered to be contributing factors of suicide (Flisher & Parry 1997; Kumar *et al.,* 2006). There is a compelling body of evidence indicating, that adequate prevention and treatment of mental and behavioural disorders such as Depression, Bipolar Mood Disorder and substance abuse has reduced suicide rates (World Health Report, 2001; The World Health Organization, 2001). Southern Africa's radical change socially, economically, politically, and a high unemployment rate and the effects of poverty and other personal problems have led to individuals ending their lives (Durand & Barlow, 2009; Wenar & Kerig, 2010).

This behaviour has placed demand for a better health care system, which in turn has had to invest funds into psychoeducation, and appropriate resources and activities, treatment for those who attempted suicide and the additional impact on their families and communities (Vawda, 2014).

Suicide prevention programmes mainly concentrate on eliminating suicide ideation and protecting individuals from suicidal behaviours (Gutierrez *et al.,* 2000). Thus early identification of individuals with suicidal ideation will result in better use of suicide prevention resources and can reduce suicide risk later on in their lives. Low socio-economic conditions have been identified as one of the main reasons for suicide in developing countries due to

economic hardships and psychological pressures (Mashreky *et al.,* 2013). The current study conducted by Mashreky *et al.*, (2013), reported that Black/African males had the highest suicide rate overall, and this could be attributed to the unavailable opportunity to find work, poverty, and unavailable access to medical care (Mashreky *et al.*,2013). Another finding from Mashreky e*t al.,* (2013), postulated that Black/African individuals prefer to receive treatment from culturally acceptable healers and not appropriate medical care providers; therefore, they are more prone to suffer from disease and disability without treatment which increases suicide risks.

In all Race groups based on the current study, it was evident that the age group with the greatest prevalence was in the 31- 40 year age group. It is without a doubt that appropriate programmes, and coping skills courses need to be put in place for all to access (Naidoo and Schlebusch, 2014). Young individuals aged between 11-20 years tend to have increasing mental illness diagnoses with problems such as self-image (Anorexia) and societal expectations and media involvement could lead to suicide (Naidoo and Schlebusch (2014). SADAG, (2015) states that more discussions, programs and positive self-image courses should be made available at all schools. Nevertheless, one cannot identify every suicide ideation and compare to those who might be at high risk, but rather changing individuals attitudes towards suicidal behaviour through positive reinforcement, and individuals who commit suicide is an efficient way in suicide prevention.

This study was therefore important to explore the fundamental aspects of profiling individuals who were at risk for committing suicide as well as developing appropriate preventative strategies for individuals who could be a future risk (Vawda, 2014).

The aim of this study was therefore to determine the demographic profile of all suspected suicide cases at the Johannesburg Forensic Pathology Service, and to describe the various methods of suicidal deaths, the seasonal patterns, and the type of location where the suspected suicide occurred.

CHAPTER 2
LITERATURE REVIEW

INTRODUCTION

In this chapter a review of the literature regarding suicide will be discussed. It will first focus on defining suicide and its incidences, then it will look at the reasons for the deceased's choice of method of suicide followed by the epidemiology. The associated factors in suicide such as the seasonal and temporal variations, sex differences and socioeconomic factors and the locations of suicide will be explored further in this chapter. The models of suicide will also be discussed, to get a clearer picture and understanding towards the contribution of suicide.

2.1. DEFINITION OF SUICIDE

Suicidal ideation is defined according to Silverman *et al.,* (2007, p. 248) as 'plans and wishes to commit suicide in the absence of any recent overt suicide attempts', whereas suicide attempt according to Webster (2018, p. 332), is defined as 'a potentially life-threatening self-injurious event or behaviour with a nonfatal outcome, where there is evidence that the individual had at least some intent to die'.

2.2. PREVALENCE AND CONTRIBUTORY FACTORS OF SUICIDE

The propensity for engaging in suicidal behaviours differs between individuals with respect to their individual risk factors (SADAG, 2015). Risk factors are immutable for example age, sex, race/ethnicity, while others are more situation specific for example loss of housing, exacerbation of pain in a chronic condition, or an onset of psychiatric symptoms. Mashreky *et al.,* (2013) state that women of the Islamic faith are placed under great pressure from their spouses and society and the financial and emotional dependency on their spouses may create a stressful environment, and increase in domestic violence and socially deconstruct and deny women empowerment which may increase the risk and may ultimately result in suicide. Based on Mashreky *et al.,* (2013) findings, research indicated that the female suicide rate within the Islamic culture accounted for 8,2 per 100,000 individuals for the female population and males having a rate of 6,5 per 100,000 people. Within an individual, the contribution of each risk factor to their suicidality will vary over the course of their lives (SADAG, 2015; SA Federation for Mental Health, 2017). No one risk factor or a set of risk factors, necessarily conveys increased suicidal risk, nor does one protective factor insure protection against encouragement in suicidal behaviours.

The link between alcohol and suicide has been found to be ambiguous and therefore it has proved challenging to establish whether alcohol (and other substances) increased risk of suicide (Cheong *et al.,* 2012). However, alcohol abuse is considered the most common type of substance dependence worldwide, and alcohol-related misconduct increases the risk of suicide, therefore individuals consume alcohol prior to their suicidal act as a means to ensure this courage is needed to complete suicide. (Pompili *et al.,* 2010).

Alcohol has a propensity to increase impulsivity and decrease one's inhibition therefore increases negative self-esteem. Alcohol and suicide share a relationship as suggested by Pompili *et al.,* (2010) who found that alcohol makes individuals act more impulsive, where suicidal thoughts may set into action and inhibit the ability to reason and function.

A study conducted in South Korea, demonstrated that suicide rates were greater in males with 32 per 100,000 compared to females with 15 per 100,000. However, suicide attempts were far higher amongst females with 228 per 100,000 whereas males accounted for 116 per 100,000 for attempted suicide (Cheong *et al.,* 2012). Cheong *et al.,* (2012) provided a possible explanation that females attempted suicide more often than males were due to pressures, demands and emotions in response to stress, and not finding suitable coping mechanisms. Coping as a mechanism has been defined by SADAG, (2015) as an individual's attempt to use behavioural and cognitive strategies to manage and regulate stress. In comparison, males had a greater psychological impact due to the effect of unemployment, illnesses and inconsistent coping mechanisms. Males in general expressed an increased likelihood to partake in negative forms of behaviour such as the abuse of substances and increased levels of alcohol, which may have increased suicidal tendencies (Cheong *et al.,* 2012).

Every year, approximately 800,000 people die by suicide worldwide. In the United Kingdom, for the period of 2018, according to the WHO, (2001) there were 6,507 completed suicides, a rate of 11,2 deaths per 100,000 individuals. Rates were found to vary across the United Kingdom with Scotland comprising 16,1 deaths per 100,000 individuals followed by Wales with 12,8 completed suicides per 100,000, and England with 10,3 suicide cases per 100,000 individuals (WHO, 2001). However, concerns were raised over the increase of suicide rates amongst the male population for 2018 who completed suicide at a rate of 17,2 per 100,000, compared to the 2017 period with 15,5 per 100,000.

For the female population the Mental Health Foundation of Scotland, (2019), pointed out that the rate for completed suicide in the United Kingdom accounted for 5,4 deaths per 100,000, which remained consistent with the overall rates over the past 10 years (Mental Health Foundation of Scotland 2019; WHO, 2001).

According to the WHO, (2001), researchers have identified causes for the possible increase in suicides in the United Kingdom; these included the recent recession, unemployment, loneliness and increase in the consumption of alcohol and use of drugs.

According to Scribante *et al.,* (2004) and NIMSS, (2011), studies conducted in South Africa, it was recorded that more than half of all suicides had occurred amongst individuals aged between 20 and 39 years of age (58,1%) with approximately five male suicides occurring for every female suicide. A comparative study conducted in the Transkei in South Africa, indicated that more than half of the suicides (51%) recorded had occurred in young adults aged between 16 and 30 years of age (Meel, 2003). Adolescents younger than 15 years of age accounted for (13%) of suicides with (19%) of suicides that occurred in the 31 to 45 years age group, with only (7%) in the 60+ year age group (Meel, 2003).

According to Meel, (2003), South African youths are at serious risk due to the socio-economic context which had consequential baring on the prevalence of suicide (Meel, 2003). With unemployment and high levels of poverty, the South African youth are faced with significant educational and socio-economic demands which proved overwhelming and debilitating especially when attempting to adjust to the transition during adolescence and young adulthood (Meel 2003).

2.3 EPIDEMIOLOGY OF SUICIDE

Research conducted by Mashreky *et al.,* (2013) documented that suicide posed a significant problem which contributed to one of the major causes of unnatural deaths that are managed at mortuaries worldwide. Globally, suicides were found to be the twelfth leading causes of death, as statistically suicide rates have increased by 60% per year worldwide within the last 45 years. However, these figures do not include statistical data for attempted suicides which according to Mashreky *et al.,* (2013) had increased up to 20 times more than completed suicides. It was estimated by the World Health Organization (WHO) that close to 800,000 people die due to suicide every year, meaning that one person dies every 40 seconds. The World Health Organization (2001), has postulated that approximately 1.53 million people will die per year as

a result of suicide in the year 2020, indicating that on average one death every 20 seconds, and one attempted suicide every 1-2 seconds. These statistics indicate that the mortality rate in suicides is 16 per 100,000 people every year. With these alarming figures it is therefore important to emphasize the understandings of the various factors behind suicidal acts, enabling one to understand the seriousness of public health and social issues (Mars *et al.,* 2004).

Bertolote *et al.,* (2002) reports that the highest suicide rates internationally were prominent in Asia. Given the populations size, almost 30% (n=1,790) of all cases of suicide worldwide were committed in China and India alone, although the suicide rate of China practically coincided with the global average and that India was almost half of the global suicide rate.

South African research has indicated that on average suicide fatalities accounted for 9,5% (n=567) of unnatural deaths in young individuals between the ages of 10 and 24 years of age, and 11% (n=657) in adults between 25 and 45 years over a period of a year (SADAG, 2015). SADAG, (2015) states that there are 22 confirmed suicides and 220 attempted suicides per day in South Africa, whereas according to NIMSS (2011) the suicide rate in a population of 100,000 is 14,3% or 853 cases indicating that 3,3 % of suicidal deaths are unaccounted for, and this poses a concern in obtaining and correctly reporting suicide data in South Africa.

2.3.1. Demographic characteristics of persons who commit suicide

2.3.1.1 Sex

Demographic features such as sex, race, and age, correlate with the various methods of suicide globally (Massaro, 2015). Suicide mortality is significantly higher in males than in females, but the ratio of males to females of suicide varies in different countries (Park, 2015). Globally, men of any age but particularly older age groups (40-55) years, have a higher suicide rate and behaviour's than their female counterparts at any age (Kaplan *et al.,* 2014). When assessing the demographic variables, research in the United States of America showed that 95% of all suicides were male victims, significantly higher than females (Bilban & Skibin, 2005).

Some suggested reasons for this circumstance would be that males , psychologically have poor coping mechanisms, leading to levels of emotional inexpressiveness, a lack of seeking help, as well as aggressive behaviour due to the use of drugs and alcohol (Moller-Leimkuhler 2003). Due to the lack of propensity in coping mechanisms, Moller-Leimkuhler (2003) postulates that males have higher rates in factors such as unemployment and gender role conflicts, therefore increasing suicide rates due to their inability to handle stress.

A study conducted in South Korea which has the world's highest suicide rate, demonstrated similar victim profiles. It was found that suicide rates in males were twice as high compared to females but that suicidal attempts were much higher in females (Cheong e*t al.*,2012). Furthermore Cheong *et al.*, (2012), also described that females have greater resources for defences against psychological trauma, whereas men more than women were impacted by the loss of financial stability which is associated with unemployment.

Mashreky *et al.,* (2013), who conducted his research in Bangladesh, found that the female suicide rate captured was 8,2% per 100,000, with males having a rate of 6,5% per 100,000 people, which differs from the global trends in relation to sex. This was most likely attributed to the majority Islamic status of the country (Mashreky *et al.,* 2013). Women experience pressures from their spouses and society, and the financial and emotional dependency on their spouses may create a stressful environment, incidences of inter-partner violence as well as social constructs that deny women the empowerment they need, therefore resulting in suicide (Mashreky *et al.,* 2013).

Research on sex and suicide within the South African domain has found to be consistent with international studies, as the suicide rate has proved to be significantly higher amongst men than women (Burrows & Laflamme, 2004). South African statistical rates reported by Groenewald *et al.*, (2008) indicate a rate of 24,5 per 100,000 individuals for males and 6,9 per 100,000 for females.

Burrows, Vaez and Laflamme (2004) reinforce this by arguing that females tend to use less violent methods of suicides than males. Violent methods of suicide are defined by the World Health Organization, (2001) as the use of physical force so as to injure, abuse, damage or destroy. Additionally, it was reported that males engaged in more violent methods of suicide and this was due to males being predominantly more aggressive, having considerable knowledge regarding violent methods, and were less concerned with bodily disfigurement. Another possible factor according to Burrows, Vaez and Laflamme (2004) would be that men who choose violent methods of suicide intended on committing the act before any intervention could take place. Hence this explains why males are more than likely to commit suicide in contrast to more females attempting suicide.

2.3.1.2 Age

Age significantly affects suicides rates (Mashreky *et al.*,2013). In many countries according to Shah, (2012), the suicide rate increases with increasing age. In the age group 15-44 years, suicide is the fourth leading cause of death in Bangladesh (Mashreky *et al.,* 2013). This study also indicated a suicide rate as high as 11,7 per 100,000 for the age group 20 to 29 years, but comes second to the oldest age group (60 years and above) having the highest suicide rate of 15,2% per 100,000 population (Mashreky *et al.,* 2013).

Research conducted in Korea stated that there was an increase in suicide rates for people above the ages of 65 years (Cheong *et al.,* 2012). The elderly commit suicide due to the inability to cope with physical ailments, being bereft of a spouse, and lack of income, inability to work and a decline in social activities, which generally all occur during old age, whereas within the age group of 15-44 years of age, individuals have poor coping mechanisms in dealing with life stressors such as poor grades at school, depression, family disruption, alcohol and substance use and abuse, poverty and unemployment. (Cheong *et al.,* 2012).

According to the National Institute of Mental Health (2017), in the year 2015, suicide was the seventh leading cause of death for males in the United States and the 14th leading cause of death for females for all ages. Additionally, this was the second leading cause of death for young people aged 15-34 and the third leading cause of death for those aged between 10-14 years (Tavernise, 2016). From the year 1999-2010, the suicide rate among Americans aged 35-64 years had increased nearly 30 %, and the largest increase were amongst women aged between 60-64 years.

Research conducted in South Africa (Gauteng), indicated that on average, suicidal fatalities accounted for 9,5% of unnatural deaths in young individuals between the ages of 10-24 years and 11% of adults between the ages of 25-45 years over a period of a year (SADAG, 2015; Meel, 2003; Durand & Barlow, 2009).

2.3.1.3 Race

Global suicide statistics reported by the World Health Organization (2001), indicate that suicide rates vary by race and ethnicity worldwide. In the United States the suicide rates were found to be much higher amongst the White and Native American /Alaska Natives than among other populations (Centers for Disease Control and Prevention, 2014). In a similar study conducted by Shaha (2012), found that there were racial and ethnicity differences within the United States

of America, and concluded that White American males showed an increase in suicide with aging, whilst White American females showed increasing suicide rates up until the menopausal period (40-55) years, with subsequent decline in suicidal behaviour. However, among native African Americans, and some East Europeans within the United States of America the trend depicted a decrease in suicide rates with increasing of age (Shaha, 2012).

South African research conducted by Naidoo and Schlebusch, (2014), reported that local research had indicated that suicide according to racial groups – Black/Africans had the highest suicide cases with 58% of individuals, followed by Asian/Indian 27% of individuals, White 13% of individuals and Coloured 2% of individuals. While further research conducted by Burrows and Laflamme (2004) in South Africa on race/ethnicity and suicide proved contradictory to the local research by Naidoo and Schlebusch, as the study postulated that the highest suicide cases were in fact amongst the White individuals, followed by Asians and then Black Africans. Contradicting Burrows and Laflamme's study, Stark *et al.*, (2010) investigated 469 suicide cases in Bloemfontein during 2003-2007, and research indicated that 72,1% of suicide victims were Black, 26% were White, 1,1% were Coloured and 0,6% were Indian. These contradicting results in comparison to other researchers mentioned were due to a national and larger study which was conducted over a longer period of time, indicating a difference in race/ethnicity rates, geographical area such as Chatsworth, Durban's inner-city suburb comprises of 60% of the Indian/Asian population, therefore lending itself to a higher number of Indian/Asians committing suicide (South African Statistics, 2014) therefore, different geographical areas in South Africa have different racial classification.

2.4. SEASONAL VARIATIONS IN SUICIDES

According to the statistics provided by Flisher and Parry (1997) and Christodoulou *et al.*, (2011), suicide rates were influenced by climate and seasonal changes. They emphasized that a high rise in suicide was predominantly seen during the spring season and a secondary rise during the autumn season.

In another study conducted by Kposowa and D'Auria, (2010), this study examined data of suicides committed by individuals over the ages of 18 years, from 50 American states. They concluded that contrary to earlier studies which showed an increase of suicides during winter and spring, the newest data reflected more suicides had occurred in the summer with 26% and Spring with 25,8%, Autumn with 24,4%, and Winter being the lowest with 23,8%. (Kposowa & D' Auria, 2010). In a similar study conducted in Brazil it was found that the peak season for

suicides for male living in the region of Rio Grande do Sul state of Parana and Santa Catarina occurred during the spring season (November), whereas females were predominantly known to commit suicide during early summer (January) Benedito *et al.,* (2007).

The authors found that there were seasonal variations. Factors such as sunshine and high temperatures were linked to increased suicide rates because of the heat and the amount of aeroallergens, viral infections present, therefore became too unbearable to work. Unavailable and limited access to medication in poor areas and far from medical care facilities posed a problem for those seeking medical care and suffering from mood disorders such as depression, were also seen to be a potential reason for seasonal fluctuation in suicides (Petriduou *et al.,* 2002).

According to Bridges and Yang, (2005), seasonal variations in Greece and the mortality from suicide were commonly seen during the spring and summer months, this study and the study conducted in Brazil by Benedito *et al.,* (2007) reported similar findings, however Bridges and Yang, (2005) reported that there was no regular annual rhythm and it was not conclusive. Both studies indicated that the seasonal variations of suicide followed more closely associated to the seasonal variation of sunshine rather than the corresponding variation of temperature, and in order to maintain a healthy lifestyle, the exposure of sunlight would depend on one's sensitivity of skin, where in the world one resides, age, diet and health history (Bridges & Yang, 2005; Benedito *et al.,* 2007).

Deisenhammer, (2003) and Clauss-Ehlers, (2010) both found that the suicide rates had peaked during the winter period, which was a similar finding to that of Kposowa & D'Auria,(2010). Intuitively, this made sense given the existence of seasonal effective disorder and the tendency to associate the winter period with depression (Cotterell, 2010). Christodoulou *et al.,* (2011) agrees with the statement made by Cotterell, (2010), and found that the colder period and suicide, had a link due to afflictions such as pneumonia and hyperthermia, which proceeded from the minimal amount of exposure to sunlight during the winter season.

It is difficult to say why different countries differ in seasonal variations to suicide, and what makes one country more susceptible to committing suicide during the different seasons. With conflicting research, it is therefore important to consider all seasonal variations and compare it holistically to the preceding section on seasonal variation, and how seasonal affective disorder

as a psychological component may influence the decision of an individual committing suicide during certain months of the year.

2.4.1. Seasonal Affective Disorder

Cotterell, (2010) defines Seasonal Affective Disorder (SAD) as seasonal depression. Seasonal Affective Disorder typically occurs when the change of season begins and most symptoms of the disorder begin around the Autumn season, and continue into the winter months. This disorder is able to occur in the spring and summer months too, however being less common (Cotterell, 2010).

According to the DSM-V (American Psychiatric Association, 2013), SAD is not unique in its entity, but rather a subtype specifier that is used to define what temporal variations in recurrent Major Depressive or Bipolar Disorders over a two-year period. Certain diagnostic criteria need to be met for a diagnosis of SAD – such as the onset of Depression within the winter periods and a full remission period of symptoms during the spring and summer season. For example, SAD can be diagnosed after two consecutive occurrences of Depression which present and cease at the same time each year, with symptoms subsiding the rest of the year (American Psychiatric Associaton, 2013).

However psychosocial stressors that are associated with a particular season resulting in an episode of Depression does not meet the requirements for seasonal pattern specifiers, and in order to demonstrate whether there is a relationship with temporal and seasonal variations and Depression, depressive episodes must have occurred in the past two-years in order to meet the requirements as an SAD diagnosis (DSM-V) (American Psychiatric Association, 2013).

The cause of SAD (Kurlansik & Ibay,2012; Cotterell, 2010), is the reduced level of sunlight during the autumn and winter months which affect an individual's levels of serotonin, which is a neurotransmitter which affects one's mood. There is no clear indication of how much sunlight is needed, as the intake of sun rays vary from person to person, and according to Cotterell (2010), the duration of required sunlight depends on the sensitivity of one's skin, complexion of skin, and in which country the individual resides in.

Decreased serotonin levels has been linked to depression (Cotterell, 2010), and research conducted by Mc Mahon *et al.*, (2016) indicated that brain scans conducted on some individuals showed that individuals who had seasonal depression in the winter months had increased levels

of serotonin transporter protein that removed more serotonin than individuals who did not have SAD (Cotterell, 2010; Mc Mahon *et al.,* 2016).

Another contributing factor according to various researchers is melatonin, which is a sleep related hormone, which is secreted by the pineal gland and has been effectively linked to SAD (Kurlansik *et al.,* 2012). The primary function of melatonin is to regulate the night and day cycles. Darkness causes the body to produce more melatonin, which will indicate to the body to prepare for sleep (Kurlansik *et al.,* 2012; Mc Mahon *et al.,* 2016). Light will decrease the melatonin hormone, therefore preparing the body to be awake. However, when days are darker and shorter the production of melatonin increases which can relieve the doldrums of winter depression and mood. (Kurlansik *et al.,* 2012; Mc Mahon *et al.,* 2016). Treatment for SAD can be quite complex as researchers reported in some studies that Cognitive Behavioural Therapy (CBT) has shown to be effective as a method of treatment, whereas some studies have reported that phototherapy which is defined by Webster (2018) as the application of light for therapeutic purposes. Coterrel, (2010) found that this method of therapy was effective as a treatment method, as 85% of diagnosed cases had shown suppression of the secretion of melatonin when exposed to phototherapy which mimics outdoor lighting, by using a light box which is used to treat SAD. This type of light box filters out most or all UV lighting, and different intensities of light will require either less time or more time spent exposed to the light box. Coterrell, (2010), postulated that this type of light therapy lifts one's mood and eases other symptoms of SAD such as Depression.

Preventative measures for SAD may prove helpful in reducing the symptoms, therefore early Autumn before the onset of symptoms, maintaining a well-balanced eating plan, exercising and spending more time outdoors, as well as increasing the amount of light at home proved to be beneficial (Kurlansik e*t al.*,2012).

2.5. CHOSEN METHODS OF SUICIDE

Many individuals who contemplate suicide and plan how to carry out the act, very often have inflated expectations about the lethality of their chosen methods. Literature and information are of importance for the implementation of appropriate prevention programs to be put into place on a national and international standard to reduce the risk and plans of one intending to commit suicide (WHO, 2001). 'More violent' method of suicide according to Christodoulou *et al,* (2012) is defined as the intentional use of physical harm, force and power against oneself. Another definition by Massaro, (2015) is one where there is an increased level of lethality in

the suicidal act. Christodoulou *et al.,* (2012) states the methods of suicide classified according to the International Classification of Diseases (ICD 9) as 'violent method' refers to (1): Gunshot/ Shooting/Fire arm, (2): Hanging/Strangulation and Suffocation (3): Jump/Fall From Height, (4): Self-immolation (5): Motor vehicle accident suicide. These are commonly attributed to the male population (Massaro, 2015). 'Less violent method' of suicide are classified according to the International Classification of Diseases (ICD 9) include suicides by (1): Solid or Liquid Substances, (2): Ingestions of drugs, (3): Gasses, (4): Vapours. Massaro, (2015) states the 'less violent' method is associated with the female population, due to its higher incidence of failed suicide as compared to the male population.

According to a study conducted by Klieve *et al.,* (2009) postulates that the use of firearms as a method of suicide is dependent on accessibility to a firearm, age and geographical location. Massaro (2015) postulates the reason for women less likely to commit suicide by fire arm, is often rejected as a tool of infliction as disfiguring of the body or 'beauty' would be disturbing for those discovering the body. South Africa is faced with the challenge of unlicensed or stolen firearms being available, and an Australian study conducted by Klieve *et al.,* (2009) also reported high incidences of firearm theft. A higher number of stolen firearms in South Africa in comparison to Australia, increases South African's convenient accessibility to firearms and therefore potential increased risk of suicide.

According to the World Health Organization Mortality Database (2001), international studies have indicated that the frequently used method of suicide varied between countries. In the United States of America for example, it was found that the most frequently used method of suicide were firearms (Bridge & Brent, 2003). In comparison to other countries, according to the World Health Organization Mortality Database (2001) the use of pesticides in Asian countries was the most frequent method used, and this became more prominent during the 1990's.

Poisoning by drugs was commonly used by the Nordic people, with similar methods of suicide seen in the United Kingdom (Eddleston *et al.,* 1998).

Within the Eastern European countries such as Estonia, Latvia, Poland and Romania it was noted that hanging was the predominant method for suicide (World Health Organization Mortality Database, 2001). However, jumping from heights within small urban societies in Hong Kong, Malta and Luxemborg, was found to be a popular choice (Gross & Piper, 2007).

According to statistics documented by NIMSS, (2011) in South Africa it was reported that hanging, was considered to be the most frequently used method, followed by Jumping from heights, Poisoning/Ingestion of substances/Overdosing, Gassing then Firearm related deaths.

2.5.1. Hanging

Hanging is defined by Saukko and Knight (2003) as the suspension of the body by a ligature which encircles the neck, and the force from the weight of the body causes constriction. Payne-James *et al.*,(2011), defines hanging as the suspension of the body by the neck, and the pressure and compression of the ligature is produced by the weight of the body. It is therefore not necessary for the body weight of the individual to play a part in death, as even slight pressure is sufficient to cause death (Saukko & Knight, 2003).

When the body is completely suspended (no part of the body touching the ground) by a ligature with the full weight being involved, it is termed a full suspension or complete hanging (Shetty, 2014). The term 'partial hangings' refers to situations in which the body is partially suspended, meaning that the lower extremities of the body (toes and the feet) are touching the ground, or that the body may be in a sitting, kneeling or even in a lying down position.

The weight of the individual is the determining factor, and this acts as the constricting force on the neck structures (Shetty, 2014). Depending on the type of ligature used, the extent of injury to the soft tissues and the supportive structures of the neck (hyoid and thyroid cartilage), will depend on the nature of the hanging, as well as the pressure applied to the neck (Payne-James & Simpson, 2011).

The types of the ligatures used for the purpose of hanging may comprise of various objects such as cords, ropes, wires, belts and objects that are relatively thin (Saukko & Knight, 2003). When ligatures such as broad fabric or a scarf has been used, the effects of the ligature used can cause an array of markings and sometimes abrasions. As a result, the interpretation of the ligature markings can be difficult to interpret based on the nature of the material.

A study conducted in the sub-region of the Transkei, South Africa in 2003 established that over half of the suicidal hanging deaths 51% recorded occurred in young adults aged between 16-30 years. Adolescents younger than 15 years accounted for 13% of the suicidal hangings with 19% of the deaths occurring in the 31-45 age group and 7% in the 60+ year's age group (Meel, 2003).

2.5.2. Jump from heights

Whilst jumping from height can be a very effective method of suicide, injuries that are related to suicide by jumping from heights, cannot determine whether the jump was an act of suicide. However, it could be suggested that based on the types of injuries noted at the autopsy may indicate a possible suicide (Massaro, 2015; Townsend & Harriss, 2005). Blunt force trauma is commonly present in individuals, due to the impact from Jump/Fall from heights. This however, is difficult to determine the manner of death in cases suspected to be from Jump/Fall from heights as being accidental, suicidal or homicidal in nature (Massaro, 2015; Townsend & Harriss, 2005). As such an autopsy alone cannot determine if any death is a suicide, and individuals opting for 'Jump from Height' will often sustain multiple blunt force injuries, as well as sharp force injuries depending on whether the deceased jumped through a window or from a building without windows as Massaro, 2015; Townsend & Harriss, 2005).

International data recorded by Henderson *et al.,* (1997), found that in Hong Kong Jump from Heights was favoured over other forms of suicide, and accounted for 59% of suicide deaths. Henderson *et al.*,(1997) also reported that Singapore had similar statistics with 60% of suicides being 'jump from heights.

South African data (Beautrais, 2007) reported that suicides by Jumping from Heights were found to occur within the cities with extensive high-rise buildings and housing, in comparison with areas that have low rise structures. It is difficult to understand the frame of mind of an individual who chooses to die by 'Jump from Height'. Beautrais (2007) postulated that one of the possible reasons for this choice would be a convenient way of dying, and those jumping from tall buildings or high places are determined to die. Another reason postulated by Beautrais, (2007) would be due to the easy accessibility of entering the building for the intended purpose of suicide.

2.5.3. Firearms

The use of firearms, a choice of suicide depends on the accessibility of a firearm (whether licensed, or unlicensed) (Klieve *et al.,* 2009). An association between risk of suicide by the use of firearms and the accessibility of firearms are considerably higher in males than in females (Klieve *et al.,* 2009). Suicidal death by means of a firearm is correlated with targeted body areas such as the side of the head (temple), mouth or chest which suggests a single shot to the area, notwithstanding that shotguns fired to the same area may result in multiple bodily wounds (Massaro, 2015).

Studies conducted within the area of firearm suicide have demonstrated that shots fired from below the chin in an upward direction appear to be the most frequent form of firearm related suicides (Massaro, 2015). Furthermore, the use of a firearm increases with acute intoxication of substances which in turn strengthens the possibility of one using a firearm to commit suicide (Kaplan *et al.*, 2014).

South African data (Burrows & Laflamme, 2004; NIMSS, 2010, 2011) indicate that suicides by firearms were predominantly committed by White males and these individuals ranged between the ages of 49 to 58 years of age. Similarly, Blumenthal (2007) found that the majority of individuals choosing death by firearm as their preferred method were predominately males 82% and White 63%, although he found that individuals using a firearm as their method of suicide fell into the 21- 40-year age group. These differences could be due to different sample and location size therefore this would explain the discrepancy in age group findings.

2.5.4. Self-mutilation and the association with individuals who commit suicide

Self-mutilation according to Guertin *et al.,* (2001) is considered to be practiced with the goal in mind to self-harm. However, the functions of self-mutilation are broad and serves different functions for various individuals in the context of their experiences. Quite often individuals who choose suicide by 'cutting wrists' as a method may experience injury of the tendons of the extrinsic flexor muscle of the ulnar and median nerves, which control the functioning of the hand (Guertin *et al.,* 2001; Hicks & Hinck, 2008).

According to Hicks and Hinck (2008), suicide by 'cutting' of the wrists was predominantly seen in White females ranging between the ages of 14-24 years of age. Female 'wrist cutters' may be suicidal, and individuals who self-mutilate are often experiencing emotional issues, or are diagnosed with a mental disorder such as Borderline Personality Disorder (Hicks & Hinck, 2008). However, studies have indicated that females considering suicide are most likely to choose a method which has a low lethality rate and will very often survive the attempt (Klonsky, 2007).

2.5.5. Drug overdose

Drug overdose (intentional) is a method which involves using medications and illicit narcotics in doses greater than the indicated levels, for the intention of committing suicide (Saukko & Knight, 2003). Ingesting medications or a combination of different medications may cause

harmful effects, and the possibility of severe organ failure and death is high (Saukko & Knight, 2003).

Global statistics according to WHO, (2001) indicated that within the United States of America it was found that out of all substance (poison & drug) related suicides, 4,571 cases per 100,000 were attributed to drugs. Many individuals opting for this method are under the impression that it will be relatively painless, and quick way to die but in many cases, they would be wrong on both accounts (WHO, 2001). Preston and Mero (1996) stated in their study that on average, time of death for overdose related cases was on average 3 hours, with a maximum of 10 hours, and that was using drugs that were consumed at lethal dosages. Therefore, a swift death cannot be relied on using most drugs.

Some drugs (including Tricyclic antidepressants) can cause convulsions and uncontrollable seizures on the way to death (Preston & Mero, 1996). Stone (1999) describes the cause of death from Tricyclic antidepressants as heart failure, respiratory depression and uncontrollable seizures, with convulsions starting around the three-hour period from ingestion, and death taking on average of approximately 6 hours after hospital admission (Stone, 1999).

In a study by Jones *et al.*,(2013), it was reported that toxicology results of suicide deceased's in South Africa showed the presence of Anti-depressants such as Citalopram, pain medication such as Paracetamol and other forms of medication and illicit drugs such as Amphetamines, Cocaine, Heroin and other substances (Jones *et al.,* 2013). Reports of the findings indicate that there was an association between suicide and the access to some of the medications mentioned (Jones *et al.,* 2013).

Further studies in South Africa indicate that approximately 40% of suicide deceased's had tested positive for alcohol, and that the levels of intoxication, combined with prescribed and over the counter medication were found during toxicology testing, which may indicate an association between suicide and mental health illness (Jones *et al.,* 2013). Kaplan *et al.,* (2014); and Jones *et al.,* (2013) concluded that from the above mentioned individuals who suffer from mental illnesses have increased access to these medications, as they are often prescribed to individuals by health care professionals (Kaplan *et al.,* 2014; and Jones *et al.,* 2013). This may result in feelings of vulnerability and therefore individuals suffering from mental illnesses are more prone to suicide or are at risk of increased suicidal behaviour therefore was indicative that from the study conducted by Kaplan *et al.,* (2014); and Jones *et al.,* (2013) resulted that

individuals consumed high dosages of prescribed and over the counter medication which were found during toxicology testing, therefore it was concluded that deceased's died from an overdose.

Kaplan *et al.*, (2014); and Jones *et al.*, (2013) state that another issue arose when an accidental illicit drug overdose from an altered batch (change in composition through either adding other substances, or diluting the batch, caused a change in composition) of the recreational drugs used such as Heroin, Amphetamines which accounted for a number of 'accidental' deaths. Jones *et al.*, (2013) postulated that reasons for the accidental deaths may be incorrectly classified as a suicide, as the manner of death proves challenging to determine at the time of autopsy, therefore requires further investigation.

2.5.6. Poisoning

Poison for the intention of committing suicide is well known for its high levels of toxicity to humans (Kaplan *et al.*, 2014). Pesticide as a substance of poison varies markedly in different parts of the world. Poisoning by farm chemicals such as insecticides, herbicides and fungicides for example are considered very common among women in the Chinese countryside, and this has been regarded as a major social problem in the country (Griffiths, 2007). In Finland, the highly lethal pesticide called Parathion was a commonly used substance during the 1950's for the purpose of committing suicide but later was banned and the chemical use was restricted (Ohberg *et al.*, 1995).

The World Health Organization (2012), states that individuals who commit suicide by poisoning, such as pesticides, has become a popular method of suicide over the years, and frequently used on an international and national scale. Mars *et al.*, (2004), conducted a study in Sri Lanka, China and India, and showed that pesticide poisoning was the most frequently used method, and this was primarily due to poor access to medical institutions and ineffective treatment of intentional poisoning which leads to the increased likelihood of successful suicide.

Aldicarb (also known as Temik) is a carbamate insecticide which according to Webster (2018) is a substance that through its chemical action usually kills, injures or impairs an organism. Verdoom, (2018), states that Aldicarb is a pesticide, banned for both use and possession in South Africa. Despite this, Verdoom, (2018) states that it is still readily and openly available on any street corner, sold for next to nothing as rat poison. Poisoning using Aldicarb is one

example of poisoning used in South Africa which could be used as a method of suicide by poisoning due to its high levels of toxicity to humans (Kaplan *t al.*, 2014).

2.5.7. Carbon Monoxide

Carbon Monoxide poisoning is defined by Saukko and Knight (2003) as a potentially fatal condition caused by inhalation of Carbon Monoxide gas which competes favourably with oxygen for binding with haemoglobin and thus interferes with the transportation of oxygen and Carbon Dioxide by the blood.

Carbon Monoxide is an odourless, colourless gas that is produced through combustion of hydrocarbons. Examples of such combustion devices can be found in furnaces, motor vehicle exhausts, generators, or gasoline powered machinery (Centers for Disease Control and Prevention, 2008).

Suicide by Carbon Monoxide has claimed the lives of many, who deliberately inhale it, usually in the exhaust fumes of their own cars. Carbon Monoxide causes more accidental deaths than any other poison in history, due to the fact that it has no taste, no smell/odour and is colourless, and by the time an individual notices, it is often too late (Saukko & Knight, 2003).

During an autopsy, the most striking features which are observed would be the appearance of the body's skin. The 'cherry-pink' complexion of the deceased gives the Forensic Pathologist the indication that the individual could have died by Carbon Monoxide Poisoning (Saukko & Knight, 2003). A study conducted by Gupta *et al.,* (2005) within the Detroit, Michigan (USA) Metropolitan area found that an average 12,000 case inquiries on Carbon Monoxide deaths annually were received. During this study, it was found that over a seven-year period (1998-2004) there were 2,900-3,400 Carbon Monoxide cases annually which were ordered for further investigation. These findings indicated from the year 1998, with 2,926 cases of suicide, nine (<1%) were due to Carbon Monoxide suicidal deaths. However, for the year 1999, suicidal death by Carbon Monoxide resulted to 10 (<1%) cases out of 3308 being due to Carbon Monoxide (Gupta *et al.,* 2005). These statistics remained the same throughout the study, with a few differences between the years with a few percentages increase and decrease.

South African studies according to NIMSS, (2010) indicated that for the period of 2010, from 1,277 cases of suicide, 61 (4,7%) were due to Carbon Monoxide poisoning. Statistics provided by NIMSS (2010), stated that the age group most frequently affected by this method of suicide

were between the ages of 55-59 year age group followed by 35-39 year-age group and the 50-54 year age group.

Suicide by Carbon Monoxide still remains to be a frequently used method, but other forms of suicide such as hangings, firearm/shooting and poisoning are frequently used method within Gauteng (NIMSS, 2010).

2.6. THE LOCATION OF SUICIDE

The geography of suicides refers to the location where the individual chooses to complete suicide. Locations have a reputation of attracting a statistically significant amount of suicides, and it is still unknown what draws individuals to their chosen location (Byard *et al.,* 2007). Suicide is often a private and secretive event that has few or no witnesses to intervene, therefore, individuals choosing a specific location such as a bedroom, garage, or indoor building may be suggested that the preference of an 'indoor' location (bedroom, garage, within a building) could delay the rescue of the individual or recovery of the body (Cox *et al.,* 2013). For some individuals, their chosen location might be where they feel attracted to the anonymity of a place away from home, or could hold a special significance (Cox *et al.,* 2013). Location of suicide may be further influenced by familiarity with the area, and choices may be based on a few factors, such as availability, opportunity, familiarity with the method, consequences of failed suicide, and time taken to die while conscious (Beautrais, 2007).

However exact data nationally and internationally of the above-mentioned poses difficulties, as investigating officers on scene are not always able to identify the location where the suicide took place (Cox *et al.,* 2013). Reasons for the deceased's choice of 'public suicide' remains unknown, and possibly for the sole reason that members of the public to witness the act, or for the body to be found by someone unknown to the deceased.

Byard, (2007) indicated one of the possible reasons for individuals completing suicide in a secluded location was due to the delay in discovering the body, ensuring that no one would find the individual prior to, or shortly after the completion of suicide , for the purpose of finding the individual in time to be saved.

One knows very little about the factors that influence an individual's choice of location, and its association may exist between their chosen location and the method of choice (Owen & Lloyd-Tomlins, 2009). Viewing suicide as a dramatic exit, in which individuals make a conscious or

unconscious decision on where to stage their final departure still remains unknown and for some still raises questions about the circumstances and their psychological reasons behind their chosen place of departure (Owen & Lloyd – Tomlins, 2009).

2.7. UNDERSTANDING MENTAL HEALTH AND THE PSYCHOPATHOLOGIES LEADING TO SUICIDE

Good mental health is related to mental and psychological well-being where individuals are able to realize their own abilities, are able to cope with normal stressors of life, and can work productively and fruitfully in order to make a contribution to his or her community (World Health Organization, 2001).

The rationale behind suicide can be rather complex, as individuals contemplating suicide do not often believe they can be helped (SADAG, 2015). Suicidal thoughts and behaviours are commonly found among individuals with psychiatric disorders, especially Major Depressive Disorders, Bipolar Mood Disorder, Schizophrenia, PTSD, Anxiety Disorders, substance-related disorders and Personality Disorders (e.g. Antisocial and Borderline Personality Disorders) (Schlebusch, 2008).

A history of a suicide attempt is the strongest predictor of future suicide attempts, and death by suicide (Schlebusch, 2008). Psychiatric co-morbidity increases risk for suicide, especially when substance abuse or depressive symptoms co-exist with another psychiatric disorder or condition (SADAG, 2015). A number of psychological factors are also associated with risk for suicide and attempted suicides. These include recent life events such as losses (employment, careers, finances, marital relationships, physical health, housing). Psychological states of acute or extreme distress especially humiliation, despair, guilt and shame, are often present in association with suicidal ideation, planning and attempts (SADAG, 2015).

Massaro, (2015) stipulated that suicidal individuals who had a previous history of psychiatric disorders were at greater risk for suicide and were shown to be twelve times more likely to demise in suicidal cases than those who showed no signs of these disorders.

In this section, psychopathology will be further investigated in different categories, for a further understanding into why certain psychopathologies can lead to suicide.

2.7.1. Mood Disorders

Mood disorders are a group of diagnoses in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) (American Psychiatric Association, 2013) classification system where disturbances in the person's mood is the main feature, where a person feels depressed and /or elated, and outwardly show signs (affect) of depression and/or mania for a significant period of time. There are two extreme poles in mood disorders: extreme dysphoria (Major Depressive Episode) and extreme euphoria (Manic Episode) (American Psychiatric Association, 2013). In mood disorders an episode of depression is always seen. In cases where there is only depression, can be categorized as unipolar mood disorder (Bielske & Friedel, 1977). In cases where an episode of depression and mania are present, this can be categorized as bipolar mood disorder. A diagnosis in this group of disorders is enough to impair normal functioning which occurs in the absence of a clearly identifiable stressor or trigger (Bielske & Friedel, 1977; Ru-Band Lu, 2015). Mood disorders, as a group of disorders, includes Major depression and Bipolar mood disorder.

2.7.1.1. Bipolar Disorder

Bipolar Disorder is characterized by alternating periods of depression with periods of mania. The degree and cycling of the depression and mania is dependent on the type of Bipolar related disorder from which the individual suffers (Bipolar 1, Bipolar 2 and Cyclothymic Disorder) (American Psychiatric Association, 2013).

Those suffering from one of the Bipolar related disorders are at an increased risk of suicide, due to the periods of depression and mania, as well as the impulsive behaviour associated with the Bipolar Disorder (American Psychiatric Association, 2013; Joyce & Rowe, 2010).

2.7.1.2 Major Depression

Major Depression, a psychiatric illness that should not be confused with feelings of sadness or the 'blues' (Ohaeri & Otote, 2002). Major Depression also known as Clinical Depression include symptoms of depression (as a mood), as well as cognitive, physical (somatic) behavioural, emotional and perceptual symptoms (Ohaeri & Otote, 2002). According to the DSM-V (American Psychiatric Association, 2013), Major Depressive Disorder should be thought of as episodic, and the minimum duration of unipolar disorder is two weeks, but may last longer.

2.7.2. Depression

Depression according to Burgess (1990) is defined as feelings of despondency and dejection, and characterizes depression as a disinterest in activities that were found to be enjoyable beforehand. However, one must not confuse feeling sad for depression, as we all go through times in our lives where we feel sad (Burgess, 1990). Sadness is an emotion, whereas depression is an abnormal emotional state, a mental illness that affects the way one thinks, feels and behaves (SAFMH, 2016). Therefore, depression spans across a range of symptoms such as sleeping and eating patterns to feelings of guilt and low moods (SAFMH, 2016).

Due to lower levels of moods, individuals diagnosed with depression are at a much higher risk of committing suicide (National Institute of Mental Health 2017). However, the risk of death by suicide may in some part be related to the severity of the depression (Burgess, 1990).

Individuals living with depression often experience different thoughts before and after a depressive episode, and this could be due to chemical imbalances which could lead the individual not understanding the options available to help them relieve their symptoms (National Institute of Mental Health, 2017).

Individuals suffering from depression often report feeling as though they have lost the ability to imagine a prosperous future, or remember, when last they experienced feelings of joy, and often do not realize that they are suffering from a diagnosis which is very much treatable (SADG, 2015).

Symptoms of depression is often displayed in other co-morbid disorders such as Borderline Personality Disorder, and Bipolar Disorder (Burgess, 1990). Individuals with depression are considered a high risk for suicide and this poses a problem in those with co-morbid Borderline Personality Disorder, as self-mutilation is one of the defining features in Borderline Personality Disorder, where this method of self-harm may be used by depressed individuals to cope with the negative emotions they are experiencing therefore serves a role in affect regulation (Burgess, 1990).

2.7.3. Borderline Personality Disorder

According to the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013; Burgess, 1990), Borderline Personality Disorder is Characterized by fears of abandonment, as well as intense and volatile

relationships and unstable self-image, and emotional insecurity. Goodman and Tomas, (2017), postulated that suicidal behaviour's and completed suicide are commonly found in individuals who suffer from BPD, and will make at least one suicide attempt in their lifetime, and many will make multiple suicide attempts. Goodman and Tomas, (2017) continues to state that individuals with Borderline Personality Disorders are more than likely to complete suicide than individuals with any other psychiatric disorders.

Individuals who have been diagnosed with this disorder usually experience intense abandonment fears, and may react with inappropriate anger or even fear when faced with separation (Burgess, 1990). The individual may associate abandonment with their own perceived negative behaviour, and feel that being left alone implies that they are 'bad'. Their efforts to avoid abandonment can become extreme and lead to self-mutilation or even suicide.

Individuals with this disorder may idealize their caregivers or lovers, but they can just as easily switch to devaluing them, if the individual feels they are not receiving enough attention (Goodman & Thomas, 2017). This devaluation can lead to extreme anger and verbal outbursts when they feel neglected or uncared for.

Individuals with this diagnosis typically display impulsivity in areas that could be potentially harmful and dangerous to themselves and others, and have a tendency to act quickly without thinking about possible consequences, such as promiscuity, gambling, reckless drinking and driving, and may engage in suicidal behaviours in a moment of intense emotional distress without thinking of the outcome (Kulacaoglu & Kose, 2018).

Borderline Personality Disorder sufferers may also experience emotional insecurities, and their emotions can change easily depending on the circumstances of their environment (SA Federation for Mental Health, 2016) (SAFMH). Some of the symptoms experienced by individuals with Borderline Personality Disorder would be a history of unstable and intense relationships, characterized by shifts between the extremes of idealization and devaluation. Fear of abandonment and frantic efforts to avoid abandonment, self-mutilation or suicidal behaviour, and risky behaviour rapid shifts in moods based on external environments, inappropriate anger and verbal outbursts are just a few to mention (American Psychiatric Association, 2013; SA Federation for Mental Health, 2016).

According to the DSM -V (American Psychiatric Association, 2013) as well as the SA Federation for Mental Health, (2016), Borderline Personality Disorder is more frequently diagnosed in women than in men. This disorder is most likely to develop among first degree relatives of an individual who has the disorder, and therefore also a risk within the family dynamics for the development of substance use disorder and Antisocial Personality Disorder (American Psychiatric Association, 2013; Trull, Freeman & Verbares, 2018). Substance use and abuse within individuals with BPD is a risk factor for suicides all by itself, meaning that when substance use are combined with individuals who suffer from BPD, this becomes a lethal combination due to increased levels of impulsivity and individuals who are using substances have access to a means for overdose (Soloff *et al.*, 2014). Duration of BPD as a factor usually lasts for years, and one of the most unique aspects of BPD is suicidal ideation, which leaves individuals with this disorder feeling that there is no other way out, despite preventative measures and effective treatments available (Stoloff *et al.*, 2014).

2.7.4. Substance abuse/Dependency

While destructive behaviour has been implicated in the act of suicide, substance abuse is seen to increase one's tendency to commit these behaviour's, thereby increasing the likelihood that such individuals will then go on committing suicide (Gahr *et al.*,2012). Research conducted into the field of suicide and its contributing factors has demonstrated that engaging in self-destructive behaviours which further becomes integrated into one's coping mechanism (O'Brien & Murrel, 2010). While the intake of substances produces feelings of happiness within some individuals, substance abuse indicates an unhealthy dependency of substances which then increases the likelihood of one committing suicide (De Grandpre, 2006).

Due to the feeling of power, control and being at ease, which the intake of such substances induces, these emotions fuel the desire to engage in self-destructive behaviour's, which then places the individual at an even greater risk of developing suicidal tendencies (De Grandpre, 2006).

2.7.5. Schizophrenia

Schizophrenia is characterized as a form of psychosis which are a variety of cognitive disturbances, emotions and behaviours (American Psychiatric Association, 2013). Individuals who have been diagnosed with Schizophrenia usually present signs and symptoms such as hallucinations, delusions, disorganized speech and erratic behaviour (American Psychiatric Association, 2013; Erdur *et al.*, 2006). The manifestation of Schizophrenia can however be a

gradual process or a rapid one. Individuals who have been diagnosed with Schizophrenia usually present with the onset around their mid 20's for males and late 20's for females (SAFMH, 2016).

Emphasis on the early identification of Schizophrenic individuals may prove positive as appropriate interventions, medications and therapeutic interventions will need to be put in place for the individuals to gain some kind of normalcy and what they perceive as a functioning life (Boteva & Lieberman, 2005).

Schizophrenic individuals engaging in destructive behaviour, suffering from auditory hallucinations often experience hallucinations and delusions that could possibly be religious in nature, stating that the hallucinations were a message from 'God', and was instructed to perform certain rituals in order to cleanse the world from evil (Boteva & Lieberman, 2005).

Despite Schizophrenia being a topic that has been researched thoroughly, one cannot make a conclusive statement regarding this type of disorder, and as for many other aspects related to Schizophrenia the issue of its dangerousness and risk of suicide and violence in individuals diagnosed with this disorder is potentially controversial and far from clear cut (Boteva & Lieverman, 2005). However, when considering Schizophrenic individuals as a suicide risk, it should be noted that up to 40% of individuals with Schizophrenia attempt suicide. Approximately 10% of Schizophrenic individuals complete suicide within the first ten years of their diagnosis (Cranco & Lehman, 2000).

The risk factors for Schizophrenic patients according to Cranco and Leham (2000), include being young, male and having a high level of education as well as the presence of insight. Schizophrenia related risk factors that appear to be of importance are in fact the number of attempted suicides as well as the presence of depressive symptoms and active hallucinations and delusions present according to Hor and Taylor, (2010), therefore linking psychosis as well as co-morbid depression and the use of substance use to the possibility of completing suicide.

2.7.6. Dissociative Identity Disorder

Dissociative Identity Disorder (DID) (formally known as Multiple Personality Disorder) can be defined as an individual having two or more distinct personalities or identities (DSM-V, American Psychiatric Association, 2013). In a comparative classification according to the ICD-10, mentions that Dissociative Identity Disorder can be classified by a disruption of

discontinuity in the normal integration of consciousness, memory, identity, emotion, perception, body representation, motor control and behaviour. Individuals diagnosed with DID may experience symptoms of 'black outs' and periods where they were unaware of where they had been (West, 1999). Individuals who present this disorder have a 'dominant personality', which may be passive, dependent and depressed. Often, these personalities are completely different from each other. These different personalities take control of the individual's identity at different periods of time. The 'dominant' personality, refers to the primary or original personality, and will answer to their given name. The 'dominant' (primary) personality is generally more passive and individuals with this diagnosis may be unaware of the other personalities (West, 1999).

Individuals with DID may experience the other personality taking turns at being in control, therefore it dissociates and this causes the person to be unaware of this happening (APA, 2013). According to the DSM-V (American Psychiatric Association, 2013), it states that self-destruction such as self-mutilation and suicidal behaviours are commonly found in individuals who display symptoms or have been diagnosed with DID, and that factors such as depression, anxiety and substance abuse are common co-morbid disorders that are seen in the context of DID. While the causes of DID remains unclear, research according to the National Institute of Mental Health (2017), postulated that it was likely due to a psychological response to interpersonal and environmental stressors, predominantly found in early childhood, when emotional neglect or abuse may interfere with personal development.

Dissociative Identity Disorder still remains unclear to its association to suicide, as it can be difficult to diagnose due to the polysymptomatic symptoms and specific features of the diagnosis may be difficult to elicit (National Institute of Mental Health 2017; West, 1999). However, one of the most common features present in individuals with DID consists of suicidal ideation and attempted suicides, self-mutilation, sexual dysfunction, alcoholism and drug use disorders, post-traumatic stress disorder, sleep disturbances, nightmares, major difficulties in personal relationships. These symptoms are due to the co-morbid factors such as Major Depression, Borderline Personality Disorder and Bipolar Disorder which mimic similar symptoms (West, 1999).

2.8. THE MODELS OF SUICIDE

In order to develop a thorough understanding of the phenomenon of suicide and why it occurs, it is useful to take a multifaceted approach to the matter. The following section will attempt to

explain the psychological, biological and developmental motivations driving the act of suicide, which will form part of the various models used to explain why the act of suicide occurs.

2.8.1. Psychological Model of Suicide

Hicks and Hinck, (2009) states that as human beings, life stressors are handled within the scope of one's emotional and mental capacity, attributing resilience to the use of healthy coping mechanisms, amongst an array of other important psycho-social factors. With the above understanding in mind, suicide may be viewed as an emotionally flawed response to coping with one's life situations. In consideration of the psychological factors driving the act of suicide, our understanding of this model proves complex and attributable to various stressors in the context of one's personal worldview (Hicks & Hinck, 2009; Klonsky, 2007).

Moreover, the act of committing suicide is also tempered by one's emotional state and whether or not he/she is afflicted with a mental illness alongside other variables such as socio-economic status, sex differences and seasonal variations. This goes to show that although the act of committing suicide may be explained, in part by a thorough psychological understanding of one's circumstances it forms a piece of the bigger puzzle concerning our understanding of the event. The most popular model used in understanding the psychological basis of suicide is the Affect Regulation Model, developed by Klonsky (2007).

There are a variety of other models, further developed by other researchers which have been initially proposed by Klonsky (2007) as well. These models include the Anti-dissociation Model, the Anti-suicide Model, and the Interpersonal influence Model. While these models do contain similarities, it is important to note that they are regarded as distinct models. For purposes of our understanding of suicide within the context of this dissertation, each model will be discussed separately.

2.8.2. The Affect Regulation Model

With an understanding of what enables psychological pathology, this model postulates that human beings engage in behaviours such as suicide, self-mutilation and substance abuse, as a mechanism of regulating effect, therefore allowing one to effectively deal with the emotions which they are experiencing (Hick & Hinck, 2008; Mikolajczak *et al.*, 2009).

With this view in mind, such behaviours can be understood as coping mechanisms to deal with difficult emotions and assist one in releasing the emotional pressure that builds inside, giving

one a sense of control (Klonsky, 2007). Very integral to this position, is that these means of regulation differs from one individual to another.

According to this model, emotional pain may be difficult to express and effectively communicate to others, hence driving them to hide behind self-destructive behaviours which can be viewed as a means of communicating pain and cry for help in itself. An inherent contradiction contained within the act of self-destruction is that most often, individuals feel too ashamed to admit that they self-destruct, which only exacerbates the action further (Hinks & Hick, 2008).

These individuals consequently do not get the help required, often end up committing suicide as a last resort to 'opting out' from the emotional pain which they face (Hick & Hinck, 2008). Various risk factors have also been implemented in our understanding of suicides. Amongst these, is the concept of emotional intelligence and how this is related to the use of defective coping strategies in coping with life stressors. According to Mikolajczak *et al.,* (2009, pp., 182), emotional intelligence can be defined as 'the ability to identify and manage one's own emotions as well as the emotions of others'.

With this definition in mind, the Affect Regulation Model asserts that individuals low in emotional intelligence are at a higher risk of engaging in defective coping strategies in dealing with emotional pain. Suicidal ideations and tendencies are seen as a physical manifestation of defective coping skills. Those who fall on the lower end of emotional intelligence spectrum also lack future orientated skills, which is regarded as one's ability to see past their emotional pain and envision a better future (Andover *et al.*, 2007). These individuals therefore, rely on the 'avoidant coping method' and choose to self-destruct because they have no other means of coping with their emotional pain. The cognitive style of individuals who engage in self-destructive behaviours is also implicated in the driving force leading to suicide. Amongst these, is the rumination style of the individual. Those who have a tendency to ruminate or excessively focus on one's issues, may be more likely to engage in self-destructive behaviours leading up to the act of committing suicide (Moyer & Welch-Nelson, 2007).

2.8.3. Anti-Dissociation Model

According to McLane (1996), dissociation refers to a feeling of being disconnected with one's reality and is commonly regarded as a lack of integration of consciousness. Very often, People who have faced emotional or physical traumas are seen as facing dissociation. Those who are

seen as engaging in self-destructive behaviours often do so as a means of eliminating feelings associated with very painful and real emotions, which are difficult to deal with.

These behaviours are seen as a means of escapism, where dissociation has also been linked to more severe psychological pathology such as Dissociative Identity Disorder and Amnesia (Tolmunen *et al.*, 2008). The act of self-destructing can be understood as allowing the individual an alternative means of viewing reality and also provides for the individual a sense of feeling invigorated and comforted. Self-destructing as a means of dissociating can be viewed as a means of stabilizing one's very difficult internal world by the physical pain experienced as well as the control one has over that pain gives the individual a sense of 'power and omnipotence' (McLane, 1996).

2.8.4. Anti-Suicide Model

According to this model, engaging in self-destructive behaviours can be viewed as a means of coping with the urges to attempt suicide and in this way can be regarded as a protective factor (Klonsky, 2007). With this, engaging in such behaviours such as substance abuse can be viewed as a diversion and 'provides the possibility of new openness' (McLane, 1996). Engaging in self-destructive behaviours also 'protects' the individual from committing suicide and afflicting one's family and friends by dismissing the desire to end one's life (Moyer & Welch-Nelson, 2007).

2.8.5. Interpersonal Influence Model

The emotional turmoil associated with any trauma can be devastating for many individuals and as a result of those closest to them trying to assist them in whichever way possible, they are often left feeling very powerless, with a bruised ego. Hence, many individuals who abuse alcohol and other substances do so in attempt to gain greater control over their situations and the people around them (Hicks & Hinck, 2008). However, while many individuals may be seen as abusing intoxicants as a means of controlling their situations and the people around them, others are ashamed of their state and may hide their destructive behaviours as a means of distracting attention from them.

2.8.6. Self-Punishment Model

While the interpersonal influence model can be seen as a means of enforcing control over one's life, the self-punishment model alludes to suicidal individuals self-destructing as a means of punishing themselves (Klonsky, 2007). Many suicidal individuals deal with tumultuous

emotions, which is only exacerbated by their socioeconomic conditions such as financial and food security, being unable to provide for their families and job strain. There are often feelings of guilt and shame associated with these circumstances and suicidal thoughts are common occurrence among such individuals. According to Moyer and Welch-Nelson (2007) in an elaboration of Klonsky's (2007) model and the reasoning behind people committing suicide, feelings of shame and guilt, which in turn perpetuates a vicious cycle, eventually leading to the individual actually committing suicide.

2.8.7. Biological Models of Suicide

While psychological underpinnings of suicide cannot be ignored, they cannot always be viewed in isolation. The biological basis for suicide is important and plays a crucial role in clarifying any discussion on suicide. For example, research conducted by Sher and Stanley (2009) has indicated that those individuals who participate in destructive behaviours have lower levels of pain sensitivity, which may be as a result of a lifetime of unresolved issues, stress or even trauma. Endogenous opioids which are endorphins, are released in response to injuries and act as a natural pain killer (Basbaum, 2004). The release of endorphins into the body may result in a sense of euphoria within individuals, experiencing a reset or altered physiological response and may even contribute to a state of deficiency (Sher & Stanley, 2009).

From here, it is reasonable to assume that stress and trauma may lower the number of endogenous opioids in one's system (Basbaum, 2004). There are a variety of other factors which contribute to self-destruction and suicidality including serotonin, dopamine and genetics where a DNA marker or a gene variant is seen in individuals who have attempted suicide than in individuals who did not. This suggests according to Klonsky *et al.,* (2011) that individuals who have this variant are especially vulnerable when they become depressed..

Selective serotonin reuptake inhibitors (SSRI's) have proven beneficial in helping treat those individuals who continuously engage in self-destructive behaviours. The primary function of serotonin is for the regulation of mood and social behaviours, where the SSRI's allow serotonin to act at the neurotransmitters for more extended periods of time thereby increasing the amount of serotonin available to the individual. Other functions such as appetite, sleep and memory are all functions of serotonin (Sher & Stanley, 2009). Low levels of serotonin are also implicated in irritability, depression and attempted suicides (Klonsky *et al.*, 2011; Sher & Stanley, 2009).

In support of this theory, the developmental model postulates that poverty, childhood trauma and other negative circumstances may biologically hinder the development of the individual, hence increasing the possibility of them developing suicidal tendencies later on in life. Therefore genetic tests on individuals who suffer from depression, and have tried to commit suicide, has indicated that a DNA marker or gene variant was commonly seen in people who attempted suicide than in those who had not, therefore suggesting that it marks out a group of people who are especially vulnerable when they become depressed (Klonsky e*t al.*, 2011).

Previous studies of twins and individuals who were adopted showed that 52% of a person's risk of suicide is due to genetic factors (Klonsky *et al.,* 2011; Sher & Stanley, 2009). Heritability of suicidal tendencies can explain tragic clusters of deaths in families, and in some cases it was proven that suicide was passed from one generation to another (Klonsky *et al.,* 2011; Sher & Stanley, 2009).

2.8.8. Systems Theory and Suicidal Behaviour

According to the Systems Theory, the individual exists as part of a complex system and is affected by both internal and external factors surrounding the system which all effect the integrity of the system with positive and negative feedback loops (Stichweh, 2011). Stichweh (2011) considers Talcott Parsons' contribution to Systems Theory and describes Parsons' theory on how the system reacts to both internal and external stimulation. Stichweh, (2011) formulated that the system can be further divided into (1) adaptive – uses future orientation and external stimulations; (2) goal attainment – uses the internal stimulation and future orientation; (3) integration refers to the use of internal integration and present time orientation and (4) maintenance of long term patterns – uses present tie orientation and external reference. Systems Theory therefore demonstrates how the individual as a system uses both internal and external stimuli to maintain the integrity of the system. Self-harm is therefore seen in terms of Systems Theory as a means to maintain the integrity of the system even though the means through which that integrity is maintained is potentially harmful to the individual (Stichweh, 2011).

2.9. IMPORTANCE OF THE MEDICO-LEGAL AUTOPSY

The following section will consider the legislative framework for Forensic Pathology Services, and the importance of the medico-legal autopsy when assessing suicides.

2.9.1. Legal importance and the regulations regarding the rendering of Forensic Pathology Services

The National Health Act 61 of 2003 makes provision for a number of regulations, including the rendering of forensic pathology, forensic medicine and related laboratory services, including the provision of medico-legal mortuaries and medico-legal services. The purpose of the forensic pathology service is the medico-legal investigation of death in cases where the cause of death is deemed unnatural.

An unnatural death according to the National Health Act 61 of (2003), is considered as:

(a) Any death due to physical or chemical influence, direct or indirect, and/or related complications;
(b) Any death, including those deaths which would normally be considered to be a death due to natural causes, which in the opinion of the medical practitioner, has been the result of an act of commission or omission which may be criminal in nature;
(c) Any death as contemplated in section 56 of the Health Professions Act, 1974 (Act 56 of 1974); and
(d) Where the death is sudden and unexpected, or unexplained, or where the cause of death is not apparent.

Therefore, all unnatural deaths need to be meticulously investigated under the National Health Act No. 61 of 2003 to determine the circumstances and possible causes of death which are or may have been due to unnatural causes.

The Inquests Act stipulates what is necessary for the reporting of deaths which are deemed to be due to 'other than natural causes' and the investigation into such deaths, procedures to be followed in terms of 'other than natural' deaths, the findings of the medico-legal autopsy and how all of this bears on the judicial system in terms of unnatural deaths.

2.9.2. Classification of different types of suicide and associated injuries

Saukko and Knight, (2003 pg. 136) define wounds as 'damage to any part of the body due to the application of mechanical force'. The characteristic of injury according to Shepherd, (2003) refers to the type of injury or wound as well as the region of the injury or wound on the deceased.

2.9.2.1 Jump/Fall from heights

In cases where a person commits suicide by means of jumping from a height (fall from height is not a suicide, but an accident) one would expect to find features of blunt force trauma, such

as lacerations, contusions and fractures (Figure 2.1). Lacerations can be defined as tearing, splitting or crushing of soft tissue and known to be a torn, ragged, mangled wound in description – according to Newman, (1982, p. 375). Furthermore, lacerations, according to Newman (1982) are commonly seen over bony regions of the body and the wound is usually torn, irregular and contused (Figure 2.2). Abrasions can be defined by Saukko and Knight, (2003, p. 138) as a superficial injury to the skin (Figure 2.3). Contusions are colloquially known as bruises, where the collection of extravascular blood has leaked from blood vessels damaged by mechanical force (Saukko & Knight, 2003). Fractures are defined by Webster, (2018) as a break in a bone.

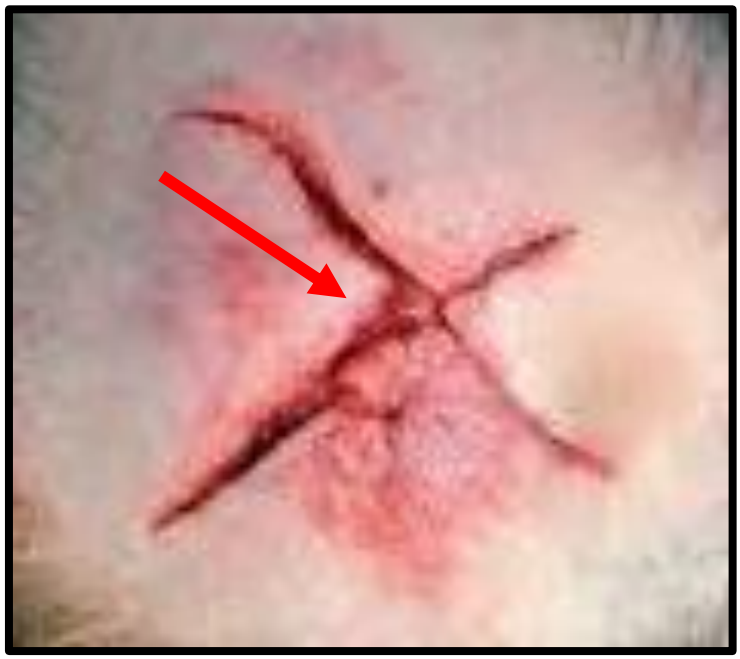


FIGURE 2.1: An example of a stellate-shaped laceration with associated contusion, found in blunt force trauma to the head.
(Department of Forensic Medicine, 2021 a)

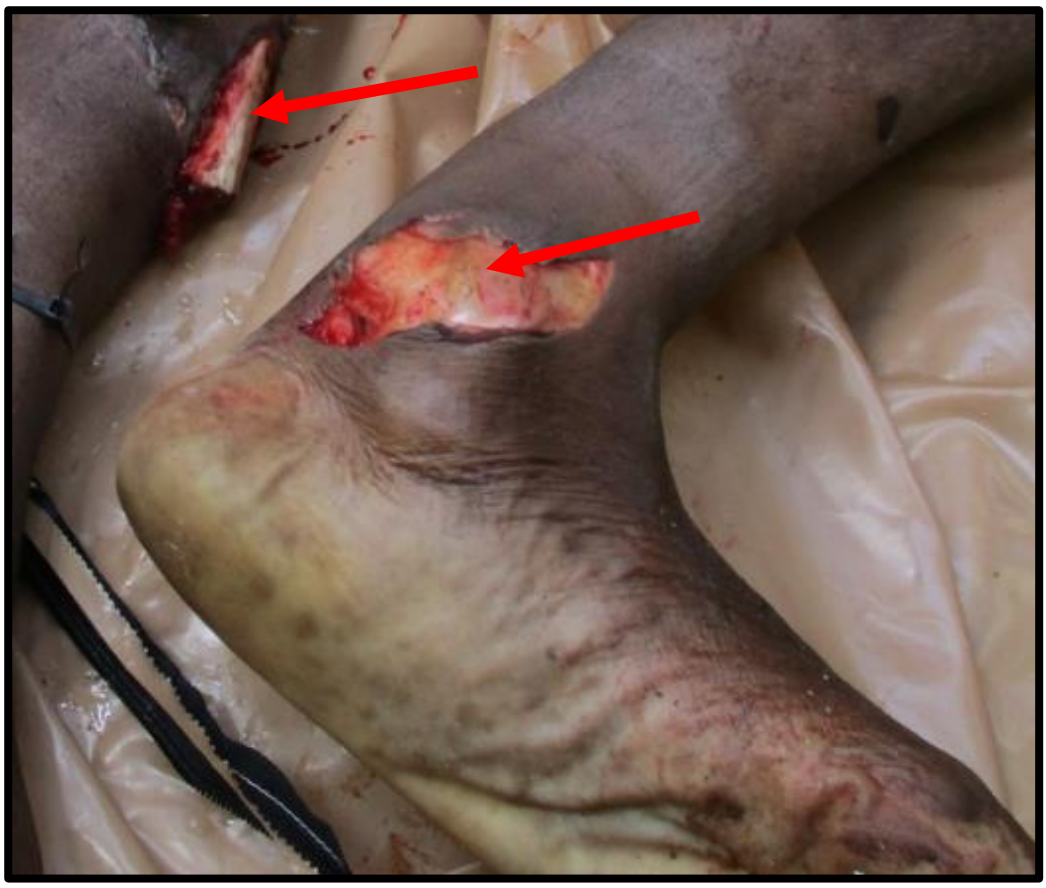


FIGURE 2.2: An example of a laceration, over the left medial malleolus. There is an open fracture of the right lower leg with an overlying laceration.

(Department of Forensic Medicine, 2021 a)

FIGURE 2.3: An example of a laceration with abraded wound edges located over the frontal area.

(Department of Forensic Medicine, 2021 a)

2.9.2.2 Gunshot wounds

Entrance and exit wounds

Gunshot wounds can be classified as either penetrating or perforating. In a penetrating gunshot wound, the bullet enters the body and remains inside, whereas in a perforating gunshot wound, the bullet will pass through the body (Figure 2.4, 2.5 & 2.6) (Saukko & Knight, 2003).

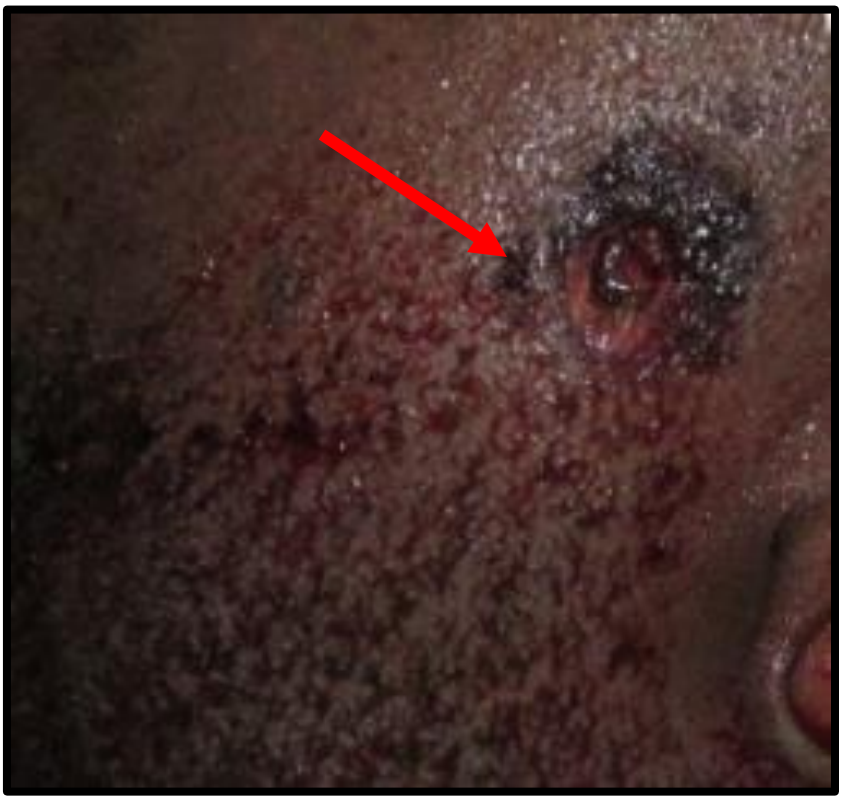


FIGURE 2.4: An example of a contact range entrance gunshot wound of the head. Muzzle imprint over the anterior and inferior aspect of the wound. (Department of Forensic Medicine, 2021 a)

FIGURE 2.5: An example of an exit gunshot wound. The wound is slit-like and has lacerated edges.

(Department of Forensic Medicine 2021, a)

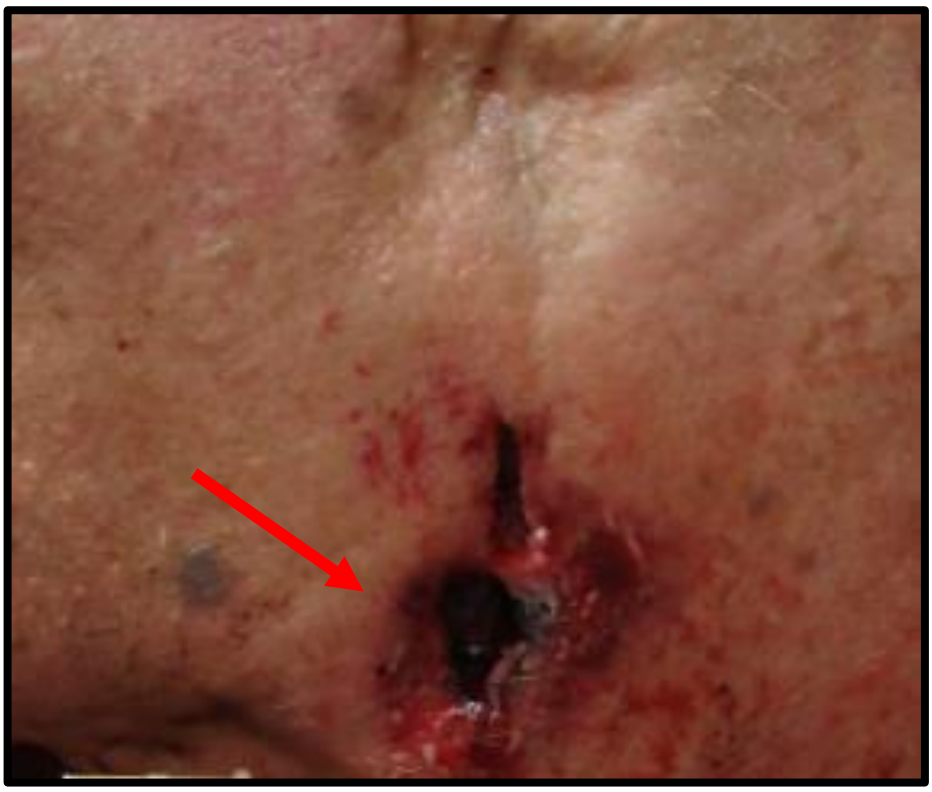


FIGURE 2.6: An example of a contact range entrance wound of the head. The wound is stellate-shaped with blackening of the wound edges.
(Department of Forensic Medicine, 2021a)

2.9.2.3. Hanging

Hanging is the suspension of the body by a ligature which encircles the neck, and the force from the weight of the body causes constriction. Abrasions can be classified according to Saukko and Knight (2003) as: (1) tangential or brush abrasions, (2) crushing abrasions, (3) fingernail abrasions, (4) patterned abrasions, (5) parchment-like abrasions. Parchment-like abrasions (Figure 2.7) are seen in hanging cases where the appearance of the abrasion is a stiff, leathery and parchment-like brown colour as a result of the drying of the exposed surface (Saukko & Knight, 2003).

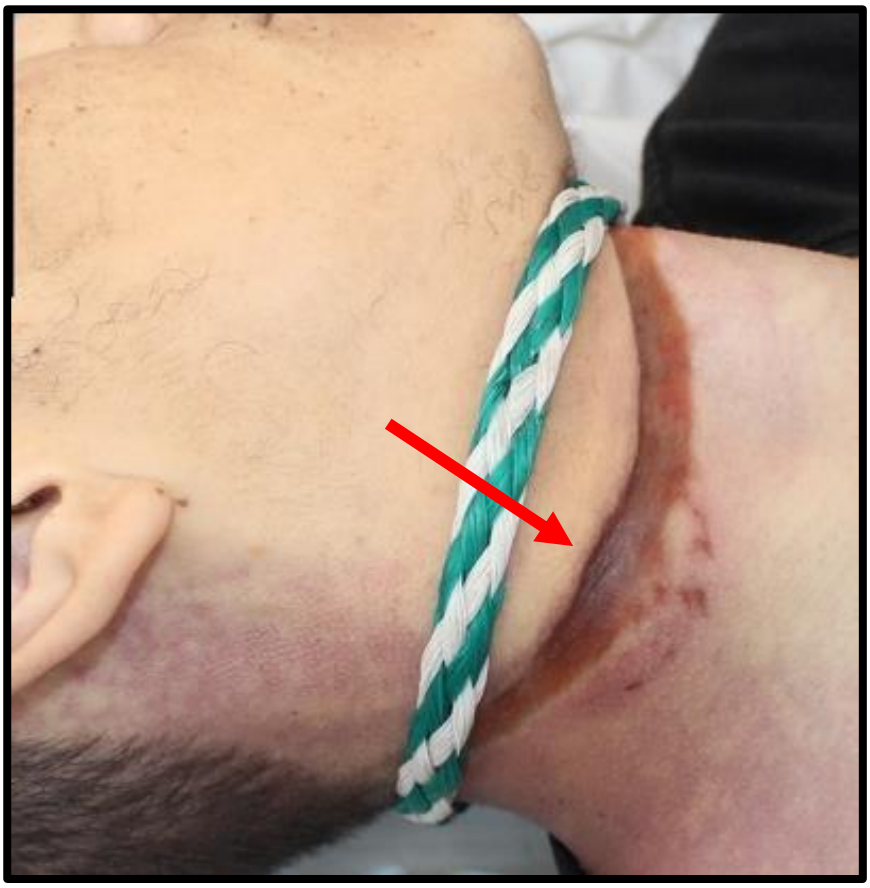


FIGURE 2.7: An example of a deep furrowed parchment-like ligature abrasion under the chin caused by a nylon rope in a case of suicidal hanging.
(Department of Forensic Medicine, 2021 b)

2.9.2.4. Gassing

Carbon Monoxide Poisoning is a potentially fatal condition caused by inhalation of Carbon Monoxide gas, which according to Saukko and Knight (2003) has an affinity for blood (Haemoglobin) which is 200-300 times greater than that of oxygen. Therefore, oxygen is displaced from the red blood cells which lowers the oxygen-carrying capacity of haemoglobin. According to the Centers for Disease Control and Prevention, (2008), Carbon Monoxide is an odourless, colourless gas that is produced through combustion of hydrocarbons. The most prominent feature seen during autopsies in Carbon Monoxide related deaths is the appearance of the skin. The 'cherry-pink' complexion of the deceased's skin is an indication that the individual could have died due to Carbon Monoxide Poisoning (Figure 2.8) (Saukko & Knight, 2003).

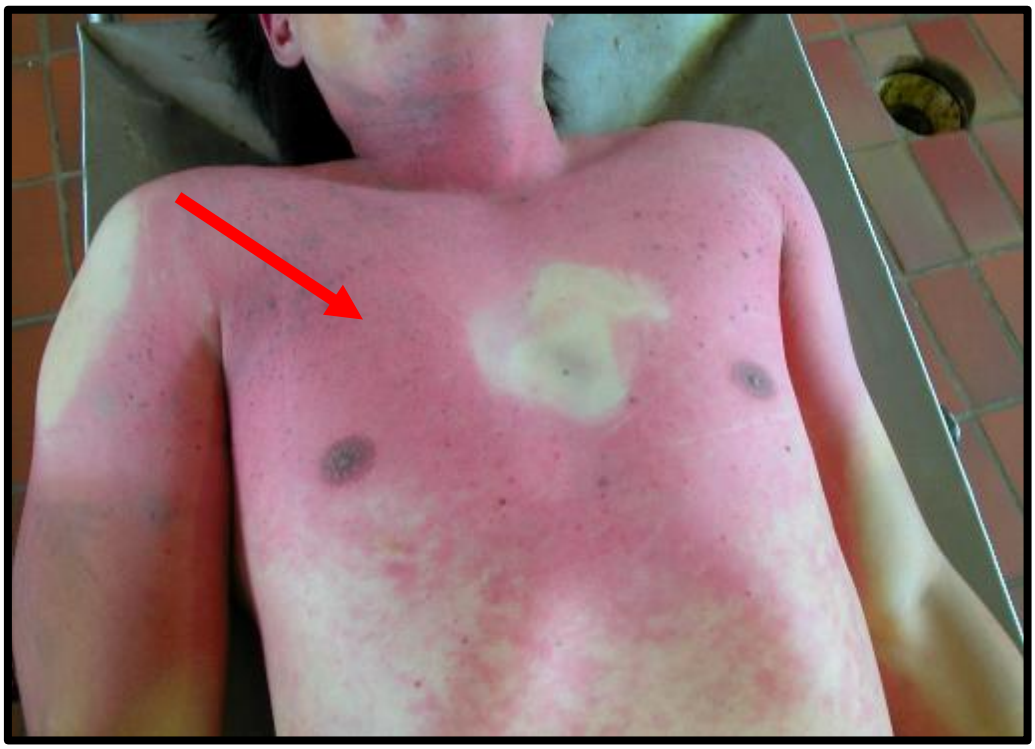


FIGURE 2.8: An example of Carbon Monoxide Poisoning, with 'cherry-pink' complexion which could be found in Carbon Monoxide cases. (Department of Forensic Medicine, 2021 b)

2.9.2.5. Drug Overdose

Drug overdose (intentional) is defined by Saukko and Knight, (2003), as a method which may involve the ingestion of medications and illicit narcotics for the intention of committing suicide. Medications such as Citalopram, Cocaine, Heroin and other substances could be used by the individual contemplating suicide (Figure 2.9) (Saukko & Knight, 2003).

FIGURE 2.9: Examples of drugs, which could be used for the intention of committing suicide, such as Opioids and Amphetamines

(Source: Carelle, 2021)

2.9.2.6. Drowning

According to Payne-James *et al* (2011) the presence of an individual who is submerged in water does not necessarily indicate suicide by drowning, deceased individuals found in water could be due to an accident, or suicide. Bodies in water undergo significant change with time, such as hands and feet that become wrinkled and macerated. There may be bloating of the body which includes the face, abdomen and genitals which is caused by the formation of gas in the soft tissues and body cavities. This is often evident after a few days of a person being immersed in water (Payne - James *et al.*, 2011).

Additional findings which may be associated with drowning could include external foam/froth and frothy fluid in the airway, emphysema aquosum/heavy lungs, pleural fluid accumulation, and subpleural haemorrhages (Figure 2.10).

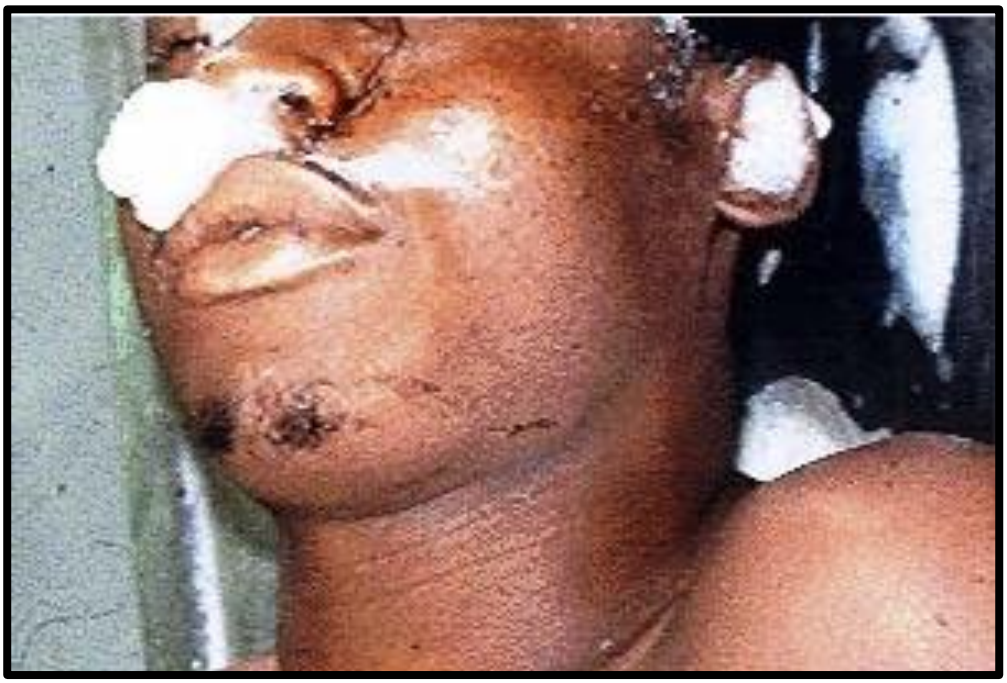


FIGURE 2.10: An example of frothy fluid exuding from the mouth of the deceased following death by drowning.
(Department of Forensic Medicine, 2021 b)

2.9.2.7. Poisoning

Poisoning is defined by Webster, (2018) as a substance that through its chemical action usually kills, injures or impairs an organism. Individuals who commit suicide by Poisoning have a variety of poisons which could be used; pesticides (including *Aldicarb* (Temik)), herbicides, fungicides and rat poison are some examples of poisons which could be used as a method of suicide by Poisoning (Figure 2.11) (Kaplan *et al.*,2014).

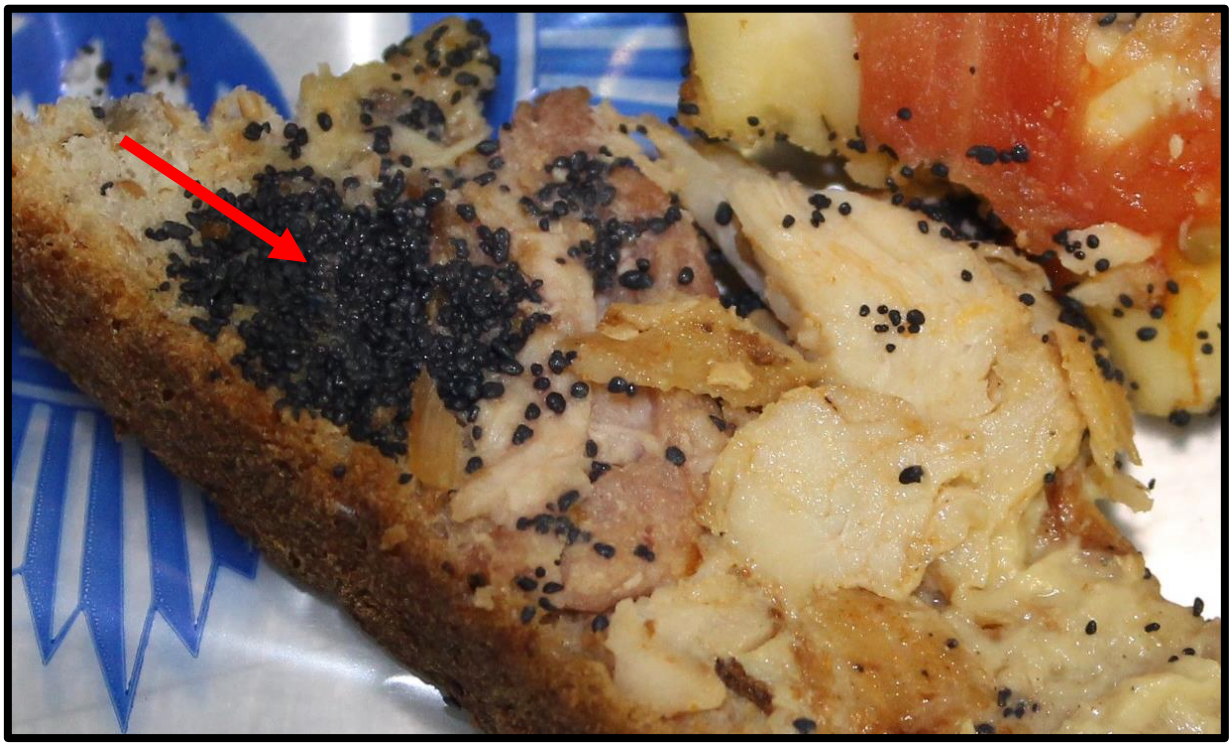


FIGURE 2.11: An example of Aldicarb (Temik) poison (also known as Two Step), may be used for the intention of committing suicide by poison.
(Copyright Department of Forensic Medicine, 2021 a)
(Source: Tracy Reindorp)

2.9.2.8. Self-immolation

Self-immolation can be defined by Webster (2018) as a deliberate and willing sacrifice of oneself often by fire. According to Sukhai *et al.,* (2002), Self-immolation is an uncommon method of suicide. However, Self-immolation is tolerated by some elements of the Buddhism and Hinduism culture, where Self-immolation has been practiced for many centuries in aid of political protests, devotion and renouncement (Sukhai *et al.,* 2002).

According to Payne - James *et al.*, (2011), the severity of burns noted during autopsies can vary. According to Saukko and Knight, (2003, p. 31) burns involving 30-50% of the total body surface are incompatible with life (Figure 2.12).

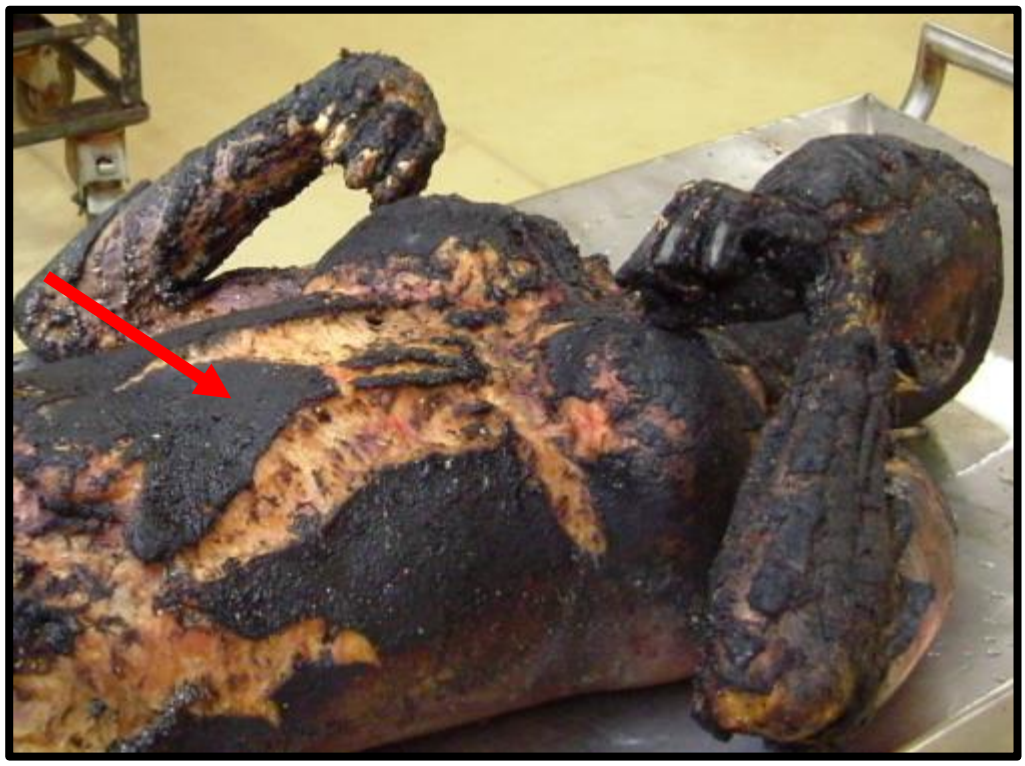


FIGURE 2.12: An example of self-immolation. The extensiveness of the burns on the deceased may vary.
(Department of Forensic Medicine, 2021 b)

2.10. CONCLUSION OF LITERATURE REVIEW

Mental health illness, depression, substance and alcohol use and abuse, the methods of suicide and the Temporal and Seasonal factors are considered to be linked to suicide. This has been considered in the literature review of how individuals engage in harmful behaviour, therefore contributes to the taking of one's life. Comorbid psychopathologies are seen in individuals who either engage in distrustful behaviour's or are diagnosed with a mental illness (Klonsky, 2007). Research has indicated that the above-mentioned risks require further investigation and preventative measures need to be implemented to suit the intended population.

CHAPTER 3

STUDY AIMS AND OBJECTIVES

The aim of this study was to determine the demographic profile of all suspected suicide victims autopsied at the Johannesburg Forensic Pathology Service and to describe the temporal trends of the various methods of suicidal deaths. The sample was from the years 2012-2016.

The objectives of this research study were to:

1. To identify the demographic profile of victims of suicide at the Forensic Pathology Service Johannesburg Medico-Legal Laboratory for the period of 2012-2016.
2. To determine the frequency of various methods of the suicide cases.
3. To determine whether there is a correlation between certain demographic variables (sex, race and age) and specific methods of suicide.
4. To describe and evaluate the seasonal and temporal trends, and which months of the year showed significance as an associated factor to suicides.
5. To determine between the presence of blood alcohol and the method of suicide used (more violent vs less violent).
6. To describe the suicide location in terms of sex, race, age demographics, and compare for correlations or relationships with indoor vs outdoor location.

3.1. METHODS

The following section will consider the methods and the procedures followed throughout this research.

3.1.1 Study Design

This study was a retrospective, quantitative cross sectional study of case files. Data was captured by the researcher from a primary source (case files), and was used to make statistical inferences from the data sampled about the population of interest.

3.1.2 Site of Study

The study was conducted at the Johannesburg Forensic Pathology Service. The main activity of the Forensic Pathology Service is the medico-legal investigation and the determination of the cause of death in cases of unnatural deaths (National Heath Act, 2003). The Forensic

Pathology Service is made available by the Department of Health. The Johannesburg Forensic Pathology Service is based in Braamfontein, 25A Hospital Street. The catchment area for the Forensic Pathology Mortuary is the greater Johannesburg area. The areas included coincide with the following police stations: Alexandra, Booysens, Bramley, Brixton, Cleveland, Douglasdale, Fairland, Hillbrow, Honeydew, Jeppe, Johannesburg Central, Langlaagte, Linden, Midrand, Mondeor, Norwood, Parkview, Randburg, Rosebank, Sandringham, Sandton, Sophiatown and Yeoville.

3.2. DESCRIPTION OF THE SAMPLE

The sample of this study was all suspected suicide-related death cases received at the Johannesburg Forensic Pathology Service Medico-Legal Mortuary from January 2012 to December 2016. The sample consisted of all individuals whose deaths were deemed or suspected to be associated with a suicidal manner of death.

The inclusion criteria for the sample were:

1. Time period – All cases of suspected suicide received at the Johannesburg FPS from the January 2012 to December 2016.
2. Demographics – All cases of suspected suicide irrespective of age, race and sex.
3. Cases in the death register which included suicide-related terms such as: Hanging, suicide, Jump or Fall from Height, Gassing, Suffocation, Jumping in front of train or moving vehicle, Burning/burnt themselves (Self-immolation).
4. All case files where the SAPS 180 (Police Report Accompanying Body to Mortuary) form indicated manner of death as ‘suicide’ or ‘suspected suicide’.

The exclusion criteria for the sample were:

1. Deaths that were assumed not to be suicide related.
   Other modes of death from the death register to be excluded that were termed:
   ‘dead on arrival’, ‘electrocution’, ‘freak accident’.

3.2.1. Data collection

Information on various cases and hence methods of suicide (and all inclusions) was gathered from the respective Death Registers of 2012-2016, and the relevant case files identified. This included identifying case numbers from the FPS JHB MLL Death Register using the inclusion criteria eligible for the demographic sample.

The Death Register is a register that manages the preliminary data of the deceased received at the mortuary for autopsy as well as documenting the removal of the deceased by the funeral homes, for administrative purposes. The death register was initially used to extract information to identify the sample population in terms of suspected suicide. Information such as (1) date, (2) name, (3) place/site of death, (4) time of death, (5) case number, (6) doctor can be found in the death register (7) samples taken, (8) date of death, (9) date of when body was removed, (10) undertakers details. Codes and categories or themes were drawn from the data, by counting and comparing the significant keywords. (1) Hanging, (2) Drowning, (3) Jump/Fall from heights, (4) Carbon Monoxide Poisoning/Gassing, (5) Burnt victim/ Self-immolation, (6) Drowning, (7) Poisoning/chemical ingestion, (8) Overdose, even just the word 'suicide' was captured under one theme. A number is allocated to every decedent that is admitted to the mortuary, and this is called a case number, which corresponds to the number on the specific case file. The case files for each case number identified in the Death Registers were obtained from the Case Files Administration Room and the information contained therein was reviewed. This information included but was not limited to: SAPS 180 form (Police Report Accompanying Body to the Mortuary), medico-legal post mortem autopsy reports and scribe notes as well as the laboratory reports.

From the SAPS 180 (Police Report Accompanying Body to the Mortuary) (Appendix 1) form, the information collected included:

- Place and site of death: in relation to the location where the deceased was found.
- History of the deceased, for example any prior suicide attempts/ psychological history if (applicable).

From the Forensic Pathology Service Report on a Medico-Legal Post Mortem Examination the information collected included:

- Age
- Race
- Sex
- Confirmatory Time of Death
- Cause of Death
- Tests Requested: in relation to blood alcohol concentration (BAC).
- Tests Received and Interpretation: in relation to how much alcohol was present prior to death.

3.2.2. Data Analysis

All data were recorded onto an Excel spreadsheet (Microsoft Office® Version 2017) (Appendix 2).

The following were performed:

- The demographic characteristics of all victims were analysed with respect to the frequency of various methods of suicide cases.
- The temporal factors including seasonal (defined by the South African Weather Service as follows: Autumn - 1 March – 31 May; Winter - 1 June – 31 August; Spring - 1 September – 30 November; Summer - 1 December – 28/29 February), and monthly, were evaluated for trends over time.
- The categories of suicide: Hanging, Jump/Fall From Height, Gunshot/Shooting, Self-immolation, Chemical Ingestion, Drowning, Gassing, Overdose/Pills, Poisoning
- The association between More Violent/Less Violent methods of suicide in relation to alcohol and substance use.
    - **More Violent methods:**
    - Hanging,
    - Jump/Fall From Heights,
    - Gunshot/Shooting,
    - Self-immolation,
    - MVA.
    - **Less Violent method:**
    - Overdose/Pills,
    - Poisoning,
    - Chemical Ingestion,
    - Drowning,
    - Gassing.
- The description of demographics in relation to location (indoors vs outdoors)
    - Indoor: situated, conducted, or used within a building or under cover (Webster, 2018) such as: bedroom, garage, indoor building.
    - Outdoor: open air (Webster, 2018) such as: open area, field, side of road, garden.
- The incidences of suicide and the methods of suicide were statistically represented as frequency proportions and percentages.

- Chi-squared analysis was used to test the association of the relationship between the demographic variables such as (Sex, Age, Race) and the methods of suicide. Every test that was conducted, compared proportions of Male vs Female in relation to 'indoor vs outdoor' location , Which Age group showed prevalence, and was at further risk. Race in relation to Males vs Females and which Race group (White, Black, Coloured, Indian/Asian) showed prevalence.

Criteria for acceptance of significance included a 95% level of significance ($\alpha = 0,05$).

3.2.3. Ethical Approval

Ethics clearance was granted from the Wits Human Research Ethics Committee: Clearance certificate number: M180122 (Appendix 3). Permission to access information and case files from the Forensic Pathology Service post mortem archives was obtained from the Head of the Department of Forensic Medicine and Pathology, University of the Witwatersrand and the Johannesburg Forensic Pathology Service Mortuary Manager.

CHAPTER 4
RESULTS

A total of 1019 cases of suspected suicide were identified over the 2012-2016 period. The data presented below provides the distribution of the data over the entire period and that of an annual basis.

4.1 DEMOGRAPHIC CHARACTERISTICS

4.1.1 Sex

The sex of suspected suicide cases for the five year period 2012-2016 were as follows: a total of 909 males and 110 females (Table 4.1).

Table 4.1: Sex of suspected suicide cases (n=1019)

SEX	NUMBER OF VICTIMS (n=1019)	PERCENTAGE %
Male	909	89%
Female	110	11%
Total	1019	100%

In all years there were more males than females, but in 2012 and 2013 there was a greater proportion of males, whereas 2014, 2015, and 2016 the proportion of males to females was much smaller (Table 4.2). There was a significant association between the proportions in each year and sex of suicide victims (χ^2 =16.0803; p<0.005).

Table 4.2: Sex Proportion of suspected suicide cases for 2012-2016 (n=1019)

Year	Males	%	Females	%	Total
2012	220	86%	30	12%	250
2013	233	91%	27	10%	260
2014	140	83%	25	15%	165
2015	155	92%	18	8%	173
2016	161	94%	10	6%	171
Total	909	89%	110	11%	1019

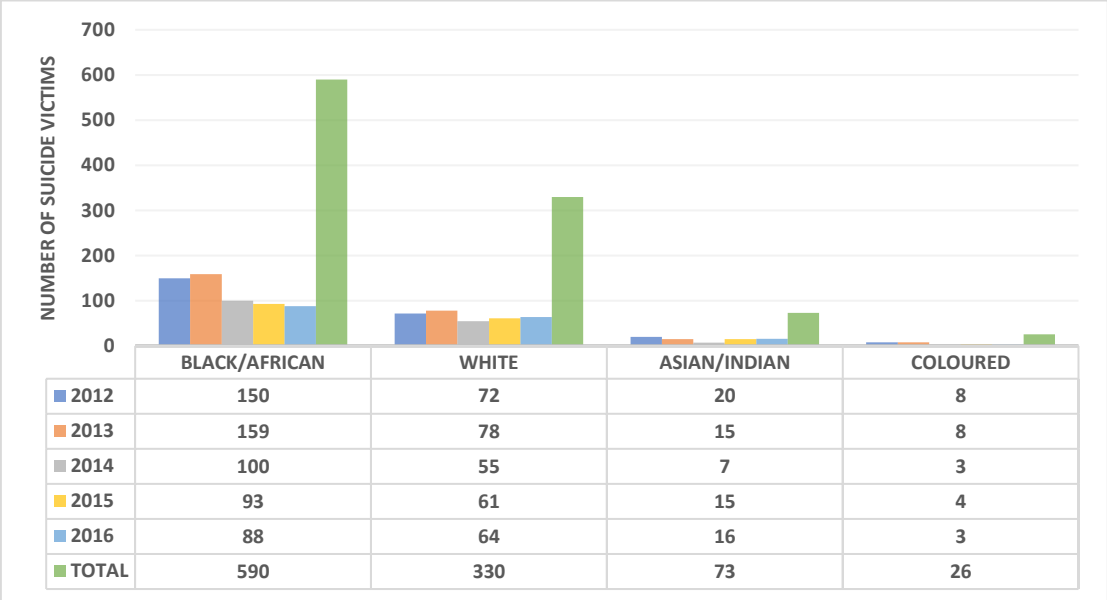
4.1.2 Race

The distribution of race for the period of 2012-2016 was as follows: from the sample size of 1019 individuals it was identified that 58% (n=590) were Black/African, 32% (n=330) White, 7% (n=73) Asian/Indian, and 3% (n=26) Coloured (Table 4.3).

Table 4.3: Race of suspected suicide cases (n=1019)

RACE	NUMBER OF VICTIMS (n=1019)	PERCENTAGE %
Black/African	590	58%
White	330	32%
Indian/Asian	73	7%
Coloured	26	3%
Total	1019	100%

Over the entire five year period Black/African deceased's were consistently higher than the number of deceased's from all other racial groups (Figure 4.1).



	BLACK/AFRICAN	WHITE	ASIAN/INDIAN	COLOURED
2012	150	72	20	8
2013	159	78	15	8
2014	100	55	7	3
2015	93	61	15	4
2016	88	64	16	3
TOTAL	590	330	73	26

FIGURE 4.1: Race Demographic Proportions for the period of 2012-2016

4.1.3 Age

The ages of suicide deceased's for 2012-2016 ranged from 11-85 years of age, with a mean age of all suicide cases being 38 years of age (Table 4).

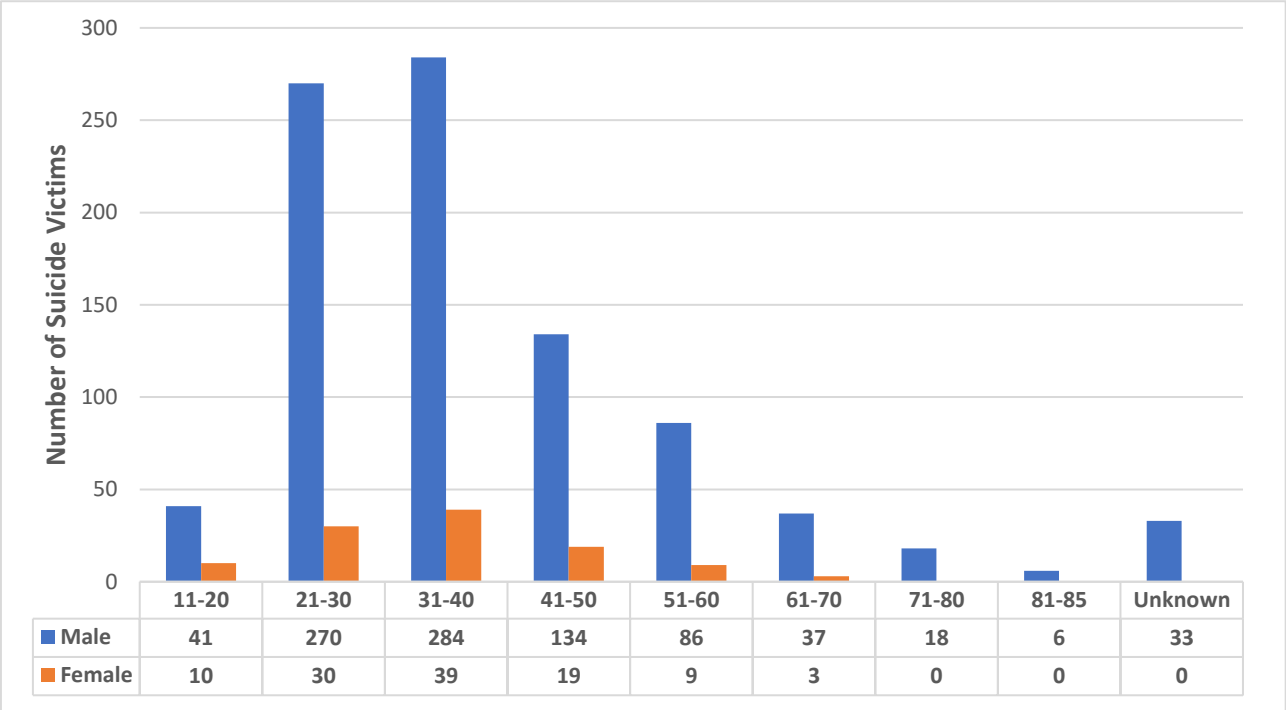
The majority of suicide deceased's were from the 31-40 year age group. The mean age of both male and female suicide cases was found to be 34 ± 3 (SD) years (Table 4.4).

Table 4.4: Age Demographic Proportion Features of suspected suicide cases (n=1019)

AGE (YEARS)	NUMBER OF VICTIMS (n=1019)	PERCENTAGE %
11-20	51	5%
21-30	300	29%
31-40	323	31%
41-50	153	15%
51-60	95	9%
61-70	40	4%
71-80	18	2%
81-85	6	0,6%
*UNKNOWN	33	3%
Total	1019	100%

* Unknown= all cases where age was not determined at the time of arrival at the FPS MLL Laboratory.

The age category with the highest frequency of suicides for both sexes was found to be the 31-40 year age group, followed by the 21-30 year age group (Figure 4.2). Two hundred and eighty four cases (31%) were reported for male individuals in the 31-40 year age group, with a mean of 34 ± 3 (SD) years. Thirty nine female individuals (35%) were reported in the 31-40 year age group, with the same mean as found in the male individuals of 34 ± 3 (SD) years.



	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-85	Unknown
Male	41	270	284	134	86	37	18	6	33
Female	10	30	39	19	9	3	0	0	0

FIGURE 4.2: Age and Sex differences of suspected suicide cases for the period of 2012-2016

4.2 FREQUENCY OF VARIOUS METHODS OF SUICIDE

The most frequently used method of suicide was Hanging with 602 cases (66%) followed by Jump/Fall from Heights with 220 cases (24%), which were categorised as 'more violent methods' of suicide. In the 'less violent method' category, Overdose was the most frequently used method comprising of 56 cases (62%), followed by Poisoning with 20 cases (19%) (Table 4.5).

There were two cases (<1%) of unknown methods of suicides recorded, meaning that the methods of suicide was not known at the time the data were captured. (Table 4.3).

Table 4.5: Frequency of various methods of suspected suicide cases (n=1019) for the period of 2012-2016.

METHOD OF SUICIDE	FREQUENCY	%
	MORE VIOLENT METHODS	
Hanging	602	59%
Jump/Fall From Heights	220	22%
Shooting/Gunshot	87	9%
*Other/(MVA)	2	<1%
Self-immolation	1	<1%
	LESS VIOLENT METHODS	
Overdose	65	6%
*Poisoning/(Rat poison)	20	2%
Ingestion of Chemicals/Acids/ Household Chemicals	9	1%
Drowning	7	1%
Gassing	4	<1%
Unknown Method	2	<1%
TOTAL	1019	100%

*Other/(MVA)= all cases where suspected suicide by motor vehicle accidents were determined.

*Poisoning/(Rat Poison)= all cases where suspected suicide by rat poisoning was identified.

4.3. THE ASSOCIATION BETWEEN DEMOGRAPHICS (SEX, RACE, AGE) AND THE METHODS OF SUICIDE

4.3.1 Sex

From the sample of 1019 individuals, 912 cases (89%) were as a result of the 'more violent' methods of suicide, and 105 cases (10%) for the 'less violent' methods of suicide, leaving two cases (<1%) where the method of suicide was unknown (Table 4.6).

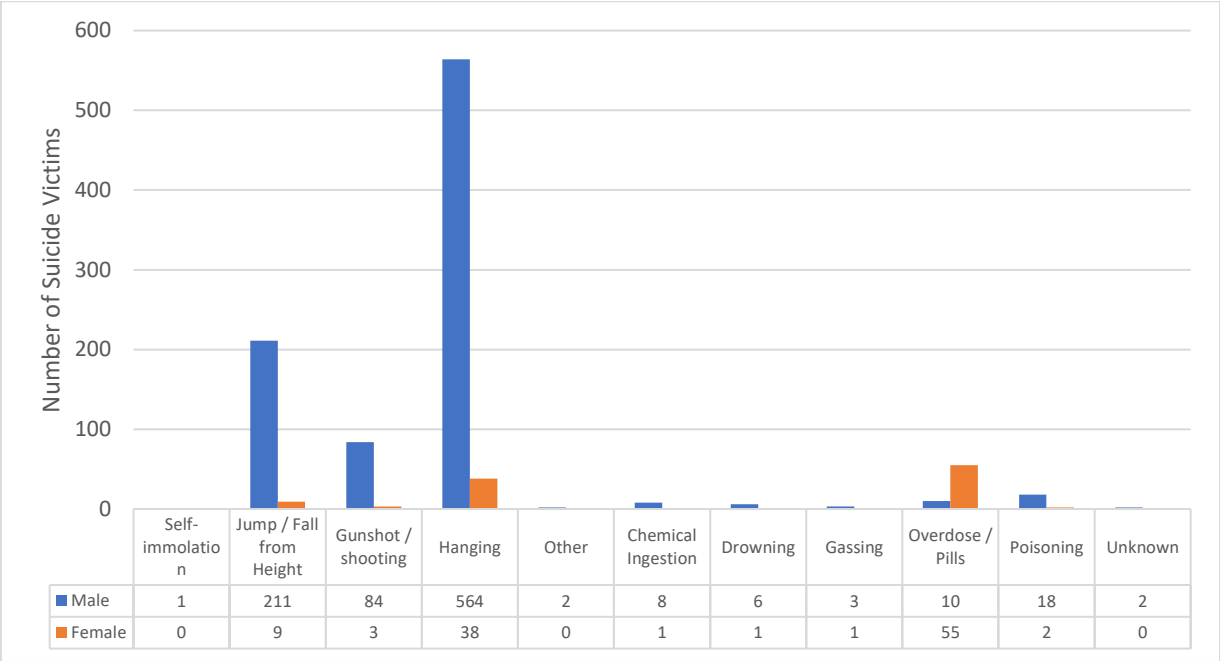
Methods of suicide such as Hanging, Jump/Fall from heights, Self-immolation, and Shooting/Gunshot can all be classified as violent methods of dying. 'More violent' is defined by the World Health Organization (2001) as the use of physical force so as to injure, abuse, damage or destroy. According to Jones *et al.,* (2013) defines 'More violent methods as a more violent approach which is guaranteed of a completed and fast suicide.

Table 4.6: The association between Sex and the violent/less violent methods of suicide in suspected suicide cases (n=1019).

2012 – 2016	More Violent Methods of suicide Victims	%	Less Violent Methods of Suicide Victims	%	Unknown	%	Total	%
Males	862	85%	45	4%	2	<1%	909	89%
Females	50	5%	60	6%	0	<1%	110	11%
Total	912	90%	105	10%	0	<1%	1019	100%

In all instances male individuals had dominated all categories of methods, with hanging being the most frequently used method (62%), followed by Jump/Fall from Heights with (23%) recorded (Figure 4.3). However the female individuals had the highest proportion in the 'less violent' methods of suicide with overdose being the frequently used method (52%) recorded.

A significant association was found between the sex of deceased's and the category of violence of the methods selected (χ=52.285; $p < 0.001$).



***Unknown = all cases where sex was not determined and recorded.

*Other = all cases where the method of suicide such as motor vehicle accident deemed as a suicide.

FIGURE 4.3: The relationship between the prevalence and the method of suicide in suspected suicide cases with respect to sex

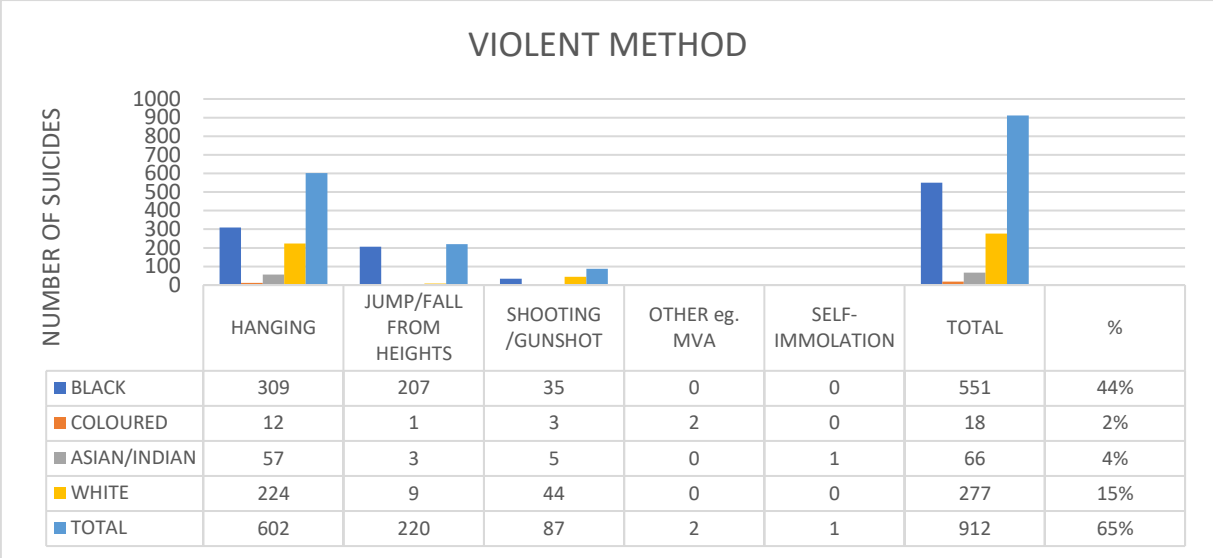
4.3.2 Race

It was found that the majority of suicide deceased's in the method of suicides were Black/African individuals followed by White individuals (Figure 4.4). The Asian/Indian and Coloured individuals comprised the smaller proportion of suicides in both categories of suicide.

It was found that suicide by Hanging was the most prevalent method selected by all races with the greatest number among Black/African individuals with (34%), followed by White individuals with (25%). Jump/Fall from Heights cases were predominantly found to be within the Black/African group with (23%) recorded , and the second most frequently used method of suicide overall amongst all victims (Figure 4.4).

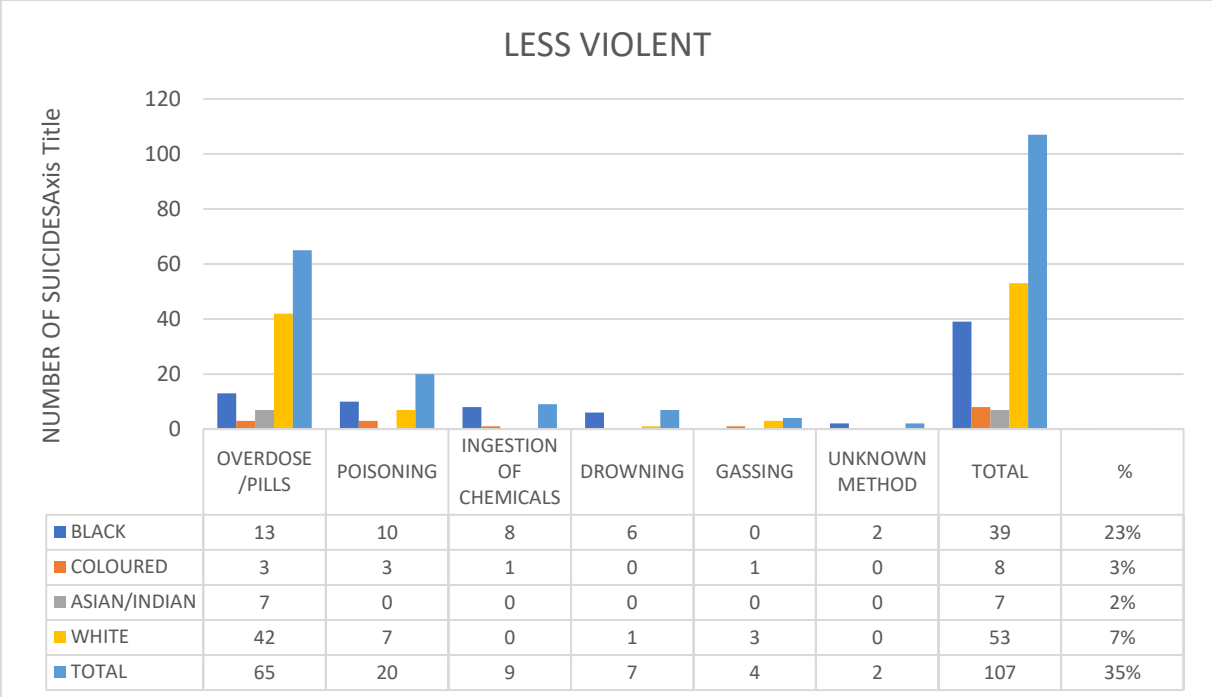
In the 'less violent' category of suicide, it was found that White individuals most frequently used Overdosing on pills a frequently used method with (40%), followed by Black/African individuals with (12%). The least frequently used method of suicide in the 'less violent' category was Gassing and Ingestion of Chemicals within Coloured individuals with one case

(<1%) recorded. In the more and less violent categories of suicide, it was found that the Coloured and Asian/Indian individuals comprised the smallest proportion overall (Figure 4.5).



	HANGING	JUMP/FALL FROM HEIGHTS	SHOOTING /GUNSHOT	OTHER eg. MVA	SELF-IMMOLATION	TOTAL	%
BLACK	309	207	35	0	0	551	44%
COLOURED	12	1	3	2	0	18	2%
ASIAN/INDIAN	57	3	5	0	1	66	4%
WHITE	224	9	44	0	0	277	15%
TOTAL	602	220	87	2	1	912	65%

FIGURE 4.4: Prevalence of Race and More Violent Method of suspected suicide cases for the period of 2012-2016 at the JHB FPS MLL



	OVERDOSE /PILLS	POISONING	INGESTION OF CHEMICALS	DROWNING	GASSING	UNKNOWN METHOD	TOTAL	%
BLACK	13	10	8	6	0	2	39	23%
COLOURED	3	3	1	0	1	0	8	3%
ASIAN/INDIAN	7	0	0	0	0	0	7	2%
WHITE	42	7	0	1	3	0	53	7%
TOTAL	65	20	9	7	4	2	107	35%

FIGURE 4.5: Prevalence of Race and Less Violent Method of suspected suicide cases for the period of 2012-2016 at the JHB FPS MLL

4.3.3 Age

It was found that individuals between 31and 40 years of age predominantly used Hanging as a method of suicide comprising of 80% of cases, followed by the 21-30 year age group with (66%) (Table 4.8).

Jump/Fall From Heights as a method of suicide was predominantly seen between the ages of 21 and 30 years with (34%) , followed by the 31and 40 year age group with (16%) (Table 4.8).

Gunshot/Shooting was predominantly seen in the older age group of 51 and 60 years of age, with (64%), followed by the 41and 50 year age group with 26 cases (17%) recorded (Table 4.8).

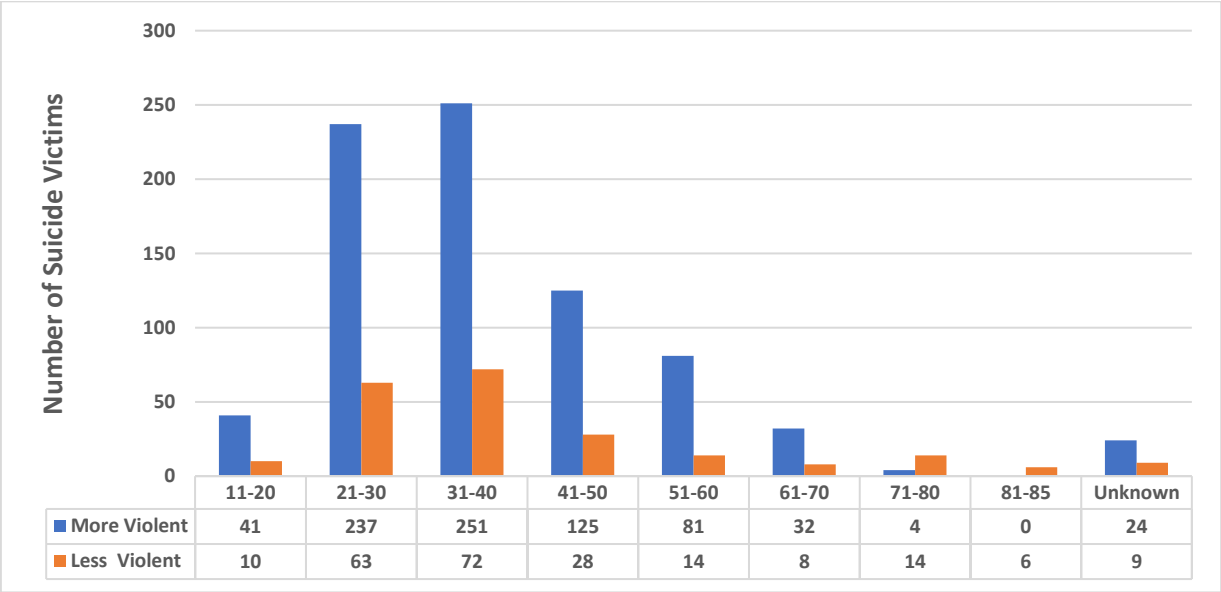
Overdose/Pills as a method of suicide was predominantly seen in the 41 and 50 year age group with (29%), followed by the older age group of 61 and 70 year olds with (38%) (Table 4.8).

The least frequently used method of suicide for all age groups combined was Self-Immolation with (1%) recorded for the 51 and 60 year age group (Table 4.8).

Table 4.7: Prevalence of Age and Method of suspected suicide cases for the period of 2012-2016 (n=1019) at the JHB FPS MLL

AGES AND METHODS												
YEARS	**Self-immolation**	**Jump / Fall from Height**	**Gunshot/ shooting**	**Hanging**	**Other**	**Chemical Ingestion**	**Drowning**	**Gassing**	**Overdose / Pills**	**Poisoning**	**Unknown**	**TOTALS**
11-20	0	10	0	40	0	0	0	0	1	0	0	**51**
21-30	0	102	0	197	0	0	0	0	1	0	0	**300**
31-40	0	53	0	260	1	6	0	3	0	0	0	**323**
41-50	0	17	26	61	1	0	0	1	44	3	0	**153**
51-60	1	0	61	33	0	0	0	0	0	0	0	**95**
61-70	0	0	0	11	0	3	2	0	15	9	0	**40**
71-80	0	9	0	0	0	0	3	0	0	6	0	**18**
81-85	0	0	0	0	0	0	0	0	4	2	0	**6**
UNKNOWN AGE	0	29	0	0	0	0	2	0	0	0	2	**33**

It was found that the dominant age in the 'more violent' category was the 31-40 year old group with (28%) of cases reported, followed by the 21-30 year age group with (26%). Within the 'less violent' method of suicide, with an overall total of (10%). The dominant age group within this category was also the 31-40 year age group with (69%) recorded. The age group which followed was found to have been the 21-30 year age group with (60%) of cases recorded. Two cases were excluded due to the unknown method of suicide. The 81-85 year age group had the least suicides in both the more violent and less violent categories. Three Percent of cases were recorded under the unknown age category (Figure 4.6).



	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-85	Unknown
More Violent	41	237	251	125	81	32	4	0	24
Less Violent	10	63	72	28	14	8	14	6	9

FIGURE 4.6: Violent and Less Violent Deaths in Different age groups of suspected suicide cases for the period of 2012-2016. (n=1019)

4.4. TEMPORAL AND SEASONAL CHANGES

March was found to be the most prominent month for the entire five year study with (16%) of cases, when the months of all five years were combined together. A secondary peak fell into the month of June with (11%) , followed by November with (9%) (Figure 4.7). Trends presented that the month of March was the highest throughout the period of 2014-2016, and June was highest in the first two years only, with the numbers decreasing for the remainder of the years. The months which presented low figures were the months of July with (6%), April (7%) and December (8%) (Figure 4.7). It was found that the number of suicides in March and June appeared significantly higher than any other month ($p<0.001$, $\chi^2=124.6$) (Figure 4.7).

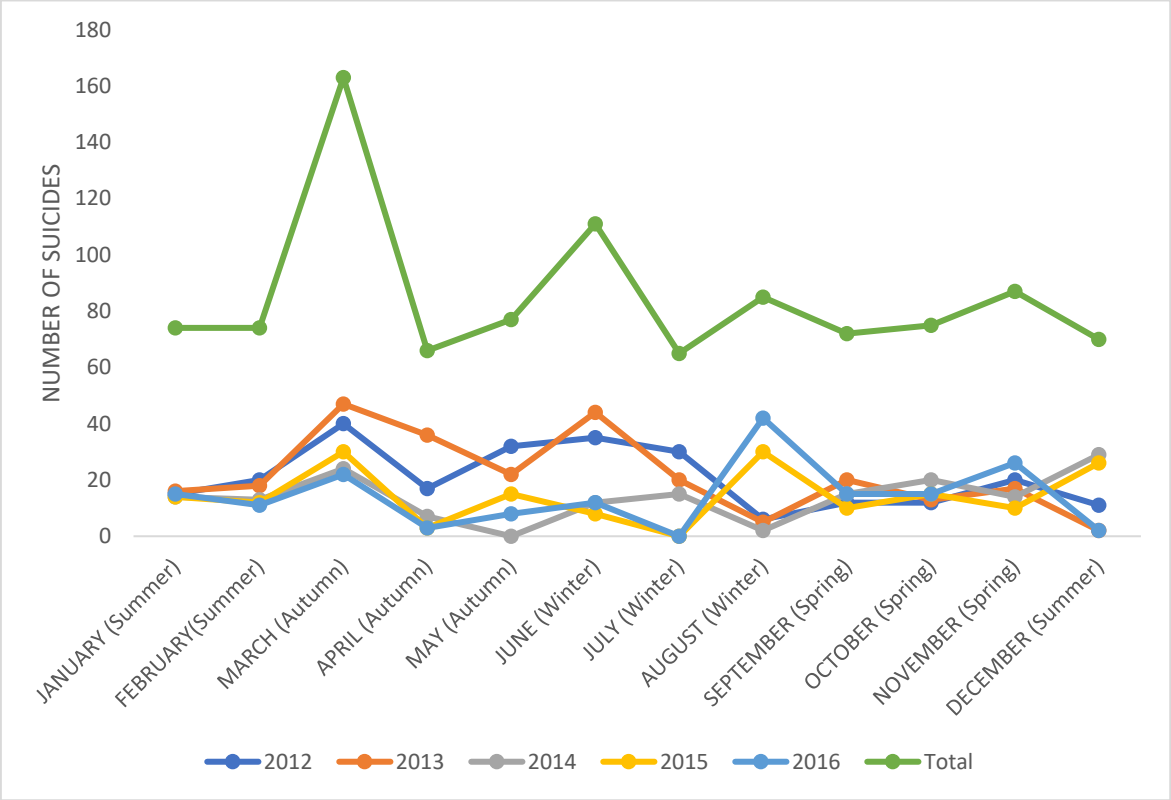


FIGURE 4.7: Temporal and Seasonal Frequencies according to the months of the year for the period of 2012-2016

Trends for Temporal and Seasonal changes in Sex and Race resulted that Black/African males predominantly committed suicide during the months of March with (11%), followed by the month of September with (10%) (Table A.1 Appendix 4).

Trends for the Coloured male individuals resulted as the lowest figure overall for the entire five year study with (2%) . However, March was found to be the preferred month with (31%) with decreases recorded for the remainder of the months (Table A.1 Appendix 4).

Trends for the Asian/Indian male individuals predominantly committed suicide during the month of March with (25%) recorded, and trends over the rest of the months showed decreases in suicides with April, July, October and December all sharing the same figure with (3%) (Table A.1 Appendix 4).

Trends for the White male individuals resulted as March being the most prominent month with (19%), followed by June with (12%). Trends for the rest of the months showed

inconsistencies with some months decreasing in cases and in other months showing figures of slight increases (Table A.1 Appendix 4).

Trends for Black/African females predominantly committed suicide during the month of March with (25%), followed by January with (16%). Inconsistencies throughout the months were recorded with certain months showing decreases in cases and then increasing sharply (Table A.1 Appendix 4).

Trends for Coloured female individuals showed inconsistencies throughout the seasonal months of the year with (30%) for March, with a decrease in cases for April and May, and then a sudden increase in June with (20%). This was followed by another increase in October and November with a sudden drop in figures in December (Table A.1 Appendix 4).

Trends for Asian/Indian female individuals comprised with the lowest figures all year round with (1%) recorded. The month of January and June both sharing the same figures with (33%). No inconsistencies in months over the five year study was recorded (Table A.1 Appendix 4).

Trends for White female individuals resulted as March being the most prominent month with (25%) followed by a decrease in cases for June with (13%). Trends showed inconsistencies throughout the remaining months, as sharp decreases were recorded for the month of July, followed by a sharp increase in August, with yet another decrease in September (Table A.1 Appendix 4).

Race/Sex proportion in relation to Seasonal and Temporal changes showed that March was the dominant month where suicides predominantly occurred, with (16%), followed by the month of June with (11%)and November with (8%). Even though there were some changes recorded throughout the five year study where certain months showed inconsistencies of cases decreasing and increasing, throughout the year, overall figures highlighted that March was consistent throughout the Race and Sex groups (Table A.1 Appendix 4).
Seasonal trends were captured as follows, starting with the highest, being Autumn with (30%) followed by Winter with (26%). Spring with (23%) and Summer respectively with (21%) (Figure 4.8).

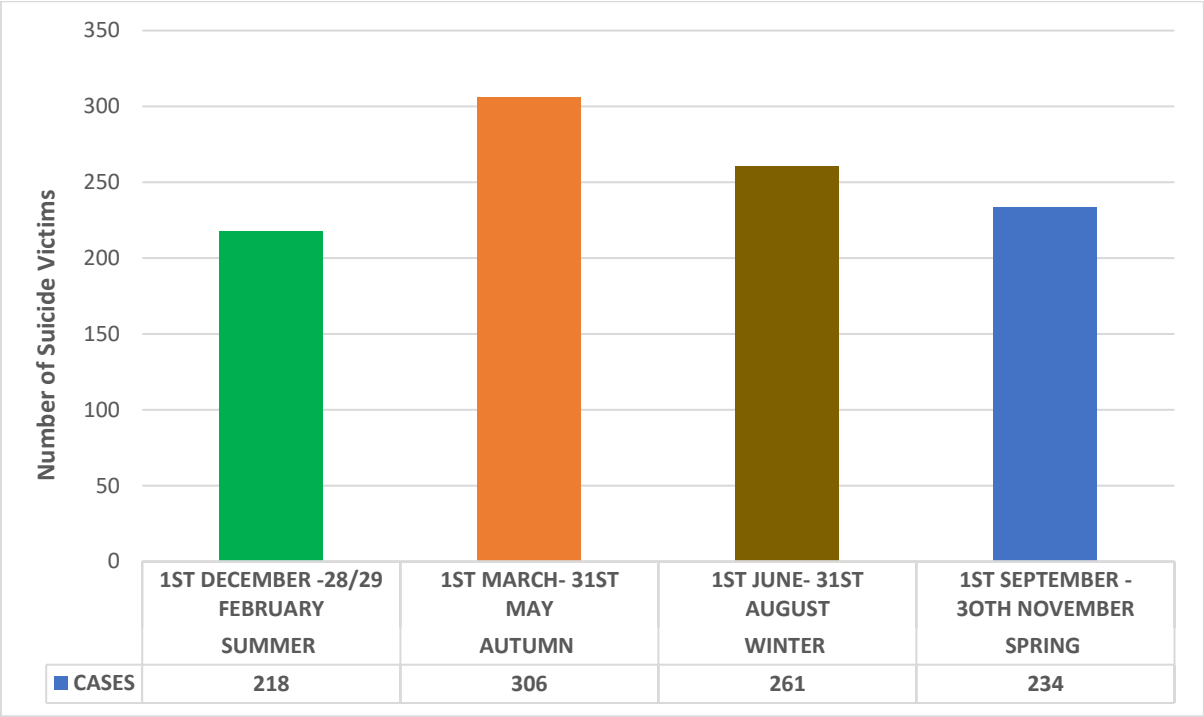


FIGURE 4.8: Highest and Lowest Seasonal Months for the period of 2012-2016

Yearly trends for Temporal and Seasonal patterns resulted in 2013 being the most prominent year, with (26%) of cases when all five years were combined followed by 2012 with (24%) of suicide cases. Trends over time showed inconsistencies with some years decreasing in cases and other years showing figures of slight increases. Two main peaks were recorded with one in March and one in June for all years. August seemed to depend on the year but the other two showed a consistent trend (Figure 4.9).

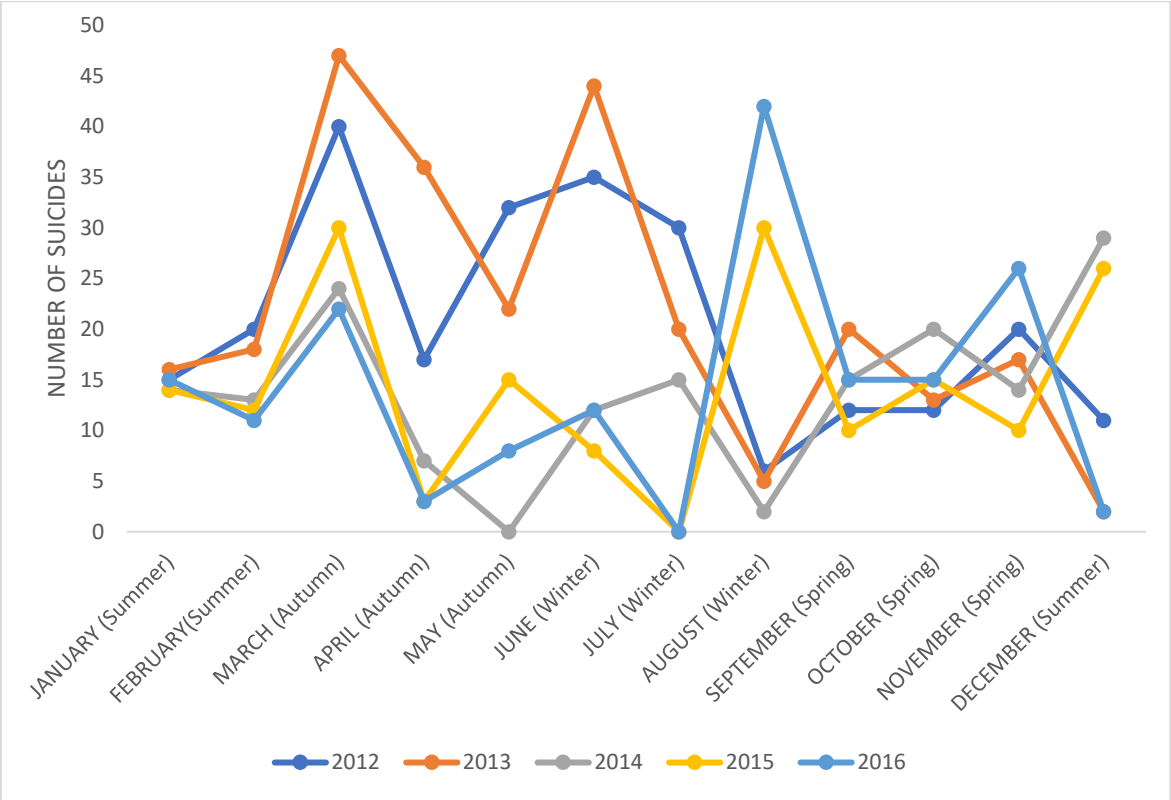


FIGURE 4.9: Yearly Trends for the Seasonal Months for the Period of 2012-2016

4.5. RELATIONSHIP BETWEEN ALCOHOL AND THE METHODS OF SUICIDE IN THE MORE VIOLENT VS LESS VIOLENT METHODS

For the 1019 cases of the 2012-2016 period, all cases had blood specimens submitted by the FPS for analysis. From the results only 909 cases had been processed for BAC and were available. A total of 596 (66%) individuals from the 'more and less violent' methods of suicide had no (negative) blood alcohol concentration (BAC) consisting of 0 g/100ML present in their systems prior to their deaths (Table 4.8). Therefore a total of 313 cases processed for BAC (34%) resulted in a positive (alcohol present) BAC, which ranges from (0,01 to > 0,45 g/100ML)

BAC results for the unavailable category for the 'more violent' methods resulted in 84 cases (8%) was undetermined for BAC results, and 30 cases (3%) in the 'less violent' methods of suicide. A total of 114 cases (11%) resulted as unavailable for BAC. (Table 4.8).

BAC for suicide victims from 2012-2016 in the 'more violent' category of suicide was found to range between 0,12-0,25g/100ML with (10%) of positive alcohol concentration present in

their systems at the time of death. The BAC range for the 'less violent' category ranged between 0,13-0,25g/100ML with (9%) tested positive for BAC prior to death.

A total of (8%) of cases for the five year period were found to range in the BAC category with 0,01-0,05g/ML and (9%) with a BAC of 0,06-0,12, for both the 'more and less violent categories of suicide. High levels of alcohol within the BAC range of 0,31-0,456 were found in (2%) of individuals having consumed large quantities of alcohol prior to their deaths (Table 4.8).

A Chi-Squared test (x^2=8,03, p=0,1555), for association showed that there was no relationship between the methods of suicide and the levels of alcohol present within this study and the use of alcohol was primarily seen as a means of encouragement to complete suicide therefore, suggesting that alcohol is not associated with the chosen method of suicide.

Table 4.8: Relationship between blood alcohol content (BAC) and the Methods of Suicide for the period of 2012-2016 (n=1019)

2012-2016 (n=1019)					
AMOUNT OF BAC (g/100ML)	**MORE VIOLENT SUICIDE RESULTS**	**%**	**LESS VIOLENT SUICIDE RESULTS**	**%**	**TOTAL**
0	544	60%	52	49%	596
0,01-0,05	71	8%	6	6%	77
0,06-0,12	78	9%	8	7%	86
0,13-0,25	93	10%	9	8%	102
0,26-0,30	27	3%	0	<1%	27
0,31-0,45	15	2%	2	2%	17
>,0,45	0	0%	0	<1%	0
***UNAVAILABLE**	84	9%	30	28%	114
TOTAL	912	100%	107	100%	1019

***** Unavailable = specimen of BAC were not made available for data capturing

4.6. BODY RECOVERY LOCATIONS AND DEMOGRAPHIC (SEX, RACE, AGE) OF SUSPECTED SUICIDE CASES

4.6.1 Sex

The results indicate that deceased were predominantly found 'indoors'. For the five year period, the overall total of 'indoor' incidences were 738cases (72%), and the overall total for 'outdoor' incidences accounted for 281 cases (28%) (Figure 4.10).

Within the male individuals, 'indoor' body recovery locations amounted to (70%) of cases, and for the 'outdoor' body recovery locations, males presented a higher figure overall, with (30%).

The female individuals 'indoor' body recovery locations resulted in 98 cases (89%), and the 'outdoor' body recovery locations 12 cases (11%) (Figure 4.10). There were no association between the sex of suicide victims and the location of where the suicide took place (χ^2=0.241; p=0.623).

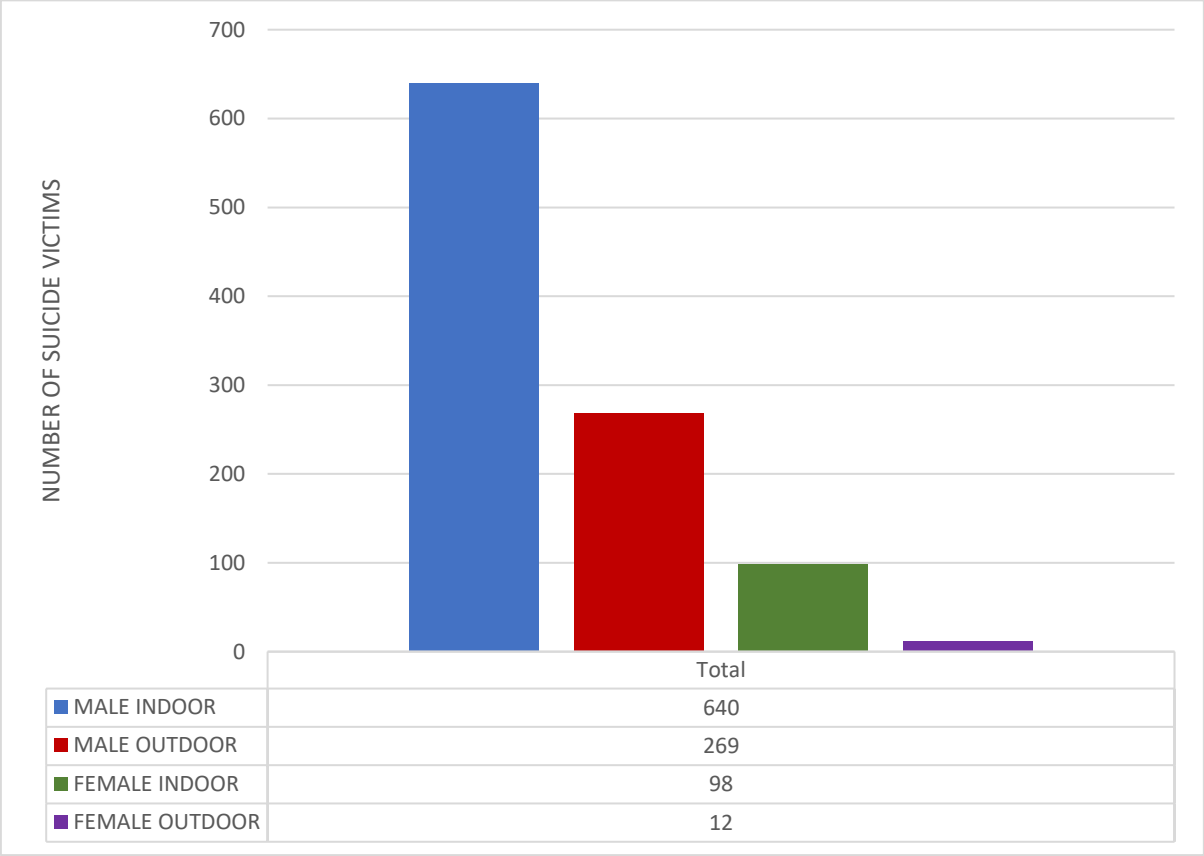


FIGURE 4.10: Body Recovery Location according to sex for the period of 2012-2016

4.6.2 Race

Race results indicated that Black/African males comprised of (48%), Coloured males (2%), Asian/Indian (10%), and White males with (40%) chose the 'indoor' body location rather than 'outdoor' which accounted for Black/Africans with (92%), Coloured (2%), Asian/Indian (2%) and White males with (4%) (Table 4.9).

Table 4.9: Body Recovery Location, method of suicide and Demographics (Sex, Race, Age) - Males for the period of 2012-2016 (n=1019)

	Self-immolation	Jump / Fall from Height	Gunshot /shooting	Hanging	Other	Chemical Ingestion	Drowning	Gassing	Overdose / Pills	Poisoning	Unknown	TOTALS
RACE/SEX INDOOR/OUTDOOR												
BLACK MALE INDOOR	0	0	5	287	0	8	0	0	2	5	0	**307**
BLACK MALE OUTDOOR	0	198	30	12	0	0	6	0	0	3	2	**251**
COLOURED MALE INDOOR	0	0	2	6	0	1	0	0	0	3	0	**12**
COLOURED MALE OUTDOOR	0	1	0	0	2	0	0	1	0	0	0	**4**
ASIAN/INDIAN MALE INDOOR	0	0	5	55	0	0	0	0	3	0	0	**63**
ASIAN/INDIAN MALE OUTDOOR	1	3	0	0	0	0	0	0	0	0	0	**4**
WHITE MALE INDOOR	0	0	42	204	0	0	0	0	5	7	0	**258**
WHITE MALE OUTDOOR	0	9	0	0	0	0	0	2	0	0	0	**11**

Black female individuals 'indoor' body location recovery accounted for (24%), Coloured (10%), Asian/Indian (6%) and White females with (60%), whereas 'outdoor' body location in Black/African females presented totals of (82%), White (18%), and Coloureds and Asian/Indian presented no cases of 'outdoor' body location (Table 4.10).

Table 4.10: Body Recovery Location, method of suicide and Demographics (Sex, Race, Age) - Females for the period of 2012-2016 (n=1019)

	Jump / Fall from Height	Gunshot /shooting	Hanging	Drowning	Gassing	Overdose / Pills	Poisoning	TOTALS
RACE/SEX INDOOR/OUTDOOR								
BLACK FEMALE INDOOR	0	0	10	0	0	11	2	**23**
BLACK FEMALE OUTDOOR	9	0	0	0	0	0	0	**9**
COLOURED FEMALE INDOOR	0	1	6	0	0	3	0	**10**
COLOURED FEMALE OUTDOOR	0	0	0	0	0	0	0	**0**
ASIAN/INDIAN FEMALE INDOOR	0	0	2	0	0	4	0	**6**
ASIAN/INDIAN FEMALE OUTDOOR	0	0	0	0	0	0	0	**0**
WHITE FEMALE INDOOR	0	2	20	0	0	37	0	**59**
WHITE FEMALE OUTDOOR	0	0	0	1	1	0	0	**2**

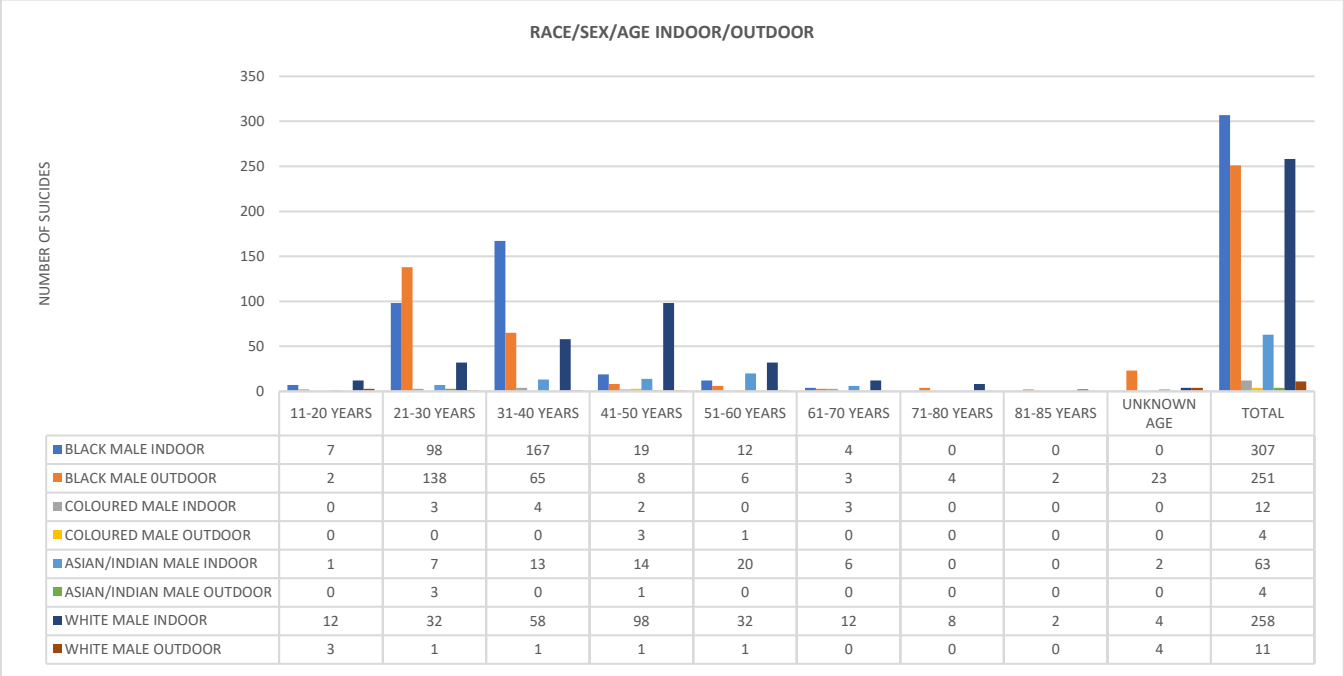
4.6.3 Age

Results for the age group reported that Black/African males aged between 31-40 years of age, preferred the 'indoor' body recovery location with (26%), followed by Black/African males aged between 21-30 years who preferred the 'outdoor' body recovery location with (36%). Twenty-three cases (9%) of unknown ages were recorded for Black/African individuals under the 'outdoor' body recovery category. (Table 4.11).

Coloured males between 31 and 40 years of age, were found most frequently in 'indoor' body recovery locations, and least in 'outdoor' body recovery location with Coloured males aged between 41-50 years . (Table 4.11).

Asian/Indian males between 51 and 60 years of age were found most frequently in 'indoor' body recovery locations , and males aged between 21 and 30 years of age were found most frequently in the 'outdoor' body recovery location. Two (1%) unknown age cases for the 'indoor' body recovery location were recorded (Table 4.11).

White males between 41and 50 years of age were found most frequently in 'indoor' body recovery locations, followed 'outdoor' body recovery locations aged between 11 and 20 years of age. four (1%) unknown ages in both 'indoor and outdoor' body recovery locations recorded (Table 4.11).



	11-20 YEARS	21-30 YEARS	31-40 YEARS	41-50 YEARS	51-60 YEARS	61-70 YEARS	71-80 YEARS	81-85 YEARS	UNKNOWN AGE	TOTAL
BLACK MALE INDOOR	7	98	167	19	12	4	0	0	0	307
BLACK MALE 0UTDOOR	2	138	65	8	6	3	4	2	23	251
COLOURED MALE INDOOR	0	3	4	2	0	3	0	0	0	12
COLOURED MALE OUTDOOR	0	0	0	3	1	0	0	0	0	4
ASIAN/INDIAN MALE INDOOR	1	7	13	14	20	6	0	0	2	63
ASIAN/INDIAN MALE OUTDOOR	0	3	0	1	0	0	0	0	0	4
WHITE MALE INDOOR	12	32	58	98	32	12	8	2	4	258
WHITE MALE OUTDOOR	3	1	1	1	1	0	0	0	4	11

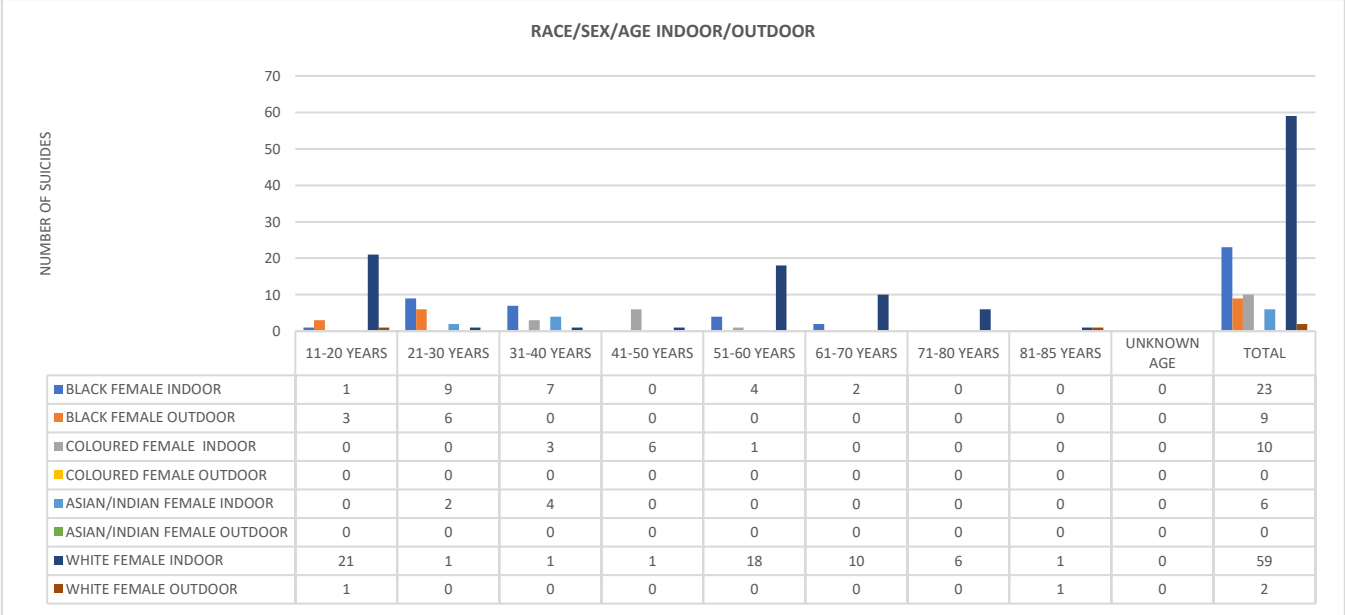
FIGURE 4.11: Body Recovery Location for indoor /outdoor and Demographics (Sex, Race, Age) (Males) for the period of 2012-2016

Black/African females between 21 and 30 years of age were found most frequently in 'indoor' body recovery locations with (10%), followed by (54%) recorded for the 'outdoor' body recovery locations were aged between 21and 30 years of age. (Figure 4.12).

Coloured females between 41 and 50 years of age were found most frequently in 'indoor' body recovery locations. No cases for 'outdoor' body recovery locations recorded. (Figure 4.12).

Asian/Indian females between 31 and 40 years of age were found most frequently in ‘indoor’ body recovery locations. No cases for ‘outdoor’ body recovery locations were recorded. (Figure 4.12).

White females between 11 and 20 years of age were found most frequently in ‘indoor’ body recovery locations, followed by the 11-20 and 81-85 year age group for the ‘outdoor’ body recovery location. (Figure 4.12).



	11-20 YEARS	21-30 YEARS	31-40 YEARS	41-50 YEARS	51-60 YEARS	61-70 YEARS	71-80 YEARS	81-85 YEARS	UNKNOWN AGE	TOTAL
BLACK FEMALE INDOOR	1	9	7	0	4	2	0	0	0	23
BLACK FEMALE OUTDOOR	3	6	0	0	0	0	0	0	0	9
COLOURED FEMALE INDOOR	0	0	3	6	1	0	0	0	0	10
COLOURED FEMALE OUTDOOR	0	0	0	0	0	0	0	0	0	0
ASIAN/INDIAN FEMALE INDOOR	0	2	4	0	0	0	0	0	0	6
ASIAN/INDIAN FEMALE OUTDOOR	0	0	0	0	0	0	0	0	0	0
WHITE FEMALE INDOOR	21	1	1	1	18	10	6	1	0	59
WHITE FEMALE OUTDOOR	1	0	0	0	0	0	0	1	0	2

FIGURE 4.12: Body Recovery Locations for indoor/outdoor and Demographic (Sex, Race, Age) (Females) for the period of 2012-2016

CHAPTER 5

DISCUSSION

The following section will consider the trends noted in the results section and will discuss these results in terms of the available literature.

5.1. INCIDENCES OF SUICIDE

Suicide cases for the period of 2012-2016 were found to comprise 9% of all unnatural deaths admitted to JHB FPS for the greater Johannesburg Metropolitan (n=11,322). Another study conducted by Burrows *et al.*, (2004) reported that South Africa has a high prevalence of suicide cases with suicide accounting for 9,4% of deaths recorded by the South African Depression and Anxiety Group, (2015) in the year 2000. The study conducted by Burrows *et al.*, (2004) consisted on 15 large South African mortuaries. A retrospective review of all possible and probable cases were referred to the Medico-Legal Laboratory of Pretoria for the period of 1997 to the year 2000. Results showed that suicides represented 9,74% of all suicide cases, which amounted to 25 per 100,000 of the population. Results from the current study shows consistency with the results provided by Burrows *et al.*, (2004).

Suicide is a global phenomenon with the WHO, (2018) reporting that 79% of global suicides occurred in low and middle income countries in 2016, therefore global statistics reported that suicides accounted for only 1,4% of unnatural deaths worldwide, making it the 18th leading cause of death in 2016 (WHO, 2018). It is therefore suggested that suicides conducted by the researcher from the year 2012-2016 at the JHB FPS were substantially higher than the global reported statistics at the time. However, a recent study conducted in the USA by the Centre for Health Statistics (NCHS, 2018) reported that there were 48,344 recorded suicides in 2015, with an increase from 42,773 in 2014. It was estimated that on average the annual USA suicide rate had increased by 24% between the year of 1999 and 2014, from 10,5% to 13% of suicides per 100,000 individuals, therefore recording the highest rate in 28 years. The USA remains one of the highest suicide countries globally, which could be attributed to its larger geographical area in comparison to South Africa.

A study conducted in Australia in 2001 reported that the overall rates of suicide remained fairly stable over the years averaging between 10 and 13 deaths per 100,000 individuals (Hassan, 1995). However the age-standardised suicide rate in 2010 increased from 10,5 deaths

per 100,000 individuals, to 14,6 per 100,000 (Australian Bureau of Statistics, 2012). Page, Taylor, and Martin, (2010), states that the increase in suicide rates were predominantly found within the male population aged between early 30's to mid 40's (Australian Bureau of Statistics, 2012). The current study corroborates with that of Australia's study, where male suicide cases was found to be within the 31-40 year age group.

Suicide, with its premature mortality rate, remains to be one of the major causes of unnatural deaths that are managed at mortuaries worldwide. Globally suicide has been found to be the twelfth leading cause of death and still remains a public health concern as suicide rates have increased by (60%) worldwide in the last 45 years (Mashreky *et al.,* 2013). In 2013 the WHO (2010), estimated that globally, nearly one million individuals would die as a result of suicides every year – therefore emphasizing the importance of comprehending the causes behind various suicidal acts enabling an improved understanding of various serious public health and social issues (Mars *et al.,* 2014).

NIMSS, (2011) reported that in South Africa, the annual suicide rate in a population of 100,000 is 14,3, and presumably has one of the highest suicide rates in Africa – this is primarily due to regular statistical collection, reviewing and reporting of suicide cases to the WHO compared to other African countries (Mars *et al.,* 2014). Many variables must be considered when conducting research into the identification of risk factors of suicidal behaviours, which include Sex, Race, Age, socioeconomic status, environmental factors as well as the mental health status of individuals (Jones *et al.,* 2013).

A local study conducted by Naidoo and Schlebusch, (2014) analysed sociodemographic characteristics and trends relating to suicides committed in Durban South Africa during the period of 2006-2007 and found that the total number of suicides in Durban had increased by 6.68% from 2006-2007. Suicide accounted for an average of 8.8% of all unnatural deaths per year of the study (Naidoo & Schlebusch, 2014). Therefore the overall suicide rates of 14,53 for the 2006 period and an average of 15,53 for the period of 2007 per 100,000 individuals. The majority of suicides occurred in single, unemployed individuals, men and younger age groups. The largest number of suicide per year was recorded in African/Black individuals, followed by Indian/Asian, White and Coloureds (Naidoo & Schlebusch, 2014). Hanging as a method of suicide was the chosen method in the majority of deceased's. This local study corroborates with the study conducted by the researcher that Hanging was predominantly seen in majority of suicide cases. Black/African individuals were a common factor and showed the same findings

to that of the current research. The findings indicate a disturbingly high suicide rate amongst the various population in Durban. The chosen method used, may be influenced by ease of access (Naidoo & Schlebusch, 2014). From the studies above in comparison to the current study, it does not contradict the normal thinking, that suicide is global problem and the trends may worsen unless there is a swift and decisive public health response and cohesive community-based programme put into place.

5.2 DEMOGRAPHICAL INFORMATION IN SUICIDES

5.2.1 Sex

Males were found to comprise a larger proportion of suspected suicide cases (89%) than females (11%). Similar findings from a South Korean study by Cheong *et al.,* (2012) found that male suicide rates comprised a larger portion of suspected suicides, with suicide rates 33,2 per 100,000 that were double to those of females with 15,8 per 100,000 respectively.

The current study and that of Cheong *et al.*,(2012) showed similarity with males comprising the majority of suspected suicide cases. A study conducted in Cape Town, South Africa, showed similar findings in suicide rates, where men served to be the majority of the deceased (Groenewald *et al.,* 2008). This however compared to the present study showed similarity as the majority of suicides were males.

Another South African study conducted in Pretoria, South Africa, by Blumenthal *et al.*,(2007), reported that males committed suicide more often than females. Over their four year study (2007-2010), they reported that from 9,379 cases that were admitted to the Pretoria Medico Legal Laboratory for investigation, 957 cases for male individuals (10.2%) were due to suicide.

In Blumenthal, (2007), from a total of 957 suicides autopsied in Pretoria between 2007 and 2010, 731 (76.4%) were males and 226 (23,6%) were female. Thus males were three times more likely to successfully commit suicide. This study shows similarities with the current study conducted at the Johannesburg Medico Legal Laboratory with figures covered herein, 1019 cases of suicide was reported, with males comprising the majority with 909 cases (89%) and females 110 (11%).

5.2.2 Race

In the present study the racial distribution was mostly Black/African (58%), followed by White individuals (32%), with Asian/ Indian (7%) and Coloured individuals (3%) comprising the smallest proportions of the sample. However in Gauteng, proportions of race groups comprises of 77,4% Black/African, 15,6% White, 3,5% Coloured and 2,9% Asian/Indian. There were no similarities noted between the present study and the proportion of Gauteng, and the only similarity was noted between the Coloured individuals.

Past studies in South Africa shows that the amount of suicide victims in a particular race group differs in different parts of the country. A study conducted in Durban South Africa on suicides reported that the proportions for race groups comprised of 58% Black/African, 27% Asian/Indian, 13% White and 2% were Coloured (Naidoo & Schlebusch, 2014). KwaZulu-Natal, proportions of race groups comprises of 86,8% Black/African, 4,2% White, 1,4 % Coloured and 7,4% Indian/Asian, and therefore no similarities between the study conducted in Durban and the KwaZulu-Natal proportions were noted, and the only similarity were between the Coloured individuals.

Even though the findings reported from Naidoo and Schlebusch (2014) showed significant differences with the present study, Black/African and Coloured individuals showed similarity in the national racial demographics between provinces. The research reported that within the Durban area, the Asian/Indian race group accounted for 27 %, compared to the present study where this race group only contributed to 7% of suicides. This could be attributed to the race demographic within the Durban area comprising of more Asian/Indian individuals living within the area.

It is evident that within South Africa, Black/African individuals accounted for the majority of the race distribution in suicides combined (Naidoo & Schlebusch, 2014). According to Naidoo and Schlebusch (2014) a possible reasons indicating this is attributed to cultural differences and beliefs, and some racial groups are driven by racial norms, pressures and expectations, factors such as individuals unable to reach their target goals, poverty and poor living conditions, therefore wanting to find escape from not meeting demands which may contribute to the completion of suicide (Naidoo & Schlebusch, 2014; SADAG, 2015).

5.2.3 Age

In 2011 a study conducted in Gauteng, South Africa, reported that the age group with the most suicides was the 31-40 year age group, with a secondary peak of suicide deaths occurring after the age of 60 (NIMSS, 2011). The current research reflected a similar pattern, with the majority of cases in the 31-40 year age group, however a second peak occurred during the 21-30 year age group, and not after 60 years of age as indicated in NIMSS (2011).

According to Naidoo and Schlebusch (2014) suicides, in general, were predominantly increasing within the younger population, and an increased frequency amongst younger individuals, in their twenties were more likely to complete suicide, compared to the older population, where unsuccessful attempts were more commonly seen. The present study found that that the younger individuals aged between 11-39 years were more likely to commit suicide in comparison to the older age groups of 50 years and over, and therefore share similarities with the study conducted by Naidoo and Schlebusch (2014). Another study conducted by Burrows (2004), and Schlebusch (2008) found that the incidence of youth suicidal behaviour in South Africa was largely underreported, especially within the rural areas. A review of the National Injury Mortality Surveillance System, 2011 (NIMSS) data over an eight year period resulted that suicide deaths were the highest amongst the 15-29 year-old groups and suicide deaths in those younger than 21 years of age constituted approximately 8% of all suicides in South Africa (NIMSS, 2011). These findings share similarities with the present study conducted.

The present study however, did not evaluate attempted suicides but only completed suicides. A recent study conducted by Burrows *et al.,* (2004) in South Africa found that younger suicide victims had a propensity to engage in dysfunctional behaviours because of the graphic exposure of information which glamorises suicides on social media.

5.3 METHODS OF SUICIDE IN SPECIFIC DEMOGRAPHICS

The method of choice for suicides is based on a few factors namely: availability of means, cultural, psychological and symbolic functions of suicide and lastly the individual's demographic characteristics such as age, sex, and race (Massaro, 2015). In this research, the most prevalent method of suicide was Hanging (59%) followed by Fall From Height (22%) and self-inflicted Gunshot (9%) while the least common was Self-immolation (with one incident). Sukhai *et al.,* (2002) conducted a five-year study (1996-2000) on Self-immolation in Durban South Africa, and reported that from 12,339 non-natural deaths, 696 (5,6%) were suicides. Self-immolation accounted for 69 (<1%) of all non-natural deaths and 69 (9,9%) of all suicides. The

present study in accordance with the study conducted by Sukhai *et al.,* (2002) showed that Self-immolation was the least frequently used method of suicide.

The present study agreed with the findings by a local study conducted by Naidoo and Schlebusch (2014), which found that Hanging was the dominant method of suicide deceased's across all racial groups for both sexes. Prior research has suggested that Hanging is frequently utilised as a method because it is rapid and there is little damage to the body without leaving harrowing images for others (Biddle *et al.,* 2010; Naidoo & Schlebusch, 2014). Materials (ligatures) were easily accessed without the need for planning or technical knowledge. Hanging according to Biddle *et al.,* (2010) was seen as the 'quickest' and easiest method with very few barriers to completion.

The most prominent age group for both male and females fell into the 31-40 year group with 323 cases (32%) combined, and possible risk factors associated for this age group would be due to a lack of appropriate coping mechanisms, engaging in risky behaviours such as the consumption of alcohol and drugs. Unemployment, poverty, mental illnesses and other environmental factors are possible pointers related to the 31- 40 year age group, Black/African individuals accounted for the majority of Hangings with 309 cases (51%), followed by White individuals with 224 cases (34%). According to statistics documented by NIMSS, (2011) in South Africa, it was reported that Hanging as a method was considered to be the most frequently used method (52,9%), therefore was consistent with the current study.

International studies showed similar findings within the Eastern European countries such as Estonia, Latvia, Poland and Romania where it was noted that Hanging was the predominant method of suicide (World Health Organization Mortality Database, 2001). Similar findings mentioned from the International studies above, as well as International studies conducted by Jones *et al.,* (2013), found that hanging deaths were a more common method of suicide within the male population whereas the female population tended to commit suicide by less violent methods such as poisoning and overdosing. The results of the present study were consistent with the findings presented by the World Health Organization Mortality Database, (2001), and findings presented by Jones e*t al.* (2013), that males preferred to use 'more-violent' methods than less violent methods.

In the United States of America for example, it was found that the frequently used method of suicide was a firearm, and this was due to the availability and accessibility of firearms owned by individuals (Bridge & Brent, 2003).

Poisoning by drugs was commonly used by the Nordic People, with similar reports of suicide were seen in the United Kingdom. Jump from Heights within small urban societies in Hong Kong, Malta and Luxemburg, was found to be the frequently used method (Gross & Piper, 2007). According to the WHO, (2010), suicide rates in South Korea is the 10th highest in the world. One factor in its high suicide rate is suicides by poisoning among the elderly between 60-70 years of age. Traditionally, children have been expected to care for their aging parents; however, because this practice has mostly disappeared in the 21st Century many older adults commit suicide, so they do not feel like they are a financial burden on their families (WHO, 2010). Pesticides poisoning in the South of Korea, amongst the elderly is commonly used for the completion of suicide, due to its easy access and availability (WHO, 2001). Due to the fact that the elderly population is the fastest growing segment of the population, the number of elderly individuals committing suicide is steadily increasing (SADAG, 2015). Sadly, suicide rates are generally higher after the age of 65 than at any other time in their life course (Naidoo & Schlebusch, 2014). Factors such as declining health, being reliant and dependent on their children, loneliness, bereft of a spouse places great emphasis on the fact that they elderly feel that they are a burden on their families (Naidoo & Schlebusch, 2014).

The present study agreed with the findings conducted by Naidoo & Schlebusch, (2014), in relation to the South Korean study, that overdose/pills and poisoning were the frequently used method of suicide, and this could be due to the availability of chronic medication that they are taking, which is available for the purpose of committing suicide. Poisons such as Aldicarb (street name Two- Step) and rat poisons, ingestion of house hold chemicals could also be used for the purpose of suicide (Naidoo & Schlebusch, 2014).

Women choosing less violent methods of suicide have a higher incidence of failed suicide attempts as compared to men, due to emergency medical intervention (Massaro, 2015). Studies in India, China and Sri Lanka show the same suicide issue with pesticide poisoning, but indicate other problems such as poor access to medical facilities and ineffective treatment that increases suicide rates (Mars *et al.,* 2014). According to the WHO (2001), suicide by pesticide poisoning, has become more common on a global scale and therefore requires more research for possible banning and regulation of pesticides used (Mars *et al.,* 2014).

According to a study conducted in Italy, the main method of suicide recorded were the use of firearms, Falling/Jumping from Height, Hanging, Drowning, Gassing and Overdose (Massaro, 2015). The more violent-like deaths such as Shooting or Hanging, are attributed to males (Massaro, 2015). In accordance with the present study, Hanging as a suicide method showed prevalence with (66%), and agrees with the international studies that hanging was the frequently used method of suicide. Hanging deaths are also more common methods of suicide within male individuals and the understanding of why males use more violent methods of suicide could be attributed to the levels of lethality (Massaro, 2015).

The rationale behind suicides was rather complex, however it was evident that psychopathologies and personality factors associated with suicide, such as depression, alcohol use and abuse, and other factors in relation to the Models of Suicide shared a link. Sex, Race and Age, and the way in which individuals engage in destructive behaviour which leads to a completed suicide, all fall under the Models of Suicide.

According to Hick and Hinck, (2008); Klonsky *et al.*, (2011); Sher and Stanley, (2009); Stichweh, (2011), the Affect Regulation Model, Anti-Dissociation Model, Anti-Suicide Model, Interpersonal Influence Model, Self-punishment Model, Biological Model, and Systems Theory and Suicidal Behaviour refers to ineffective coping mechanisms, trauma, poverty, unemployment, alcohol use and abuse, ineffective goal attainment which is the use of internal thought process and future goals.

One cannot say for certain which Age group, Race and Sex fall under each Model of Suicide, but viewing them as a whole, where the Models of Suicide correlates to the psychopathologies of each individual that completed suicide. The current study reported that 313 cases (34%) had alcohol present in their bodies prior to their deaths, therefore according to the Affects Regulation Model, Interpersonal Influence Model and Self-punishment Model in relation to the psychopathologies , these individuals lacked the coping mechanisms needed to prevent a fatal outcome. Even though data was not collected to ascertain whether each deceased had an associated mental pathology, the Models of suicide and the understanding of psychopathologies are linked to the Models of Suicide as pre-disposing factors such as abuse, neglect, substance use, interpersonal relationship problems, peer pressure and dysfunctional family dynamics could be contributing factors, and could have been present at the time.

5.4. TEMPORAL AND SEASONAL CHANGES AND THE PATTERNS ASSOCIATED WITH SUICIDE

According to the findings from the current research March was found to be the most prominent month for the entire five-year study, with an overall total of 163 cases (16%) recorded. There was inconsistency through the years of 2013-2016 where an increase, in suicides in 2013 and a sharp decrease in suicides for 2014, followed by an increase of eight cases in 2015, and a decline in 2016 with two cases reported. The month of June showed prominence for the first two years of 2012-2013 with a drastic decline in suicides for the period of 2014- 2016.

The month of July reported as the lowest with an overall total of 57 cases (6%), followed by the months of April and November sharing the same figure of 64 cases (7%) reported. Trends overall for the months of the year showed that there were two main peaks: one in March and June for all years. August however seemed to depend on the year, and the other two showed a consistent trend.

Findings from the current study do not share similarities from the research conducted by Flisher and Parry *et al.,* (1997) and Christodoulou *et al.,* (2011), who reported that the high rise in suicide rates in South Africa within the seasonal variations in suicide was predominantly seen during the Spring season and the secondary rise was during the Autumn season. Therefore no similarities with the current study which reported that for the five year period Autumn was the most prominent season, followed by Winter, and Spring, and not as suggested by Flisher and Parry *et al.,* (1997), Christodoulou *et al.,* (2011), that Spring was the frequently used season.

However, the current study's findings were similar to that conducted by Kposowa *et al.,* (2010), who conducted their study from 50 American states, indicated that the most prominent season for their study period was Winter with 10% of cases. The current study reported that 111 cases (11%) of suicides in June (Winter) showed similar findings with that of Kposowa & D'Auria, (2010).

The current study also agrees with the study conducted by Kposowa and D'Auria, (2010) that there was no real valid association overall between seasonal and temporal variations and suicide, due to the inconsistency through the years of 2013-2016, where trends overall for the months of the year were erratic. And therefore no conclusive evidence indicated that seasons and the month of the year were a definite factor in suicide.

However it could be suggested that contributing factors such as Seasonal Affective Disorder could rather be the missing link to why individuals commit suicide during certain Seasons (Cotterell, 2010). Findings from Cotterell (2010) and Kposowa and D'Auria,(2012) share similar findings from the results found in the current study. Cotterell , (2010) found that the Autumn and Winter months had higher numbers, and this was suggested that Seasonal Affective Disorder could be the missing link, and according to Cotterell, (2010) Seasonal Affective Disorder typically begins around the Autumn season and continue into the winter months, as findings from the current researcher showed these trends.

5.5. BLOOD ALCOHOL CONTENT AND ITS RELATIONSHIP TO THE METHOD OF SUICIDE

The researcher of this study reported that there was no direct association between individuals who consumed alcohol prior to their deaths and those who had no alcohol present in their bodies, did not impact the method of suicide used. Pompili *et al.,* (2010) however postulated that alcohol has a propensity to increase impulsivity and decrease one's inhibition. Therefore with increasing consumption levels of alcohol, it highlights that alcohol is a contributory factor for committing suicide and has the tendency to increase negative self-esteem, impulsiveness and suicidal thoughts, and may set into action and inhibit one's ability to reason and function. In a United States of America (USA) study, alcohol consumption was identified in (36%) of males and (28%) of female suicide victims indicating that (64%) in total had the presence of alcohol prior to death (Jones *et al.,* 2013). In contradiction to the USA study, the current study reported a total of (66%), individuals from the 'more and less violent' category of suicide had no (negative) blood alcohol concentration (BAC) present in their systems prior to their deaths (Table 4.8). Therefore a total (34%) resulted in a positive (had consumed alcohol) BAC. However, negative BAC results, indicate that alcohol is not needed to fulfil the execution of a completed suicide, as results from the current study resulted as only 2% were found to have high concentrations of alcohol present in their bodies prior to their time of death (0.31-0.45g/100ML). This however, cannot be ignored that alcohol may be a contributing factor in decreasing one's inhibition, and the association between alcohol and suicide still remains questionable and therefore does contradict to the normal thinking that alcohol is needed in order to complete suicide. However, Pompili *et al.,* (2010) states that alcohol increases impulsiveness, suicidal thoughts, which could be brought about the courage to commit suicide.

5.6. BODY RECOVERY LOCATION AND THE DEMOGRAPHIC (SEX, RACE, AGE) OF SUSPECTED SUICIDE CASES

The results of the current study indicated that suicide victims were predominantly found indoors, with males tending to use Hanging as the most frequently chosen method of suicide. In outdoor areas Jump/Fall From Heights was the most frequently used method with males comprising the majority.

Females were found to have similar results to males with suicides mainly occurring indoors, however Overdoses were the most frequently used method indoors, followed by Hanging. Outdoor areas, in the female sample resulted with Jump/Fall From Heights as the frequently used method. Townsend *et al.,* (2005) postulated the reason for an outdoor location, would be the convenience of the method used. With respect to race it was found that that Black/African, White and Asian/Indian male individuals preferred the 'indoor' location with Hanging as the preferred method, and comprised of the majority.

In the current study it was found that all race groups in the female sample had opted for the indoor location with Overdose being the preferred method, followed by Hanging. The outdoor location for the Black/African female sample, was the only race group which opted for Jump/Fall From Heights with nine cases recorded. According Townsend *et al.,* (2005) the reason for an 'indoor' location would be for the late discovery of finding the body, and 'outdoor' for the purpose of convenience.

In all race groups it was evident that the age group with the greatest prevalence was the 31-40 years age group, with indoors as a preferred body recovery location followed by the 21-30 year age group, also preferring the indoor body recovery location. The least age group for the body recovery location was amongst the 81-85 year olds, with 6 cases recorded. There were a total of 33 unknown ages recorded, and this could be due to undocumented illegal immigrants, homeless individuals or members of the South African Police Service not filling out the SAPS 180, as well as death scene forms correctly leaving out some important information surrounding the age of the individual.

5.7 CONCLUSION

Suicide is considered a very controversial topic in society and frowned upon by most who do not understand why individuals contemplate taking their own lives. It is evident that suicides are present, and received at the Johannesburg Forensic Pathology Medico Legal Laboratory. This study identified which individuals completed suicide, and were at risk, thus it can be used to help develop targeted, preventative measures for vulnerable groups. Findings of this research concluded that the majority of suicide were found to be males. Age affected the nature of the suicide because deceased's who chose a more violent method of suicide (Hanging, Shooting/gunshot) were within the 31- 40 year age group. The less violent method (Overdose/Poisoning/Gassing/Drowning) shared the same age group.

Race showed a definitive relationship, and Black/African individuals made up the larger proportion of the sample with Hanging as the dominant method of suicide used by the majority mainly because of its simplicity and proven effectiveness. There was also an association between sex and the method of suicide, 'more violent method' vs 'less violent method', where males showed preference for the 'more violent' methods whereas females preferred the 'less violent' methods of suicide. Alcohol did not play a significant role in suicides and 66% of the victims showed negative BAC results, although research remains to highlight alcohol as a suicidal risk.

Seasonal and Temporal factors and trends in relation to the months of the year and Race/Sex showed no real significant association, and in terms of year consistency as the general trends showed inconsistency with increases and decreases throughout the results. It was suggested that perhaps the contributing factors were related to Seasonal Affective Disorder, and perhaps the missing link as to why individuals had completed suicide during certain months and seasons of the year. However, it was reported that there were two main peaks shown in the month of March and June for all years combined, and the month of August depended on the year, which recorded a significant increase from the year 2015-2016 in comparison to 2012-2014. Therefore March and June showed a consistent trend throughout the years.

Irrespective of Race, Sex, Age, the findings of this research concluded that the deceased preferred to commit suicide 'indoors' rather than 'outdoors', with Hanging as the predominant method used in males. Females shared similarities where the 'indoor' location was favoured with Overdose being the preferred method of suicide. It may be suggested that the choice of an 'indoor location could be to the delayed recovery and discovery of the body.

CHAPTER 6
LIMITATIONS AND FUTURE RECOMMENDATIONS

The following section will consider the limitations of the study and future recommendations. The limitations experienced with this research will be discussed and the impact of the limitations will be considered. Future recommendations will be highlighted as an important factor, and how this research could help improve the collection of Suicide related statistics within the division of the JHB FPS MLL services.

6.1 LIMITATIONS

During the data collection this study was mainly limited by the manual filing system of the case files as well as missing case files which could not be located. These cases may still be under investigation, have inconclusive findings, or there could have been problems with the manual filing systems. Some case files were misplaced by the JHB FPS MLL service due to various officials having access to files, which affected access by the researcher, resulting in delays with regards to the collection of important data relating to the cause of death and other specific post mortem reports. Another limitation incurred were cases which could have been suicides but were excluded due to the exclusion criteria, by targeting different words in the data mining process (retrieved from the death register) research could miss certain cases that were potentially cases of suicide, therefore any error made in the 'death register' will be carried over into the present study.

6.1.2 Future Recommendations

Suicides in general are particularly problematic and further understanding regarding the motivations and risk factors contributing to the termination of one's life is necessary for the development of prevention programs. It is also hoped by the researcher that this research can be circulated to other researchers conducting similar studies as well as those within the medical field to increase their knowledge and understanding of risk factors and their potential link to suicide. For research purposes highlighting that SAPS needs to complete the SAPS 180 more efficiently for noting when suicides were suspected so that we may analyse these results and create prevalence statistics for suicides in the South African context, thereby indicating whether suicides were more common within South Africa than previously thought.

This will also provide an indication as to how many of these individuals engage in self-destructive behaviours leading to a completed suicide, as well as the demographics of those individuals indicating which group (Sex, Age, Race) are at a greater risk. This will inevitably improve the efficacy of determining whether each case was in-fact suicidal in nature. As seen in the results of this research, the study comprised mostly of male suicides. It is of importance to implement preventative measures targeting males specifically within the urban-rural areas. Men have a unique way of responding to events and situations in their lives, and appropriate interventions need to be considered between how men deal with life situations, anger, stress and undertaking impulsive risky behaviours, and their ways of expressing these.

The focus of suicide preventative measures will focus on the strengths that men bring to any stressful situation and supporting them to understand their responses to stressful situations and manage them safely such as:

- Creating environments which encourage men to openly talk about their stressors, by talking to a friend, family member and informal groups such as support groups for men.
- Supporting the development of life skills such as problem solving, anger management and coping skill to build resilience through psycho-education programs which will effectively deal with life stressors.
- Creating support groups and networks within rural and urban communities and having access to services for men at risk for suicide through counsellors providing training and resources at no cost.

With many risk factors preceding suicide, ranging from their own personal afflictions such as depression, mental illnesses, alcohol and substance abuse, unemployment and other environmental factors, with adequate preventative programmes as well as commitment from health care professionals is within reach to reduce the rates in suicides. This recommendation could prove positive if all health care practitioners engage in Psycho-education training.

Future recommendations for this study would also be to investigate the reasons into manual filing systems, where data should be automated in order to know where files are to be located, this will reduce the amount of paperwork involved, and less chances of files being mismanaged and lost.

Members of the South African Police Service need to be further educated in the filling out of SAPS 180, as well as death scene forms, as certain information is incorrectly written, leaving some of the important information surrounding the death of the individual unknown

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Appendix 1

G.P.-S 002-0097

SAPD 180
SAPS

SUID-AFRIKAANSE POLISIEDIENS — SOUTH AFRICAN POLICE SERVICE

POLISIERAPPORT WAT LYK NA LYKSHUIS VERGESEL
POLICE REPORT ACCOMPANYING BODY TO MORTUARY

1/2

SAPD 13 No. ..... Lyk No. .....
SAPS 13 No. ..... Body No. .....

Naam van lid/persoon van wie lyk ontvang word
Name of member/person from whom body is received .....

Nommer, rang en naam van lid wat lyk ontvang
Number, rank and name of member receiving body .....

.....

Volle naam en adres van oorledene
Full names and address of deceased .....

.....

Merk toepaslike blok met X / Mark applicable square with X:

ID No. .....

Wit White	Swart Black	Bruin Brown	Asiër Asian	Manlik Male	Vroulik Female

In lewe bekend as (volle name)
Known as (full names) .....

Ouderdom ..... Huwelikstatus ..... Land gebore .....
Age ..... Marital status ..... Land born .....

BESONDERHEDE VAN STERFGEVAL • PARTICULARS OF DEATH

Datum en tyd van dood ..... Plek van dood .....
Date and time of death ..... Place of death .....

Merk toepaslike blok met X / Mark applicable square with X:

Motorbotsing Motor accident	Bestuurder Driver	Passasier Passenger	Voetganger Pedestrian	Fietsryer Cyclist	Motorfietsryer Motorcyclist

Selfmoord Suicide	Vuurwapen Firearm	Opgehang Hanging	Pille Pills	Vergas Gassed	Van gebou afgespring Jumped from building	Ander Other

Ander Other	Van gebou geval Fell from building	Met vuurwapen gedood Killed with firearm	Met mes/voorwerp gesteek Stabbed with knife/object	Vergiftig Poisoned

Sterf onder narkose Died under anaesthetic	Skielike dood sonder mediese geskiedenis Sudden death without medical history	Sterf in aanhouding Died in custody

Volledige geskiedenis
Full history .....

G.P AlOO2-0091

SAPO 180

SAPS

SUID-AFRIKAANSE POLISIEOOENS • SOUTH AFRICAN POLICE SERVICE

POLISIERAPPORT WAT LYK NA LYKSHUIS VERGESEL POLICE REPORT ACCOMPANYING BODY TO MORTUARY

112

SAPO 13 No. Lyk No.
SAPS 13 No..... Body No.....

Naam van lid/persoon van wie lyk ontvang word
Name of member/person from whom body is received .....

Nommer, rang en naam van lid wat lyk ontvang
Number, rank and name of member receiving body.....

Volle naam en adres van oortedene
Full names and address of deceased.....

10 No.

In lewe bekend as (volle name) Known as (full names) .....

Wit White

Swart Bruin Ash3r Manlik Vroulik Black Brown Asian Male Female

Merk toepasllke blok met X / Mark applicable square with X:

Land gebore
Age..... Maritial status..... Land born .....

BESONDERHEDE VAN STERFGEVAL • PARTICULARS OF DEATH Datum en tyd van doad
Plek van doad

Date and time 01 death ..... Place of death ..... Merk toepaslike blok met X / Mark applicable square with X:

Ouderdom Huwelikstatus

Motorbotsing Motor accident

Selfmoord Suicide

Ander Other

Bestuurder Passasier

Voetganger Pedestrian

Vergas Gassed

Fietsryer Motor!ietsryer Cyclist Motorcyclist

Ster! onder narkose Died under anaesthetic

VoJledige geskiedenis Full history.....

Skielike dood sander mediese geskiedenis
Sudden death without medical history

Driver

Vuurwapen Firearm

Van gebou geval Felilrom building

Passenger

Opgehang Pille Hanging Pills

Van gebou afgespring Jumped from building

Ander Other

Vergiftig Poisened

Met vuurwapen gedood Killed with firearm

Met *mes/voorwerp* gesteek Slabbed with knife/object

Ster! in aanhouding Died in custody

Appendix 2

EXCEL SPREADSHEET EXAMPLE

Case number	Sex	Race	Age	Time of death	Date of death	Month and Season of the year	Manner of death	Location	Alcohol Drugs	Suicide notes	Type of ligatures	Other

Appendix 3

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R14/49 Lorena Carelle

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M180122

NAME: (Principal Investigator)	Lorena Carelle
DEPARTMENT:	Forensic Medicine and Pathology Johannesburg Forensic Pathology Service Medico-Legal Laboratory
PROJECT TITLE:	A Retrospective Analysis of Suspected Suicide and their Associated Link to Victim Profiles
DATE CONSIDERED:	26/01/2018
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Prof G. Labuschagne and L. Hill
APPROVED BY:	Professor CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	31/01/2018

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in January and will therefore be due in the month of January each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 4

Table A.1: Temporal and Seasonal patterns according to the months of the year in relation to Sex and Race

2012-2016 (n=1019)	SEX/RACE AND MONTH OF THE YEAR								
MONTHS	**BLACK/ AFRICAN MALE**	**COLOURED MALE**	**ASIAN/ INDIAN MALE**	**WHITE MALE**	**BLACK/ AFRICAN FEMALE**	**COLOURED FEMALE**	**ASIAN/INDIAN FEMALE**	**WHITE FEMALE**	**TOTAL**
JANUARY (Summer)	32	2	9	16	5	1	2	7	**74**
FEBRUARY (Summer)	32	1	10	26	3	0	0	2	**74**
MARCH (Autumn)	62	5	17	52	8	3	1	15	**163**
APRIL (Autumn)	42	0	2	22	0	0	0	0	**66**
MAY (Autumn)	38	0	3	26	3	0	0	7	**77**
JUNE (Winter)	49	4	9	32	5	2	2	8	**111**
JULY (Winter)	42	0	2	20	0	0	0	1	**65**
AUGUST (Winter)	39	2	4	27	4	1	0	8	**85**
SEPTEMBER (Spring)	59	0	1	11	0	0	0	1	**72**
OCTOBER (Spring)	57	0	2	14	0	1	0	1	**75**
NOVEMBER (Spring)	50	2	6	18	2	2	1	6	**87**
DECEMBER (Summer)	56	0	2	5	2	0	0	5	**70**
TOTAL	**558**	**16**	**67**	**269**	**32**	**10**	**6**	**61**	**1019**

Appendix 5

DATA SHEET FORM - POSTMORTEM OF SUICIDES

Documentation of suicides

Suicide Indicator: _____

Case Number: _____ Research number:_____

Date of Death: _____ Age at Death_____Estimated/Actual

Time of death: _____ Day of the week _____

Sex: _____ (M/F) Race: _____ (B/W/C/A)

1. Description of "circumstance" of death

☐ MVA ☐ PVA ☐ Fall

☐ Hanging ☐ Gassing ☐ Drowning/Asphyxia

☐ Poisoning/Overdose ☐ Gunshot wounds

☐ Other _____

2. Location where body was found:

_____
_____

3. Area where body was found:

_____
_____

4. Season: ☐ Spring ☐ Summer ☐ Winter ☐ Autumn
(Seasons will be defined according the South African Weather Services.