COMORBID MOOD AND SUBSTANCE USE DISORDERS IN RELATION TO YOUTH SUICIDE

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ABSTRACT

Research has found that 90% of those who complete suicide have a history of one or more psychiatric disorders. Mood disorders and substance use disorders (SUDs) are the key disorders related to suicide. This study not only replicates other data from previous research studies but examines other variables such as comorbid mood and SUDs associated with suicide, while also comparing different age ranges. We investigated three main domains. The first parallels work done by numerous groups comparing suicide completers to controls. The second, more novel approach, examined factors that differentiated those with MD/SUDs and those without it. The last approach, also unique to our study, focused on identifying factors associated with the two main age ranges (12-18 years old and 19-25 years old). Becoming aware of the increased risk of suicide completion within these domains can better prepare professionals when addressing treatment options.

RESUME

Des recherches antérieures ont trouvé que 90% des individus décédés par suicide portent un historique d'un ou plusieurs antécédents psychiatriques. Les troubles de l'humeur ainsi que des troubles de consommation sont ceux qui sont principalement associés au suicide. La présente étude confirme les résultats mentionnés ci-haut et examine de nouvelles variables telles que la comorbidité entre les deux troubles et son association au suicide à travers divers groupes d'âge. Nous avons investigués trois domaines. Le premier présente le travail de plusieurs groupes de recherche ayant comparé le profil d'individus décédés par suicide à un groupe contrôle. Le second, abordé de façon plus novatrice, examine les facteurs qui permettent de différencier les individus souffrant d'un trouble de l'humeur ou d'un trouble de consommation à ceux qui n'en souffrent pas. Le troisième domaine exploré est aussi un qui est unique à notre étude. Par ce dernier, nous visons l'identification de facteurs associés à deux groupes d'âge spécifique, soit les 12 à 18 ans et les 19 à 25 ans. La connaissance de ces facteurs de risque permettrait aux professionnels d'être mieux équipés lorsque vient le temps d'offrir des traitements.

CHAPTER 1

INTRODUCTION:

SUICIDE AND ITS ASSOCIATIONS

SUICIDE DEFINITIONS AND TERMS

Suicide is defined as taking one's own life intentionally and is one of the leading causes of death in the world (Jacobs, Baldessarini, Conwell, Fawcett, Horton, Meltzer, Pfeffer, Simon, 2003). Suicide may be described in three terms; suicide ideation (SI), suicide attempt (SA), and suicide completion (SC). SI involves thoughts of ones own death, how others will be affected by the death, and how to carryout the act. SA is the physical effort to carryout the act; however, not all of those who attempt suicide succeed. Thus, SC involves individuals who successfully take their own life. Statistics indicate that there are more SIs than SAs and more SA than SCs (Statistics Canada, 2002; Shaffer, Pfeffer, Bernet, Arnold, Beitchman, Benson, Bukstein, Kinlan, McClellan, Rue, Shaw, & Kroeger, 2000). The act itself can be broken down to 4 categories; veritable, aborted, interrupted and ambiguous. Veritable suicide is behaviour towards one self with the intention of dying. Aborted suicide is considered when an individual has carried out some steps towards veritable attempt, but does not go through with the final act on their own accord. Interrupted suicide is an attempt where the individual is in the final steps to ending their life and is thwarted be another person or circumstance. Ambiguous suicides are attempts that are probably the most frustrating to deal with. Here an individual shows overt signs of an attempt, but refuses to admit that it was an attempt.

Within the whole population, the most documented means of suicide for males as of 2004 are, starting from the most frequent: 1. hangings, strangulation, and asphyxia. 2. firearms. 3. carbon monoxide poisoning, and 4. deliberate medication overdosing (Saint-Laurent & Gagne, 2007). Women on the other hand have a similar profile but with deliberate medication overdosing being the second most prevalent.

Statistics within general population

Canada's suicide rate is ranked thirteenth in the world (Langlois & Morrison, 2002), with Quebec having the highest suicide rate in the country (Renaud, Berlim, McGirr, Tousignant, & Turecki, 2008). Almost 4.6% of North Americans have made at least one attempt in their life (Kessler, Guilherme, & Walters, 1999). Men show high risk suicide activity between 15-49 years old, while females are said to be more active between 15-34 years old, however, children as young as 11 years old have reported to commit suicide (Renaud, Berlim, McGirr, Tousignant, & Turecki, 2008). Teen suicide has increased an average of 300% from 1950 to 1990 (O'Carroll, Potter, & Mercy, 1994), but has shown a decline of 35% from 1990 to 2003 (Shain, 2007).

According to Shaffer et al. (2000) youth and adolescent suicides have common precipitating stressors such as relationship break-ups, school trouble, and family conflicts. Bundled with other factors such as genetics and psychiatric disorders (which will be discussed later on) make for a deadly combination. These young peoples inability to deal with these life stresses or perceived stresses may make them more likely to attempt suicide. In 2003 the centre for disease control (CDC) conducted mass surveys targeting high school students in the USA. Twenty-nine percent of these students reported feelings of sadness and hopelessness almost everyday for at least 2 consecutive weeks. Approximately 17% said they were thinking about attempting suicide, while 9% attempted suicide. Thus suicide is a present concern in our youth.

SUICIDE AND PSYCHOPATHOLOGY

Research has repetitively found that 90% of those who complete suicide have at least one psychiatric disorder (Barraclough, Bunch, Nelson, & Sainsbury, 1974; Brent, Perper, Mortiz, G., Allman, Friend, Roth, Schweers Balach, & Baugher, 1993; Lesage, Boyer, Grunberg, Loyer, & Chawky,1994; Shaffer, Gould, Fisher, Trautman, Moreau, Kleinman, & Flory, 1996; Cavanagh, Carson, Sharpe, & Lawrie, 2003; Séguin, Lesage, Chawky, Guy, Daigle, Girard, & Turecki, 2006; Shain, 2007; Renaud et al., 2008). Furthermore, it has been documented that treating these psychiatric disorders early may significantly decrease the likelihood of suicidal behaviour (Cavanagh et al. 2003; Isacsson, 2006). Thus, much research has investigated the early identification and treatment of such disorders.

Many factors have been noted to contribute to suicidal behaviour. Biological/genetic factors (internal traits) with a predisposition to certain psychiatric disorders compounded by external traits such as, life stressors, life events, and substance use all contribute to suicidality. A few examples of internal traits that are related to suicide are attention deficit hyperactivity disorder, borderline personality disorder, and schizophrenia. External traits range from relationship issues, socioeconomic status, alcohol abuse, and other types of negative life stressors. Two main disorders that have been given much attention due to their significant link to suicide are mood disorders and substance use disorders (SUDs) (Arsenault-Lapierre, Kim, & Turecki, 2004; Trémeau, Staner, Duval, Corrêa, Crocq, Darreye, Czobor, Dessoubrais, & Macher, 2005).

Research has also found that individuals with suicidal behaviour may come from a family that has other suicidal members (Egeland & Sussex, 1985). For

example, children whose parents suffer from depression (a known risk factor for suicide) are 3 times more likely to be depressed in their adulthood (Birmaher, Ryan, Williamson, Brent, Kaufman, Dahl, Perel, & Nelson 1996; Tremeau et al., 2005). In support, studies on twins and adopted individuals have found a genetic component to suicide. Runeson & Asberg (2003) compared rates of suicide completion in both family members of suicide victims and a comparison sample that died of non-suicidal means. Suicide was prominent within those families of suicide victims, once again suggesting a familial link to suicide. In addition, mental disorders were also high within these familial groups, but researchers found that family history of suicide was a risk factor independent of psychiatric disorders. Roy, Rylander, & Sarchiapone (1997) also proposed that some individuals have a vulnerability to suicide that is genetically based and independent from psychiatric disorders. Egeland & Sussex (1985) argue whether it is a family history of suicide that increases the risk for suicide, or whether it is a family history of mental disorders (that are known associates of suicide) that increase the likelihood of suicidality. Mann, Waternaux, Haas, & Malone (1999) conducted a large study investigating suicide risk factors. These researchers agreed that some families share both suicidal tendencies and psychiatric disorders, such as personality (cluster B) disorders. However, they concluded that suicidality can be present within families in the absence of psychopathology. They also believed that suicide, at least within the genetic/family association, can be independent of psychiatric illness.

The notion of ‘at risk’ and ‘vulnerabilities’ has been given much attention over the years. The work by Rutter (1985) stated that though there are vulnerability factors, such as genetic predispositions, that increase an individual’s susceptibility to

stressors, there are also protective factors (buffers) which counteract the effects of these stressors. Simply stated, factors such as genetics (depression related biological factors) cannot be controlled, however whether a person shows these characteristics can be mediated by the amount of protective factors in place. These protective factors range from religion (Lizardi, Currier, Galfalvy, Sher, Burke, Mann, & Oquendo, 2007) to parental bonding and a sense of family connection (Patterson & Stouthamer-Loeber, 1984, Wichstrom, 2009).

ASSOCIATION OF MOOD DISORDERS AND SUICIDE.

Though not all depressed individuals are suicidal, suicidal people are usually depressed (Davison et al., 2004). Of all the psychiatric disorders, mood disorders are primarily linked to suicide (Birmaher et al., 1996; Kessler et al.,1999; Turecki, 2001; Keilp, Gorlyn, Oquendo, Brodsky, Ellis, Stanley, & Mann, 2006; Tuisku, Pelkonen, Karlsson, Kiviruusu, Holi, Ruuttu, & Punamaki, 2006; Renaud et al., 2008). Mood disorders are disabling disturbances in emotion (Davison et al., 2004). According to the Diagnostic and Statistical Manual of Mental Disorders (4^{th} edition), they consist of two main types (American Psychiatric Association, 1994). The first type is depressive disorder which consists of major (unipolar) depression and dysthymic disorder. The second type is bipolar disorder, which consist of bipolar 1, 2 and cyclothymic disorder. Within the general population (aged 15 and older) approximately 4-7% are said to have a major depressive disorder (12 months prior to data collection) (Kessler, Berglund, Chiu et al, 2003; Statistics Canada, 2004; Currie, Patten, Williams, Wang, Beck, El-Guebaly, Maxwell, 2005; Kessler, Chiu, Demlar, Heeringa, Hiripi, Jin, Pennell, Walters, Zaslavsky, & Zheng, 2005), and 10% with

any mood disorder (major depression, dysthymia, and bipolar 1 & 2) (Kessler, Chiu, Demlar et al., 2005).

Several theories have been created to better understand the development of mood disorders. A neurochemical viewpoint suggests that low levels of serotonin not only affect depression but also suicide (Davison et al., 2004). Mann et al. (1999) and Turecki (2001) discussed the role of impulsive-aggressive behaviours as being prominent within suicide completers. They suggested that low serontonergic activity was linked to this impulsive-aggressive behaviour, which could possibly increase the likelihood of depressed patients committing suicide.

Some cognitive theories of depression on the other hand give less importance to the neurochemical stance. Beck's Theory of Depression states that depressed people feel the way they do because their thinking is biased toward negative interpretations of their environment (Davison, Neale, & Kring, 2004). Freud's classic Psychoanalytic Theory of Depression (Davison, Neale, & Kring, 2004) has probably been the most popular theory when discussing mood disorders and suicide. Freud believed that the potential for being depressed is created in early youth. Even though Freud developed this theory, it is not given much emphasis in the current field of gene-environment and biological realms of academia.

Adolescent Studies of Suicide Completers (SC).

Although suicide is reported in all age groups, it represents about one-third of death in the adolescent population. When investigating youth suicide, majority of studies focus on the 13-18 year age range. Generally within this age group, we notice that almost 50% of all these suicides have accompanying mood disorder diagnoses irrespective of geographic location. Brent, Perper, Goldstein, Kolka, Allan, Allman,

& Zelenak (1988), Shaffer et al. (1996), and Renaud et al. (2008) report that approximately 60% of their suicide completer (SC) group had mood disorders prior to death. Marttunen, Aro, Henriksson, & Lonnqvist, (1991), Brent et al. (1993), and Groholt, Ekeberg, Wichstrom, & Haldorsen (1997) report close to half of their suicide sample having an affective disorder. Both Brent's, Shaffer's and Renaud's studies were conducted within North America, while Marttunen's study took place in Finland. All these studies reported lifetime prevalence of psychiatric disorders, with the exception of Shaffer et al. (1996), who reported only 3 months leading to the SC.

A large review by Fleischmann, Bertolote, Belfer & Beautrais (2005) investigated youth suicides and psychiatric disorders in several geographic locations, such as North America, Australia, Israel and Sweden. They also report a similar high prevalence (42.1%) of mood disorders within their review of suicide populations. This suggests that youth suicide, despite their cultural and geographic differences, may have strong relations to depression.

Mood disorders not only encompass depressive symptoms but also manic symptoms. Though major depressive disorder is considered to be the most associated with suicide, bipolar patients in one of their mixed episodes also seize a high proportion of suicides (Harris & Barraclough, 1997). Kessler, Guilherme, & Walters (1999) stated that an individual with bipolar disorder was 30 times more likely to attempt suicide compared to those without a psychiatric disorder. However, as expected, suicide occurs more in bipolar patients during their depressive phase compared to their manic phase (Jacobs, Baldessarini, Conwell et al. 2003).

Adult studies of Suicide Completers.

There seems to be similarities in what studies have found for older SCs in regards to mood disorders compared to their youth counterparts. A number of studies report roughly 50% in their sample (Lesage et al., 1994; Beautrais, 2001; Kim, Lesage, Seguin, Chawky, Vanier, Lipp, & Turecki, 2003). Seguin et al. (2006) on the other hand, report a slightly higher prevalence of 66%. All these studies recorded psychiatric disorders 6 months prior to the suicide, with the exception of Beautrais (2001) who recorded one month prior to the SC.

A worldwide meta-analysis carried out by Cavanagh et al. (2003) examined 76 studies investigating suicide in both adolescent and adult populations from 1985 - 2000. Similar to the above findings, approximately 59% of the suicide completers had a mood disorder. Another world wide meta-analysis by Arsenault-Lapierre et al. (2004) reviewed 27 adolescent and adult suicide studies from 1986- 2002. Approximately 43% had a mood disorder. Arsenault-Lapierre et al. (2004) explored one database and were very rigorous in the type of studies they included within their meta-analysis, while Cavanagh, Carson, Sharpe et al. (2003) used slightly broader search parameters and additional databases which may account for the slight difference in findings.

In summary, we can notice the strong correlation depression has with SC. In adolescent suicides, approximately 50% prevalence of mood disorders is found. Depression by itself increases the likelihood of SC and is the most documented psychiatric disorder associated with suicide, but depression (mood disorders) is not the only disorder that needs attention.

ASSOCIATION OF SUDs AND SUICIDE.

Some clarification needs to be made on the definition of SUDs and what this definition entails. Generally, substance *abuse* is considered to be a less severe concept relating to social and legal aspects of the substance use, while *dependence* is more severe and is related to physiological, psychological and cognitive areas of the substance use (American Psychiatric Association, 1994). Thus, for clarification, SUDs will be used as an umbrella term that includes abuse, dependence, and any other terms related to substance misuse. SUDs usually involve substances such as alcohol and illicit drugs that are abused to the point that behaviour becomes negatively affected; social and occupational functioning impaired and control or abstinence becomes impossible (Ostacher, 2007). Approximately 4% of the general population has a substance use disorder (Statistics Canada, 2004; Currie, Patten, Williams et al., 2005; Kessler, Chiu, Demlar et al., 2005).

Lubman, Allen, Rigers, Cementon, & Bonomo (2007) divided each sub category of SUDs and found that, at least within their study, certain substances were more prevalent within their suicidal group. Their top five were, from highest to lowest, cannabis, opiate, alcohol, amphetamine and volatile substances. Though other studies have found slightly different rankings of these substances, majority of them agree that alcohol is consistently used more. Harris & Barraclough (1997) reported that there were more suicide deaths with those who abused alcohol than any other substance (such as opium, sedatives and cannabis). Alcohol use disorder, which is sub category of SUD, is caused by ingestion of alcohol over periods of time and in ways that leads to problems with health, personal relationships, school/work, and is primarily related to suicide.

Though SUDs (especially alcohol) are usually associated with depression when assessing suicide (Chatterji, Dave, Kaestner, & Markowitz, 2004), some evidence has shown SUDs to be an independent risk factor when major depressive disorders are controlled for (Wagner, Cole, & Schwartzman, 1996; Cutler, Glaeser, & Norberg, 2001; Kim et al., 2003).

Mann et al. (1999) believed that social drinking and binge drinking were related to suicide in some respect. They suggested that those with head injuries were more likely to commit suicide; and individuals seem to attain most head injuries while they are intoxicated (or abusing drugs). Chatterji et al. (2004) suggested that SUD (especially alcohol abuse) was linked to suicide via the aggression and violence involved. Suicide is just a form of violence and aggression, not necessarily directed outwards, but rather inwards. Being intoxicated reduces ones self-control and impairs cognition. This may all prompt suicide tendencies. Furthermore, Pirkola, Marttunen, Henriksson, Isometsa, Heikkinen, & Lonnqvist (1999) discussed that there is an increase in suicidality among alcoholics who start their drinking habits early on in life compared to those who start later on. This was also supported by Grunebaum, Galfalvy, Nichols, Caldeira, Sher, Dervic, Burke, Mann, & Oquendo (2006) who added that the earlier the onset of alcohol use the greater the chance of developing lifetime alcohol abuse.

Chatterji et al. (2004) and Connor & Goldston (2007) suggested a link between SUD and suicide involving a "deterioration of social ties" theory. They believed that substance abuse interferes with several aspects of an individual's life, aspects that relate to a persons well-being and mental/emotional stability. This theory suggests that having SUD (especially alcohol use disorder in adolescence and young

adulthood) impedes on all aspects of education (i.e., school, homework and attendance). This negatively affects neurological development creating a divide among these abusing individuals from the rest of the mentally developing class. All this may lead to suspension or expulsion, thus being rejected by normal peers and encourages the individual to seek other substance abusing peers who are or have been through a similar situation. This creates a cycle of substance use. To feel part of something (new found substance abusing peers) the individual must continue abusing substances. Lacking a stable or complete education may translate to lowered employment opportunities. It is difficult to acquire a job that is fulfilling or well paying without an education. This in turn creates a poor economic situation (lower status among society) and/or unemployment. Overall, this leads to financial difficulties which are known to be associated with increased risk of suicide (Connor & Goldston, 2007).

Substance use also affects an individual's judgment. Those who are intoxicated have excessive responses to stimuli (Hufford, 2001). There is an increased level of impulsivity, irritation, disinhibition and lowered ability to problem solve (Lejoyeux, Huet, Claudon, Fichelle, Casalino, & Lequen, 2008). Individuals with this type of diminished mind set, fail to realize other possible solutions to problems, and coupled with their disinhibition and impulsivity are likely to take part in detrimental behaviours such as suicide (Connor & Goldston, 2007; Mann, Waternaux, Haas et al., 1999).

Apart from academic, occupational and judgment issues, relationships are also affected (Brady, 2006; Connor & Goldston, 2007). Disruptive parental relationships, romantic relationships, and social networks caused by the substance use behaviour

can increase isolation. This isolation is related to suicide risk (Brady, 2006). We know that single individuals, or those divorced or separated are significantly more at risk for suicidal behaviour compared to those who have a partner (Lesage, Boyer, Grunberg et al. 1994).

Thus, through its biological and social aspects, we can see how SUDs may increase the risk for suicide.

Adolescent Studies of Suicide Completers (SC).

Brent et al. (1988) and Shaffer et al. (1996) had at least 30% with substance abuse, while Brent et al. (1993) and Renaud et al. (2008) found slightly lower reports around 25% within their SC group. A Norwegian study by Groholt, B., Ekeberg, O., Wichstrom, L., & Haldorsen (1997) found an even lower report of 17%. These above studies report statistics for substance abuse disorders, and do not include dependence. This may be a consequence of the age used. These studies all had means of 16-18 years old. Substance dependence is considered worse than abuse, and also develops later on, almost a continuation of substance abuse. Perhaps if these substance abusing subjects were followed for a longer period of time (if they had not completed suicide), their symptoms may have progressed further into more severe symptoms of dependence, such as tolerance, withdrawal and a persistent desire or unsuccessful efforts to reduce or cease. Marttunen et al. (1991) study which discussed both abuse and dependence (i.e., SUD) found 30%. The large review study by Fleischmann et al. (2005) found a higher prevalence of 41%. This high prevalence (which closely resembles an adult population) may be accounted for by the distribution of subject ages. Though majority of their SC sample was under 21 years old (approximately

70%), a small proportion (30%) were 21 and older. Due to this 30% older group, it may explain why a higher percent was observed within their subjects.

Adult Studies of Suicide Completers (SC).

Research in this area suggests that SUD may be present in almost half of adult suicides. Lesage et al. (1994) report 57%, Kim et al. (2003) report 52%, while Séguin et al. (2006) report 59%, all of which were investigated 6 months prior to the suicide. One potential explanation for this high percent maybe due the ease at which adults have in obtaining substances compared to their youth counterparts. Adults are more likely to be employed, thus being able to purchase these legal or illegal substances, and they also meet the legal age for alcohol purchase and consumption in most countries. A New Zealand study compared SCs and SAs between 14-88 years old (mean age of 37) (Beautrais, 2001). This study reported a lower prevalence of 31%. Compared to other adult studies mentioned in this section, Beautrais' (2001) study investigated psychiatric disorders one month prior to death, while the other studies looked at a longer time frame of psychopathology (6-12 months prior to death). These subjects may have had psychopathology (specifically SUD) earlier on that was not reported, which may explain the discrepancy.

The worldwide meta-analysis by Arsenault-Lapierre et al. (2004) concluded SUD was prevalent in approximately 26% of suicides. Several continents (Asia, Australia, Europe, and North America) were included into this overall percent. The highest prevalence was found in North America (40%), while Asia (27%), Australia (24%), and Europe (19%) reported significantly lower levels. As stated earlier, 30% of adolescent and 50% of adult suicides exhibit SUD, but Arsenault-Lapierre et al.

(2004) review grouped all studies investigating suicide, despite the age variations. This may account for the slightly varied levels of SUD worldwide.

Though alcohol seems to be the main substance abused where suicide is concerned, illicit drugs such as cocaine, marijuana and opium have also shown strong associations. Overall, though SUDs are capable of increasing the risk of adolescent suicide independently (approximately 25-30% in North America and 26% worldwide), it is when they are combined with other psychiatric disorder, such as mood disorders, that significantly increase the likelihood of suicide.

INTERACTION BETWEEN SUICIDE AND COMORBIDITY

Both mood disorders and SUDs are risk factors of suicide; however the risk of suicide is increased when these disorders are comorbid with each other (Koplin & Agathen, 2002; Jacobs et al., 2003; Grunebaum et al., 2006;). Comorbidity refers to the presence of two disorders within one individual. It is reported that at least 40-70% of depressed children and adolescents in clinical settings suffer from comorbid disorders, with 20-50% having even more than two disorders (Birmaher et al., 1996).

Several theories/hypotheses have been developed to explain the etiology of a comorbid disorder and SUD (Bolton, Robinson, & Sareen, 2009; Khanzatien, 1985; Davis, Rush, Wisniewski, Rice, Cassano, Jewell, Biggs, Shore-Wilson, Balasubramani, Hussain, Quitkin, & McGrath, 2008). One theory discusses how certain disorders share risk factors. For example being sexually abused as a child is a risk factor for borderline personality disorder and post traumatic stress disorder, and altogether increases the risk of suicide **(**Tuisku et al., 2006). Another theory postulates that a certain disorder is a consequence of the social, interpersonal and

occupational problems related to the SUD. Finally, the hypothesis that is probably most debated over is the self- medication hypothesis (SMH) (Khantzian, 1985; Lansford, Erath, Yu, Petti, Dodge, & Bates, 2008; Davis et al., 2008). It proposes that individuals suffering from some types of psychiatric disorders (such as depression) may use substances such as alcohol to alleviate negative symptoms caused by the initial disorder. However, there is much debate on whether this hypothesis is valid.

Adolescent & Adult Studies of Comorbid Mood Disorder and SUDs without SC.

Ostacher (2007) believed that 66% of those with comorbid mood disorders and SUDs were more likely to have alcohol dependence than any other substance, suggesting a strong connection between depression and alcohol. Generally this comorbidity manifests itself as having more depressive episodes, lower functioning and an increase in suicidality (Goldberg, Singer, & Garno, 2001; Davis et al., 2005; Ostacher, 2007). In addition, those with a comorbid mood disorder and SUD start their first mood episode at 18 years old while single disorder groups with depression start their first episode later on at age 24 (Grunebaum et al., 2006).

Lubman et al. (2007) studied 16-22 years olds recovering from drug addictions. Out of the SUD individuals, almost 50% had a current mood disorder, primarily major depressive disorder (MDD). Rohde, Lewinsohn, & Seeley (1996) sampled 14-18 year olds and reported that 80% of their alcohol abusing sample had some form of psychiatric disorder with 48% specifically having depression. Not all researchers have found such strong relationships between SUDs and mood disorders. Kandel, Johnson, Bird, Weissman, Godman, Lahey, Regier, & Schwab-Stone (1999) investigated 14-17 year olds and found that 32% had a comorbid mood disorder and

SUD. Riggs, Baker, Mikulich, Young, & Crowly (1995) also looked at adolescents (13-19 years old) but only found a 15.2% comorbid SUD and mood disorder within their sample. Generally, a link between MD and SUDs has been found and supported numerously throughout academia.

Davis et al. (2005) investigated the differences between living individuals (aged 18-75) with major depressive disorder (MDD) and without a comorbid SUD. Approximately 28% suffered from comorbid MDD and SUD. These comorbid MDD and SUD subjects, in comparison to individuals with a MDD only diagnosis, were more likely to be males, divorced or never married, have a younger age of onset of depression, increase severity of illness, report being hospitalized more, fewer years in the education system, and a lower psychosocial functioning. In regards to suicide, they were found to have higher number of suicide attempts and more suicide ideation compared to MDD only subjects. Thus, there is an increased level of suicide ideation and suicide attempt within this comorbid grouping.

Adolescent Studies of Comorbid Mood disorder and SUDs within SC.

Brent et al. (1988) found 15% comorbid mood disorder and SUD in their suicide sample. Shaffer et al. (1996) found a slightly higher prevalence of 23%. More recently, Renaud et al. (2008) reported 11.5% of their suicide sample having this comorbidity. Groholt et al. (1997) reported an even smaller rate of 5%. Once again, these studies only discussed substance abuse. Marttunen's et al. (1991) sample on the other hand had 33% with SUD.

Adults Studies of Comorbid Mood disorder and SUDs within SC.

Kim et al. (2003) reported 27% comorbidity, Dumais, Lesage, Alda, Rouleau, Dumont, Chawky, Roy, Mann, Benkelfat, & Turecki (2005) reported 52%, and Seguin et al. (2006) reported 42% in their suicide completer sample. The review study by Fleischmann et al. (2005) reported a lower rate of 14.1%. Again, this may be explained through the age distribution of their subjects. Since 70% were younger than 20, this may account for a lower prevalence of the comorbidity.

In summary, though much research has explored this comorbid relationship to suicide, there is some variation in the prevalence rates that may be accounted for by age ranges. When consolidating the information from these various studies we get a better picture of how mood disorders and SUD relate to suicide. Within the adolescent and young adult population in North America, approximately 50% of suicide completers have a mood disorder, 30% have a SUD and comorbid mood disorders and SUDs is found between the 11% -30%.

RATIONALE

Suicide and its association to psychopathology has been well studied. Majority of studies investigate age groups in two main ways. Specific research studies look at a small age range (i.e. 12-19 years old or 15-19 years sold), while general research studies investigate a wide range of ages (i.e. 12-85 years old or 32-65 years old) (refer to table 1). A problem arises when using either way. Specific groups cannot be applied to other age ranges, while general groups cannot be narrowed to look into each age specifically. Thus, knowing that psychopathology and suicide is high between adolescence and early adulthood, we will investigate the

relationship between suicide and psychiatric disorders, especially mood disorder and SUDs, in hopes of identifying risk factors and key associations. Also, age strata will be investigated to better understand the differences age plays within suicide related factors.

RESEARCH OBJECTIVES

Generally, we are interested in how mood disorders and SUDs are associated with suicide. We will investigate several areas associated to suicide, with an emphasis on three main outcomes. First, we wish to identify factors that differentiate suicides and controls. Second, we hope to identify factors that differentiate those with MD/SUDs and those without it. Last, we want to identify factors associated with the two main age ranges (12-18 years old and 19-25 years old). We wish to better understand how SUD (and its sub categories of abuse and dependence) play a role in suicide.

HYPOTHESIS

Several questions will be addressed within this study. First, are adolescent and young adult suicides and psychiatric disorders related? We expect that suicides will have significantly more psychiatric disorders compared to controls. Second, within the suicide sample, is there a certain comorbidity that is more prevalent? We anticipate that the MD/SUD grouping will be most prominent within SCs compared to any other comorbid grouping. Third, what is the difference between those who completed suicide compared to living community controls? Next, what is the difference between those with the mood disorder and SUD comorbidity compared to

those with other comorbidities? Finally, is there a difference between the adolescent group (12-18 years old) and the early adult group (19-25 years old) in regards to SUD sub categories (i.e., abuse and dependence)?

Table 1: Summary of identified studies addressing Mood Disorder and SUDs.

Study	Year	Proband	Age
Brent, Perper, Goldstein et al.	1988	Comparing suicide completers with suicidal inpatients.	13-19
Christie, Burke, Regier et al.	1988	Comorbid MD and SUDs	18-30
Marttunen, Aro, Henriksson et al.	1991	Mental disorders in Finland suicides	13-19
Weiss, Griffin, & Mirin	1992	Drug addicts with depression	18-62
Brent, Perper, Moritz et al.	1993	Comorbid MD and SUDs suicides	13-19
Lesage, Boyer, Grunberg et al.	1994	Comorbidity and male suicide	18-35
Henry, Feehan, McGee et al.	1993	Importance of conduct and depressive symptoms for predicting substance use	11-15
Riggs, Baker, Mikulich et al.	1995	Current substance dependent subjects with comorbid MD	13-19
Birmaher, Ryan, Williamson et al.	1996	10 year review on youth children	

		and adolescents depression	
Rohde, Lewinsohn, & Seeley	1996	Comorbid alcohol abuse and other psychiatric disorder	14-18
Shaffer, Gould, Fisher et al.	1996	Psychiatric risk factors of children and adolescents suicide	<20
Wagner, Cole, & Schwartzmer	1996	SA with comorbid MD and SUDs	12-21
Groholt, Ekeberg, Wichstrom et al.	1997	Comparison of youth suicide And controls in Norway	8-20
Harris & Barraclough	1997	Review of mental disorders and suicide risk	n/a
Clark, Kirisci, & Tarter	1998	Examines SUDs in adult males compared to adolescent males.	16-47
Abraham & Fava	1999	MD or SUDs; which manifests first	18-65
Kandel, Johnson, Bird et al.	1999	Comorbid MD and SUDs in youth	14-17
Kessler, Guilherme, & Walters	1999	SA and comorbidity	15-54
Pirkola, Marttunen, Henriksson et al.	1999	SC and alcohol use	13-22
Shaffer, Pfeffer, Bernet et al.	2000	Assessment and treatment of Suicide	n/a

Beautrais	2001	SC and SA comparisons in New Zealand.	13-88
Goldberg, Singer, & Garno	2001	Substance abuse with affective disorders within suicide	n/a
Turecki	2001	Suicide and genetic predisposition	n/a
Koplin & Agathen	2002	Suicidality within children adolescents and adolescents	children and adolescents
Jacobs, Baldessarini, Conwell et al.	2003	Assessment and treatment of suicide	n/a
Kessler, Berglund, Chiu et al.	2003	SA and comorbidity	15-54
Kim, Lesage, Seguin et al.	2003	SC and comorbidity	18-65
Chatterji, Dave, Kaestner et al.	2004	SA and alcohol abuse	14-18
Currie, Patten, Williams	2005	General population survey	15 and older
Davis, Rush, Wisniewski et al.	2005	Comorbid MD and SUDs and treatment options	18-75
Dumais, Lesage, Alda et al.	2005	SC in major depression	18-45
Fleischmann, Bertolote, Belfer et al.	2005	Review of SC in young people from around the world.	8-29
Grunebaum, Galfalvy, Nichols et al.	2006	Bipolar with and without SUDs	17-67

Seguin, Lesage, Chawky et al.	2006	SUDs and MD	17-82
Conner & Goldston	2007	Male suicide prevention	11-21
Lubman, Allen, Rigers et al.	2007	Comorbid MD and substance abuse in youth	16-22
McGirr, Paris, Lesage et al.	2007	MD in suicides and controls	29-56
Ostacher	2007	Substance dependence and depression	n/a
Shain	2007	SC and SA in adolescents	15-24
Renaud, Berlim, McGirr et al.	2008	Comorbid MD and SUDs suicides	11-18

SC= suicide completion, SA= suicide attempt, SI= suicide ideation, MD= Mood disorder, SUD= substance use disorder.

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CHAPTER 2

MOOD DISORDERS AND SUBSTANCE USE DISORDERS: THEIR COMORBID IMPACT ON ADOLESCENT AND ADULT SUICDE.

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ABSTRACT

Background: Research has repetitively found that up to 90% of those who complete suicide have at least one psychiatric disorder. The key disorders associated with suicide are mood and substance use disorders (SUD) and it is when these disorders occur together (comorbid) which further increases suicide risk.

Objectives: We were interested in how mood disorders and SUDs were associated with adolescent and young adult suicide in a case-control study. We also examined the association age differences and comorbid mood disorder and SUDs had with suicide risk factors.

Method: Our study consisted of 67 suicide completers aged 12-25 years who were matched with 56 community controls from the province of Quebec. We used the psychological autopsy method to gather information on both groups. SCID I and II, socio-demographics, family pathology, impulsiveness, and aggression were the main scales and measurements used to collect data.

Results: Main disorders found in suicide completers were mood disorders (52%) followed by SUD (43%). As hypothesized, psychiatric disorders and comorbidity were more prevalent in suicide completers than controls, X^2 (2) =62.084, p<.0001, X^2 (2) =72.105, p<.0001. Prevalence of the mood disorder and SUD comorbid grouping within suicide completers was 27% (n=18). Education level of subject (OR 6.659, 95% CI = 1.219-36.373) was found to be significant for suicide completers, indicating that suicide completers were more at risk of having a lower education.

Conclusion: As expected, suicide completion was significantly associated with psychiatric disorder, comorbidity (especially MD/SUDs), lower education, more family members with psychopathology, and higher scores for impulsiveness and aggression. In addition, age seems to increase the likelihood of having substance dependence in those who have completed suicide.

Limitations: The main limitation was based on small sample size, cross sectional analysis, and potential recall biases.

Keywords: Suicide, comorbidity, substance, mood.

Abbreviations: Substance use disorder (SUD), suicide completion (SC), mood disorder and substance use disorder comorbidity (MD/SUD).

Introduction

Research has repetitively found, in various geographic locations that up to 90% of those who complete suicide have at least one psychiatric disorder (Lesage et al., 1994; Beautrais et al., 1996; Shaffer et al., 1996; Cavanagh et al. 2003; Séguin, et al., 2006; Renaud et al., 2008). Thus, much research has investigated the early identification and treatment of such disorders.

Background literature

1.0 Depression and suicide

Though not all depressed individuals are suicidal, suicidal people are usually depressed (Davison, Neale, & Kring, 2004). Of all the psychiatric disorders, mood disorders are primarily linked to suicide (Birmaher et al., 1996; Kessler, Guilherme, & Walters 1999; Turecki, 2001; Keilp et al. 2006; Tuisku et al., 2008). Within the general population (aged 15 and older) approximately 4-7% are said to have a major depressive disorder (12 months prior to data collection) (Kessler et al., 2003; Statistics Canada, 2004; Currie et al., 2005; Kessler et al., 2005), and 10% with any mood disorder (major depression, dysthymia, and bipolar 1 & 2) (Kessler et al., 2005).

1.1 Adolescent Studies of Suicide Completers (SC).

When investigating adolescent suicide, majority of studies focus on the 13-18 year age range. Generally within this age group, we notice that at approximately 50% of all these suicides have accompanying mood disorder diagnoses irrespective of geographic location (Brent et al., 1988; Brent et al., 1993; Groholt, et al., 1997; Marttunen et al., 1991; Renaud et al., 2008; Shaffer et al., 1996;)

1.2 Adult studies of Suicide Completers.

There seems to be similarities in what studies have found for older suicide victims in regards to mood disorders compared to their adolescent counterparts. A number of studies report roughly 50% in their sample (Lesage et al., 1994; Beautrais, 2001; Kim et al., 2003).

Depression by itself increases the likelihood of suicide and is the most documented psychiatric disorder associated with suicide, but depression (mood disorders) is not the only disorder that has a strong link to suicide.

2.0 SUD and suicide

SUDs are the next in line in terms of risk for suicide (Jacobs et al., 2003). SUD is an umbrella term which includes both abuse and dependence. SUDs usually involve substances such as alcohol and illicit drugs that are abused to the point that behaviour becomes negatively affected; social and occupational functioning impaired and control or abstinence becomes impossible (Ostacher, 2007). Approximately 4% of the general population has a substance use disorder (Statistics Canada, 2004; Currie et al., 2005; Kessler et al., 2005).

2.1 Adolescent Studies of Suicide Completers (SC).

Both Brent et al. (1988) and Shaffer et al. (1996) had substance abuse in at least 30% of their suicide population. Brent et al. (1993) and Renaud et al. (2008) found slightly lower reports around 25%. An even lower rate was found by a Norwegian study by Groholt et al. (1997) of 17%. These above studies report statistics for substance abuse disorders, and do not find dependence. Marttunen et al. (1991) study which discussed both abuse and dependence (i.e., SUD) found 30%. (Please refer to the next section 2.2 for further discussion on age and substance use).

2.2 Adult Studies of Suicide Completers (SC).

Studies suggest that more than half of adult suicides have some form of SUD. Lesage et al. (1994) report 57%; Kim et al. (2003) report 52%, while Séguin et al. (2006) report 59%. The accessibility adults have in obtaining substances compared to their youth counterparts may be one explanation for the higher prevalence observed. Adults are also more likely to be employed, thus being able to purchase these legal or illegal substances, and they also meet the legal age for alcohol purchase and consumption in most countries.

Overall, though SUDs are capable of increasing the risk of adolescent suicide independently (approximately 25-30% in North America and 26% worldwide), it is when they are combined with other psychiatric disorders, such as mood disorders, that significantly increases the likelihood of suicide.

3.0 Interaction (Comorbid) with each other

Both mood disorders and SUDs are risk factors of suicide; however the risk of suicide is increased when these disorders are comorbid with each other (Koplin & Agathen, 2002; Jacobs et al., 2003; Grunebaum et al., 2006;). Comorbidity refers to the presence of two or more disorders within one individual. According to Statistics Canada, approximately 17% of Canadians 15 years of age and older in the general population, have a comorbid mood disorder and some type of dependence (Statistics Canada, 2004; Currie et al., 2005).

Though much research has explored this comorbid relationship to suicide, there is some variation in the prevalence rates that may be accounted for by age ranges (please refer to tables 1 and 2). When consolidating the information from these various studies we get a better picture of how mood disorders and SUD relate to

suicide. It seems, at least within the adolescent and young adult population in North America, approximately 50% of suicide completers have a mood disorder, 30% have a SUD, and comorbid mood disorders and SUDs is found between the 11% -30%.

OBJECTIVES AND HYPOTHESES

Thus, the present study is interested in how mood disorders and SUDs are associated with adolescent and young adult suicide in a case-control study. Several questions will be the focus of this study. 1. Are adolescent and young adult suicides and psychiatric disorders related? We expect to have higher prevalence of psychiatric disorders in our suicide cases than our community controls. 2. Within the suicide population, is there a certain comorbidity that is more prevalent? Here, we expect to find higher comorbidity among the SCs compared to the living community controls. We also believe that SCs will have a higher prevalence of the mood disorder and SUD comorbidity. Furthermore, we wish to examine what differences exist within the SC group. 3. Specifically, what is the difference between those with the mood disorder and SUDs comorbidity compared to those with another comorbidity? For instance, is there a difference between their socio-economic status, or impulsivity? We also expect that additional factors such as number of depressive episodes, number of past suicide attempts, family pathology, and aggression also play a role.

METHODS

4.1 Subjects

In the present study 67 suicide completers (based on Quebec Coroner examination) between the ages of 12-25 from a Quebec sample were compared to living community controls also between 12-25 years old and from Quebec.

The psychological autopsy method was used on both groups. It is a procedure for investigating a person's death by reconstructing what the person thought, felt, and did preceding his or her death. This reconstruction is based upon information gathered from personal documents, academic records, medical files, coroner's records, and face-to-face interviews with proxies (usually families and friends) who knew the person of interest.

For suicide completers, the coroners' office was given information about the current study who in turn contacted families of the deceased. Once families approved, the research teams made contact. For controls, Quebec school administrators were contacted and they in turn asked students (and their proxies) to take part in the study. If the family agreed, the research team contacted them directly. Members of community sectors also referred us to controls. This type of informant (proxy) does not interfere with the quality of data collected, as reported by Kim et al., (2003) and Lesage et al. (1994), among others.

4.2 Axis I & II diagnoses

The Structured Clinical Interview for DSM Disorders (SCID) is a semi-structured interview for making DSM-IV axis I and II psychiatric diagnoses. The SCID records psychiatric disorders in the past and in the present (last 6 months of life or the date of the interview). It was administered by trained professionals.

4.3 Other information

The Barratt Impulsive Scale (BIS), which is used to measure impulsivity and the Brown-Goodwin History of Aggression (BGHA), which measures aggression throughout life, were also used within this study.

Supplementary information regarding subject life history, family structure and family psychopathology (which only records diagnosis's of depression, mania, schizophrenia, SA, SC, alcoholism, drug abuse, Alzheimer's disease, and obsessive-compulsive disorder) was collected via the Socio-Demo and Family pathology measures.

4.4 Statistical analysis

Main analyses were conducted using SPSS version 15. Chi squares of independence were used to analyze categorical data, while t-tests for independence were used to identify differences within the groups. Logistic regressions were used to identify factors that differentiated groups.

For differences related to age, 2 groups were created from our sample. Group one had those suicides between 12-18 years old (n=18), while group 2 had suicides between 19-25 years old (n=49). Ages were divided based on legal definitions of being an adult, hence age 18.

RESULTS

5.1 Study group characteristics

Sixty-seven suicide completers and 56 living community controls were recruited into this study. Mean ages were approximately the same for each group; suicide completers 20.48 (3.35), controls 20.20 (3.11). There were 53 males and 14

females in the SC group, compared to the 43 males and 13 females in the control group. Majority of our sample was Caucasian (n = 105, 87%). The minorities consisted of those from African decent (n =3, 2.3%), and mixed ethnicities (n =13, 11%). Socioeconomic status was divided into 4 subsections (refer to figure 1). Suicide completers were found to have received less education compared to controls, X^2 (3) = 15.219, p>.05. There was also a significant difference for the employment type of suicide completers (X^2 (2) = 20.257, p>.05) compared to controls. There was no difference for household income and source of revenue.

5.2 Method of suicide

Hanging was mainly used as a means of suicide (n= 47, 70.1%), followed by firearms (n=7, 10.4%), jumping (5, 7.5%), and over dose (3, 4.5%) (refer to figure 2).

5.3 Family psychopathology

Family Psychopathology was investigated within direct members of the family, i.e., parents and siblings.

Psychopathology was present in 57% (n=38) of the SCs. Approximately 34% of cases had one family member, 13% with two family members, and 9% with 3 family members. For controls, psychopathology was present in 38% (n=21). Approximately 29% of controls had one family member, 7% with two family members, and 2% with 3 family members. A chi square of independence was performed and revealed that suicides had significantly more family members with some sort of psychiatric disorder (X^2 (1) = 4.513, p<.05) compared to controls.

Depression was reported in 46% (n= 31) of the families of the deceased and 32% (n= 18) in controls' families. Depression was found to be significantly more prevalent in the SC group compared to the control group, X^2 (1) = 2.540, p<.05.

Alcoholism was found in 31% (n= 21) and drug abuse was found in 13% (n=9) in the suicide families, while for controls, alcoholism was reported in 4% (n= 2) and drug abuse was reported in 5% (n=3). Alcohol use was significantly more prevalent in the suicide families compared to the controls, X^2 (1) = 15.476, p<.05, while there was no difference for drug abuse between the two groups, X^2 (1) = 1.277, p>.05.

Suicide attempts were reported in 24% (n=16) of the families of the deceased, with one subject having a family member who completed suicide. No control was related to a family member who completed suicide, however, 5% (n=3) did have suicide attempters in their direct family.

5.4 Axis I disorders

Prevalence rates for current axis I disorders for suicide completers were 84% and 14% for controls (refer to table 3). As expected, the suicide completers had higher prevalence of axis I psychiatric disorders compared to living community controls, X^2 (2) =62.084, p<.0001. Majority of the controls did not have an axis I disorder (86%). The main disorders reported were mood disorders (52% of suicide completers) followed by SUD (43% of suicide completers). Specifically, 37% of suicide completers had major depression, followed by 7% with dysthymic and 3% with bipolar disorder. Within SUD (n=29), cannabis was prevalent in 22%, followed by alcohol (21%) and cocaine (6%). Poly drug use (9%) was also prevalent. We observed 10 (15%) with substance abuse, 15 (22%) with dependence, and 4 (6%) reporting both an abuse and a dependence (refer to figure 4) of a different substance.

Adjustment disorder (12%), pathological gambling (5%) and social phobias (4%) were also recorded within suicide completers.

5.5 Axis II disorders

As expected, the suicide completers had higher prevalence of axis II psychiatric disorders compared to living community controls, X^2 (2) = 29.799, p<.0001.Within the SC group, 52% reported a personality disorder, while only 7% were recorded in the control sample. Borderline personality disorder ranked highest at 22%, while avoidant personality disorder (19%), antisocial personality disorder (15%) were next. The highest prevalence among controls was obsessive –compulsive personality disorder (4%) followed by antisocial (2%), avoidant (2%) and narcissistic personality disorder (2%).

5.6 Comorbid disorders

As expected, the suicide cases had higher prevalence of axis I and II psychiatric disorders compared to living community controls, X^2 (2) =72.105, p<.0001. Specifically, 97% of the SC group had at least one axis I and/or axis II disorder. Prevalence of the mood disorder and SUD within suicide completers was 27% (n=18), while the prevalence of the mood disorder and SUD comorbidity with an axis II disorder was 34%. Refer to table 6 for a break down of other axis I comorbid groupings. Forty-four percent of the comorbid mood and SUD group had an accompanying borderline personality disorder, followed by antisocial disorder (33%), passive-aggressive (22%), and avoidant personality disorder (17%). Controls on the other hand did not show as much comorbidity. Only one control subject had comorbidity (2 anxiety disorders).

5.7 Previous History of Suicidality

Controls had no previous suicidal history while 28% of the SC group had reports of past suicide attempts. Within the SC group, attempts ranged from 0-4.

Precisely, 72% did not have a past attempt, while 9 (13%) attempted only once, 6 (9%) attempted twice, 1 (1%) attempted three times and 3 (4%) attempted four times.

5.8 Number of Depressive episodes

Depressive episodes were absent in 43% (n=29) of the SCs, while 49% (n=33) had one, 6% (n=4) had two, and 1.5% (n=1) had three depressive episodes during their *lifetime* (refer to figure 3). Twenty-eight subjects had a present depressive episode only, while four had a depressive episode in the past and present. Three subjects did not have a present episode but had a past depressive episode. Controls did not have depressive episodes.

Thus, in summary, 32 subjects (28 who had one depressive episode and 4 enduring their second depressive episode) committed suicide during their last 6 months of life, while 3 did not have a current depressive episode.

5.9 BIS & BGHA

A significant difference was found between BIS scores for suicide and controls ($t_{(121)}$=4.060, p<.05). In regards to BGHA, all three age groups; childhood, adolescence, and adulthood, were found to be significantly different for suicide completers and controls, $t_{(114)}$=5.012, p<.05, $t_{(114)}$=6.738, p<.05, and $t_{(114)}$=3.269, p<.05 respectively.

5.10 Age strata

The MD/SUDs comorbidity, mood disorder subgroup, SUD subgroup, and number of depressive episodes were all significantly more prevalent in the older SC group than the younger SC group, X^2 (1) =5.689, p<.05, X^2 (1) =10.377, p<.05, X^2 (1) =8.355, p<.05. No substance abuse was found in the younger group, while 14 cases were found in the older group, X^2 (1) =6.501, p<.05. Substance dependence was

found in 2 younger suicide completers, while in 17 older suicide completers. Hence, a trend was found, X^2 (1) =3.604, p=.05765. (Please refer to figure 4).

5.11 Predictors

In order to look at what factors might differentiate suicide completers and controls, variables such as age, gender, family pathology, family attempts, socio-economic status, BIS, and the BGHA were entered. Using a logistic regression analysis, only education level of subject (OR 6.659, 95% CI = 1.219-36.373) was found to be significant. Thus, lower education was 6.6 times more frequently associated with suicide completers than controls.

In the MD/SUD comorbid grouping, no other variables were found to be significant.

Discussion

In the present study, 67 suicide completers were compared to 56 community controls from the province of Quebec. Both groups were similar in terms of age, ethnicity, and geographic area.

There is much research that has been conducted within this area. Majority of studies on suicide have concluded that suicide, despite the age group being investigated, have several consistent associations. Subject psychiatric disorder, levels of impulsiveness, aggression, and family psychopathology are associated to SC.

Not only was this study a replication of previous data, but it also investigated adolescents and adults, and compared these age groups to identify potential risk factors. This was unique to our study. Another unique aspect that this study adds to

the research realm is its comparison of those with the mood disorder and SUD comorbidity to those devoid of it.

6.1 SES

As expected, socio-economic status (SES) as a whole was not found to be significantly different between suicide completers and controls. Subdividing the SES, revealed that education level and employment type was significantly different within our sample. We observed that the majority of our SC group had lower levels of education compared to controls.

6.2 Family pathology

Also, as expected (Brent, 1995), family members of those who completed suicide also showed more psychiatric disorders compared to family members of the controls (excluding drug abuse). Thus, be it nature (genetically based) or nurture (environmentally based), having a family member with a psychiatric disorder increases the likelihood of having a psychiatric disorder in the proband.

6.3 Axis 1 disorders

This study reports 82% psychopathology within the SC group, consistent to what others have found (Mann et al., 1999; Kim et al., 2003; Turecki et al., 2005; Renaud et al., 2008). We also found a higher prevalence of psychiatric disorders in the SC group compared to the controls, as hypothesized. Furthermore, many studies report approximately 40-60% of those who completed suicide have a mood disorder (Brent et al, 1988; Shaffer et al., 1996; Renaud et al., 2008). Major depression was most associated with SC in our sample, X^2 (1) =40.889, p<.001. Bipolar disorder did not represent a significant number of psychiatric disorders within our SC group, which was also reported by other studies (Martunnen et al., 1991; Shaffer et al., 2000;

Kim et al. 2003; Seguin et al. 2006; and Renaud et al., 2008). Though our lower levels of bipolar disorder within our SC group is mainly supported by past research, Brent et al. in two subsequent samples (1988; 1993) however, did not. They found that bipolar disorder was significantly associated with their SC group. These discrepancies may be explained by diagnostic issues such as those brought up by Keller (1987) and Potter (1983), whom suggested that some adolescents with bipolar disorders may be diagnosed incorrectly with a borderline personality disorder or a conduct disorder. Other authors such as, Kochman, Hantouche, Ferarri, Lancrenon, Bayart, & Akiskal (2005) also mentioned conduct disorder misdiagnosis in those with depression who manifested conduct disorder-like symptoms (i.e. aggressive behaviours and psychotic features). These individuals may later develop bipolar disorder.

Next in terms of most prominent within our SC group were SUD (43%). Much variation occurs when comparing our SUD results to that of other studies. Both Brent et al. (1988), Brent et al (1993), Shaffer et al. (1996), and Renaud et al. (2008) had substance abuse in approximately 25-30% of their SCs. An even lower rate was found by a Norwegian study by Groholt et al. (1997) of 17%. The above studies report prevalence rates for substance abuse disorders, and did not find substance dependence. Our study on the other hand did find substance dependence in 22% of our SCs. The studies by Brent et al. (1988; 1993). Shaffer et al. (1996), Renaud et al. (2008) and Groholt et al. (1997) had means of 16-18 years old. We know that substance dependence is considered worse than abuse, and also develops later on, almost a continuation of substance abuse. Perhaps if their substance abusing subjects were older, we might have observed their symptoms of abuse progressing

into more severe symptoms of dependence. Thus, this could explain our studies higher prevalence of substance use (which includes both abuse and dependence). The large review study by Fleischmann et al. (2005) found a higher prevalence of 41%. They also had an age range similar to ours (8-29 years old). Even the worldwide meta-analysis by Arsenault-Lapierre et al. (2004) concluded that of those who completed suicide, 40% had SUD. Thus, our results maybe best suited to compare to the SUD prevalence found in Fleishmann et al. (2005) and Arsenault-Lapierre et al. (2004). (Please refer to section 6.6 for further discussion of age and SUD).

6.4 Age Strata.

Some youth studies investigate substance abuse but have not found substance dependence. As previously stated, this could be a result of the younger ages of the samples studied by researchers. Our study on the other hand had age groups that span both adolescence and early adulthood giving a broader scope of substance consumption. Interestingly, no reports of substance abuse were found in the younger SC group; all substance abuse cases were in the older SC group. Dependence on the other hand was found in low rates in the younger SC group, while significantly more prevalent in the older SC group. Thus, our hypothesis about dependence being more prominent in the older SC group was somewhat supported, however, other studies will be needed to confirm our findings. A problem that may interfere with making firm conclusions on this topic is the fact that we had 18 SCs between 12-18 years old versus 49 SCs between 19-25 years old. Thus, our conclusions are limited by the small sample size.

6.5 Comorbidity

The mood disorder and SUD comorbidity was the comorbid grouping that was most prevalent compared to any other comorbid grouping, which was expected. Though many studies report that this comorbidity is most recorded (Martunnen et al, 1991; Brent et al., 1993; Renaud et al., 2008) there was some variation in the prevalence rates found. Our study was found to be generally higher compared to the other adolescent studies (refer to table 1) in regards to the mood disorder and SUD grouping. Once again, this may be explained through the age variations used. Our mean was slightly higher at 20, while the other adolescent studies had lower means. Our study is more comparable to the results found in adult samples (refer to table 2), with group means greater than 20.

6.6 BIS and BGHA

As expected (McGirr, Renaud, Bureau, Seguin, Lesage, Turecki, 2008; Renaud et al., 2008), there were significant differences between SCs and controls for both impulsivity and aggression. Generally, those who completed suicide seem to have significantly higher levels of impulsivity and aggression compared to living controls.

6.7 Predictors

The purpose of the first logistic regression was to identify factors that differentiated SCs and controls. Only education level was significant, indicating that those with lower education have a higher risk of SC.

The purpose of the second logistic regression was to identify factors that differentiated those with MD/SUD comorbidity to those without it. No significant variables were found here.

6.8 Limitations

Although we replicated significant results in our suicide case-control study, our sample size was small. In particular, we had a small number of subjects in the younger SC group. We had 18 SCs between 12-18 years old versus 49 SCs between 19-25 years old, thus limiting the conclusions we can draw.

Also, inherent to case-control studies, recall biases have to be highlighted. However, our group has demonstrated that it does not affect the results (Kim et al., 2003; Lesage et al.,1994).

Though our controls have shown comparative prevalence rates (4%) with the Canadian general population for SUD (5%), the same can not be said about major depression prevalence rates. Statistics within Canada report 4-7% with major depression in the general population (Statistics Canada, 2004; Currie, et al., 2005) while we did not find any in our controls sample. This maybe related to the small sample size or selection bias related to recruitment procedure. Another potential explanation may rest on the exclusion criteria; only those without a history of suicide were to be taken. Many suicidal individuals have accompanying depressive symptoms. By excluding those with past suicidality we may have inadvertently excluded majority of those with depression (or other disorders associated with suicide), hence explaining our low prevalence rate of mood disorders in our controls.

Conclusion

In the present study, 67 suicide completers were compared to 56 community controls. As expected, suicide completion was significantly associated with psychiatric disorder, comorbidity (especially MD/SUDs), lower education, more

family members with psychopathology, and higher scores for impulsiveness and aggression.

Also, age seems to increase the likelihood of having substance dependence in those who complete suicide.

Studies should take into account the transition between adolescent and young adulthood to gain a better understanding of the pathology of suicide related disorders.

Acknowledgements

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Table 1: Specific studies investigating Mood disorders, SUDs, Mood disorder and SUD comorbidity (MD/SUD), and suicide completion in an adolescent sample.

Authors	$\bar{X}$	Range	Year of Death	Mood Disorders	SUDs	MD/SUD
Brent et al. (1988)	18	13-19	1984-1986	63%	37%**	15%**
Marttunen et al. (1991)	17	13-19	1987-1988	52%	30%	33%
Brent et al. (1993)	17	13-19	1986-1990	49%	27%**	24%**
Shaffer et al. (1996)	17	<20	1984-1986	61%	35% **	23%**
Groholt et al. (1997)	17	8-20	1990-1992	46%	17%**	5%**
Fleischmann et al. (2005)*	-	8-29	1982-2001	42%	41%	14%
Renaud et al. (2008)	16	11-18	2000-2003	60%	24%**	11.5%**

* Review paper. Approximately 71% of the young people were less then 21 years, therefore they were included within the adolescent sample opposed to the adult sample.
** Substance abuse disorder was investigated rather than SUD.

Table 2: Specific studies investigating Mood Disorders, SUDs, Mood disorder and SUD comorbidity (MD/SUD), and suicide completion in an adult sample.

Authors	$\bar{X}$	Range	Mood Disorders	SUDs	MD/SUD
Lesage et al. (1994)	19	18-35	49%	57%	-
Beautrais (2001)	37	14-88	56%	31%	-
Kim et al. (2003)	29	18-65	50%	52%	27%
Dumais et al. (2005)	42	18-45	*	*	52%
Seguin et al. (2006)	45	17-82	66%	59%	42%

- study did not report this specific information.
* study results cannot be generalized to other studies.

Table3:
Prevalence of Axis I Disorders (6 month prevalence)

	Suicide Completers (n=67)		Controls (n=56)	
	N	%	N	%
Mood disorders	35	52	0	0
Major Depression	25	37	0	0
Dysthymia	5	7	0	0
Bipolar	3	4	0	0
SUD	29	43	3	5
Cannabis	15	22	0	0
Alcohol	14	21	3	5
Poly Drug	6	9	0	0
Cocaine	4	6	0	0
Adjustment disorder	12	18	2	4
Anxiety Disorders	9	13	2	4
Social Phobia	4	6	0	0
Specific Phobia	3	4	0	0
Panic Disorder	1	1	0	0
Post Traumatic Stress Disorder	1	1	0	0
Obsessive-Compulsive Disorder	0	0	1	2
Generalized Anxiety Disorder	0	0	1	2
Pathological Gambling	5	7	0	0
Eating Disorders	4	6	0	0
Anorexia Nervosa	2	3	0	0
Bulimia Nervosa	2	3	0	0
Other Axis I Disorder	3	4	1	2
Tourette Syndrome	2	3	1	2
Oppositional Defiant Disorder	1	1	0	0
Schizophrenia	2	3	0	0
Hypochondriasis	1	1	0	0

Substance use disorder= SUD

Table 4:
Prevalence of Axis II Disorders

	Suicide Completers (n=67)		Controls (n=56)	
	N	%	N	%
Borderline	15	22	0	0
Avoidant	13	19	1	2
Antisocial	10	15	1	2
Passive Aggressive	8	12	0	0
Narcississtic	4	6	1	2
Obsessive-Compulsive	3	4	2	4
Dependent	1	1	0	0
Depressive	1	1	0	0
Paranoid	2	3	0	0

Table 5:
Prevalence of Comorbid MD/SUDS with Axis II Disorders

	Suicide Completers (n=18)	
	N	%
Borderline	8	44
Antisocial	6	33
Passive Aggressive	4	22
Avoidant	4	22
None	3	17

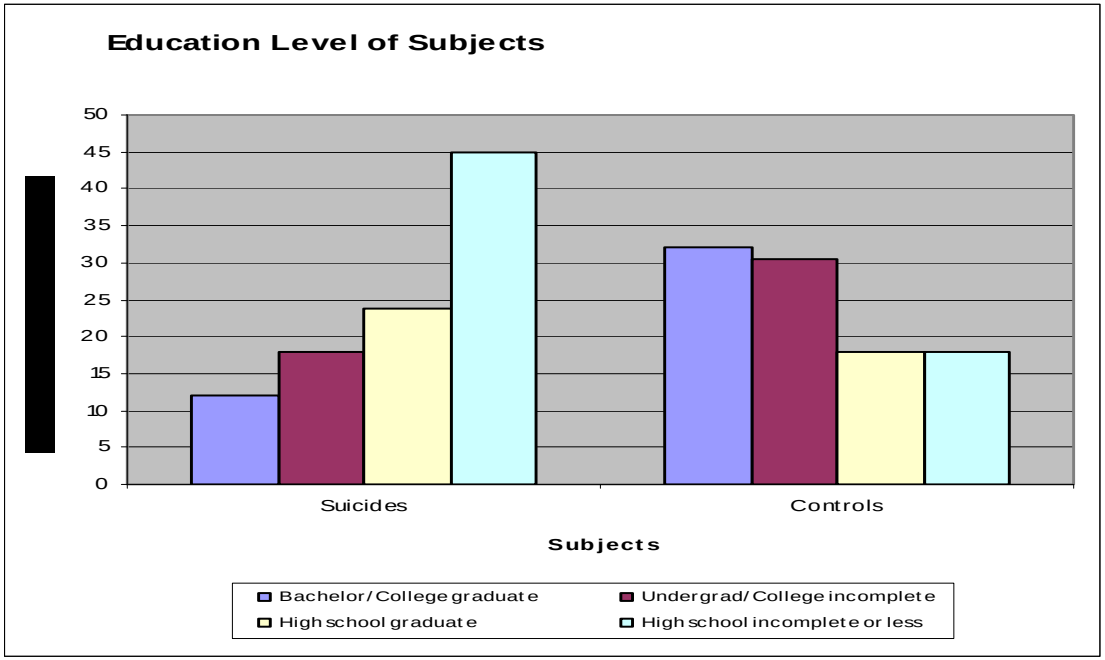
Table 6:
Most prevalent comorbid disorders in Axis I (6 month prevalence)

	Suicide completers with any comorbidity in axis I n=56 (84%)
Mood + SUD	18
Mood+ Anxiety	5
Mood + Eating Disorders	4
Mood + Gambling	2
Mood + Schizophrenia	1
Mood + Conduct	1
Mood + Other	1
SUD + Adjustment	3
SUD + Anxiety	2
SUD + Schizophrenia	2
SUD + Gambling	2
SUD + Other DSM	1
SUD + Somatoform	1
SUD + Conduct	1
Anxiety + Adjustment	2
Anxiety + Other DSM	1
Mood + Mood	0
SUD + SUD	11

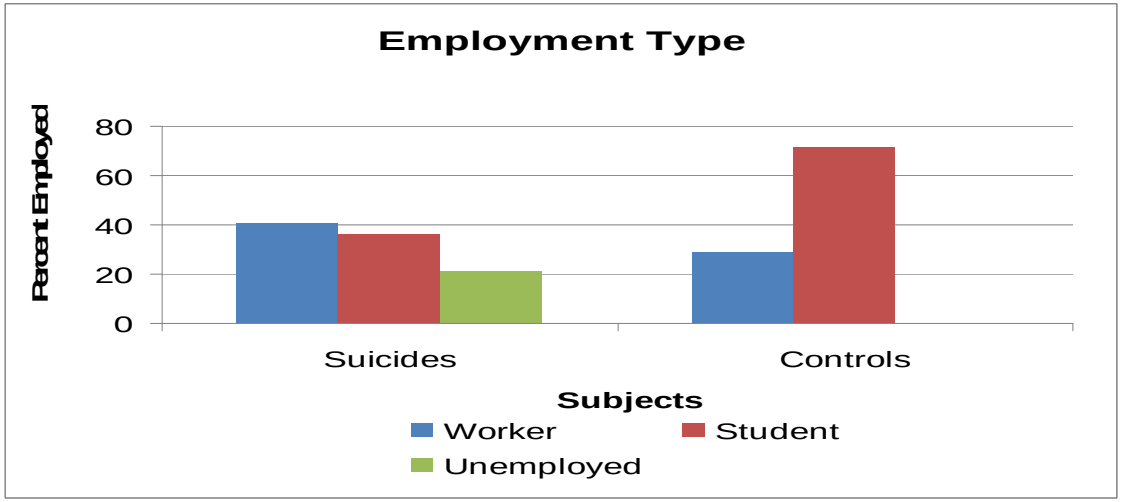
SUD= substance use disorder.

Figure 1a-1d:
Socio economic status

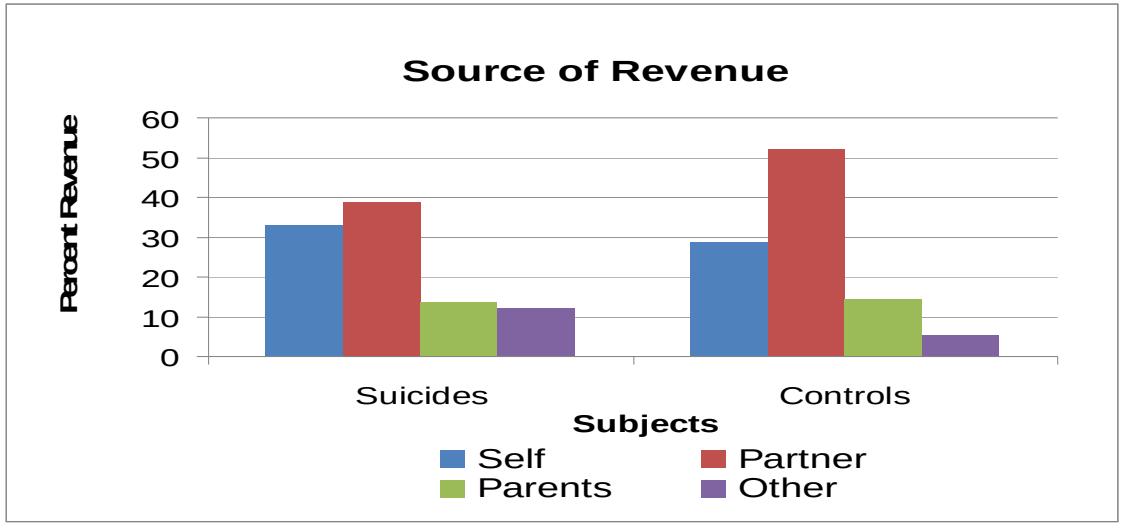
a) Education Level of subjects



b) Employment Type of Subjects



c) Source of revenue for Subjects



d) Household Income for Subjects

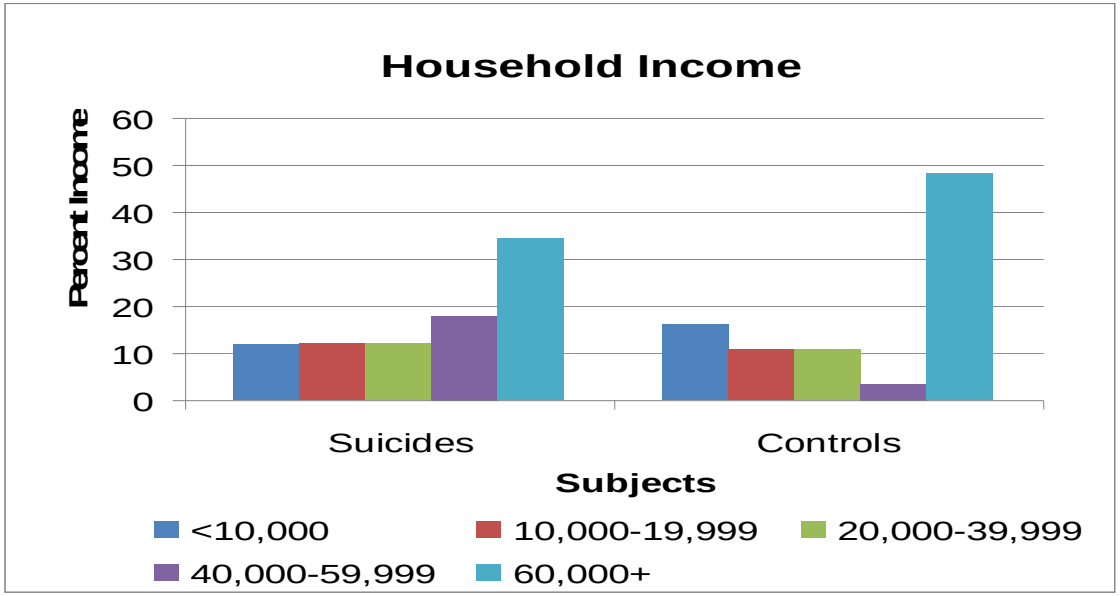


Figure 2:
Method of Suicide (n=67)

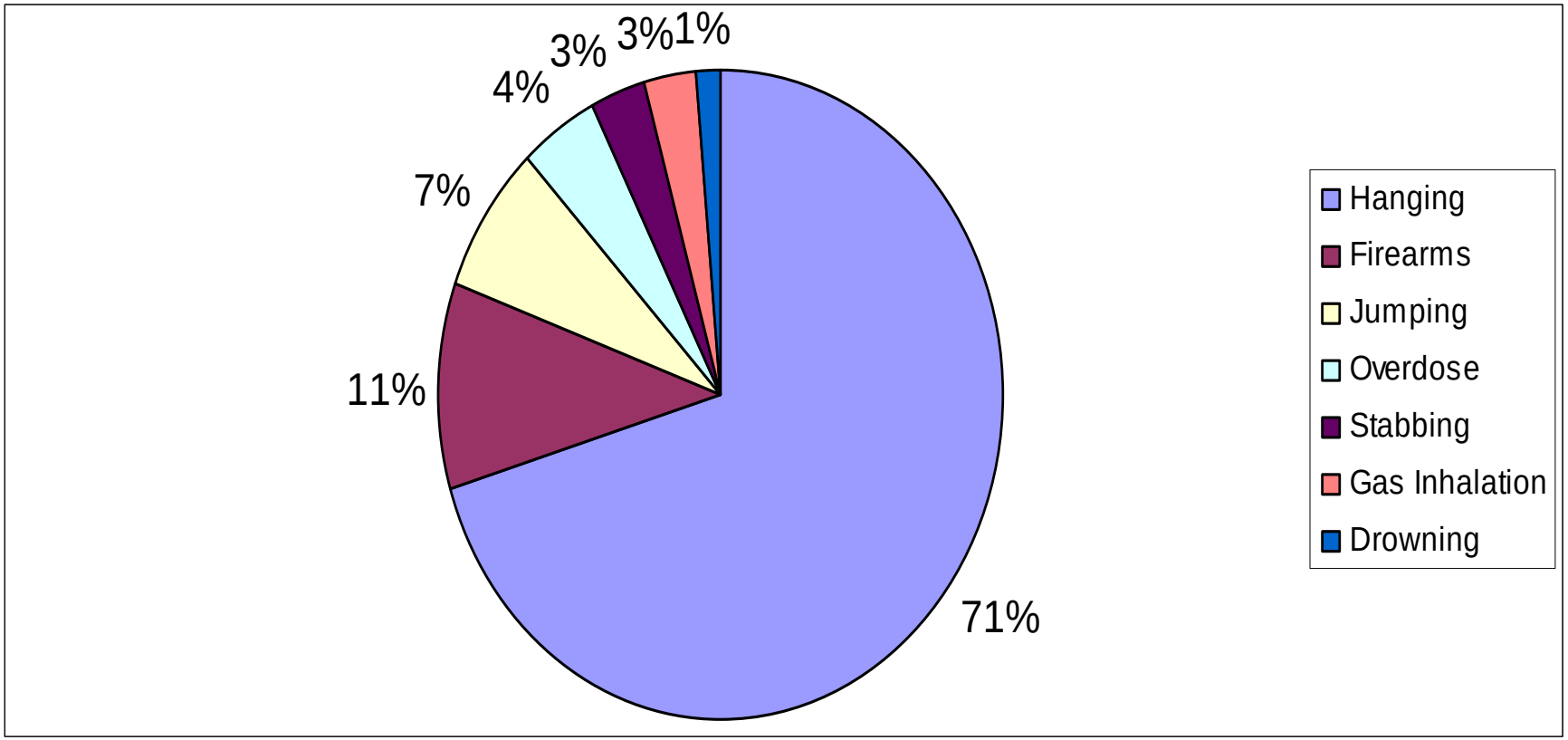


Figure 3:
Number of depressive episodes within suicide completers.

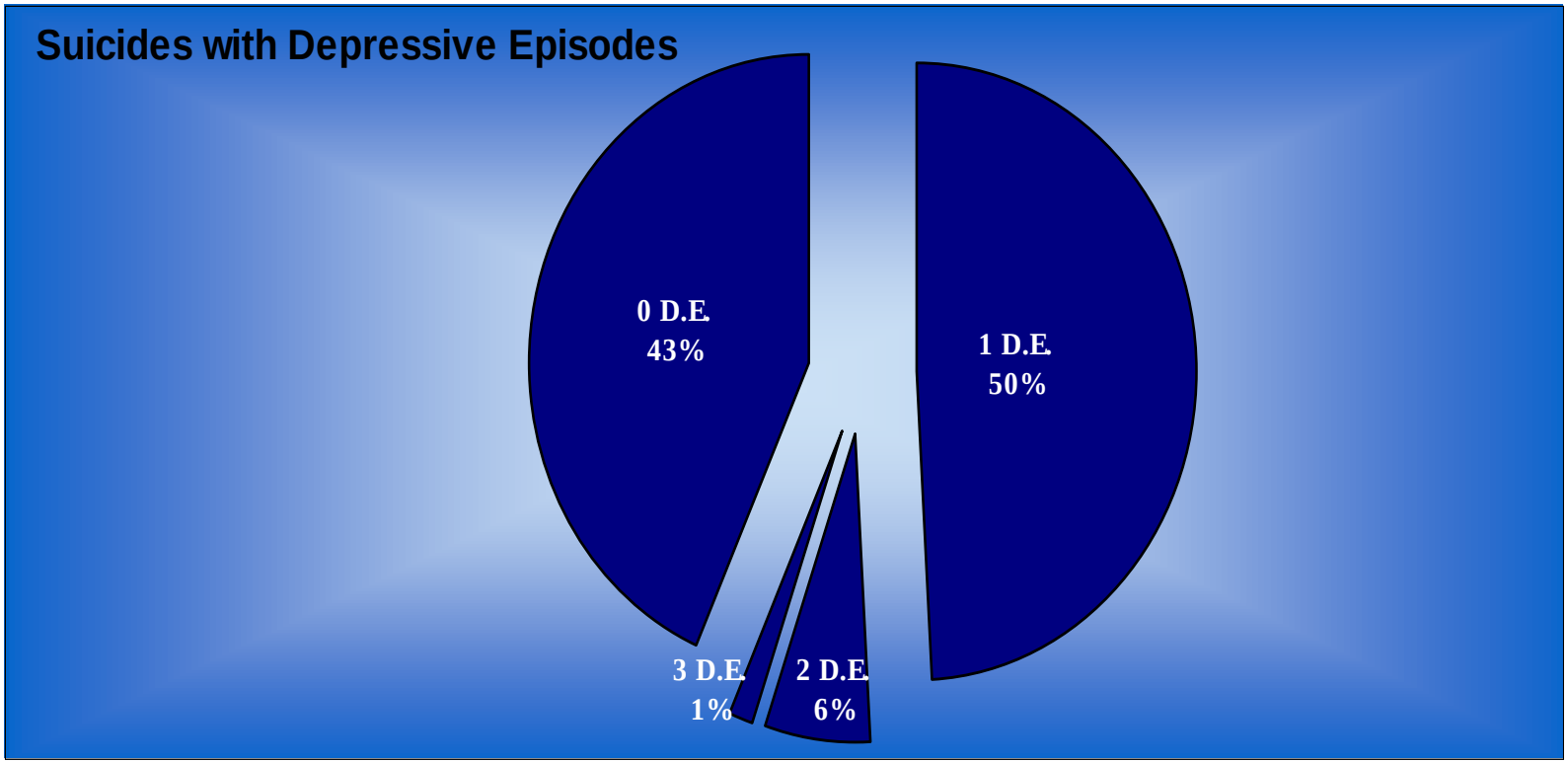
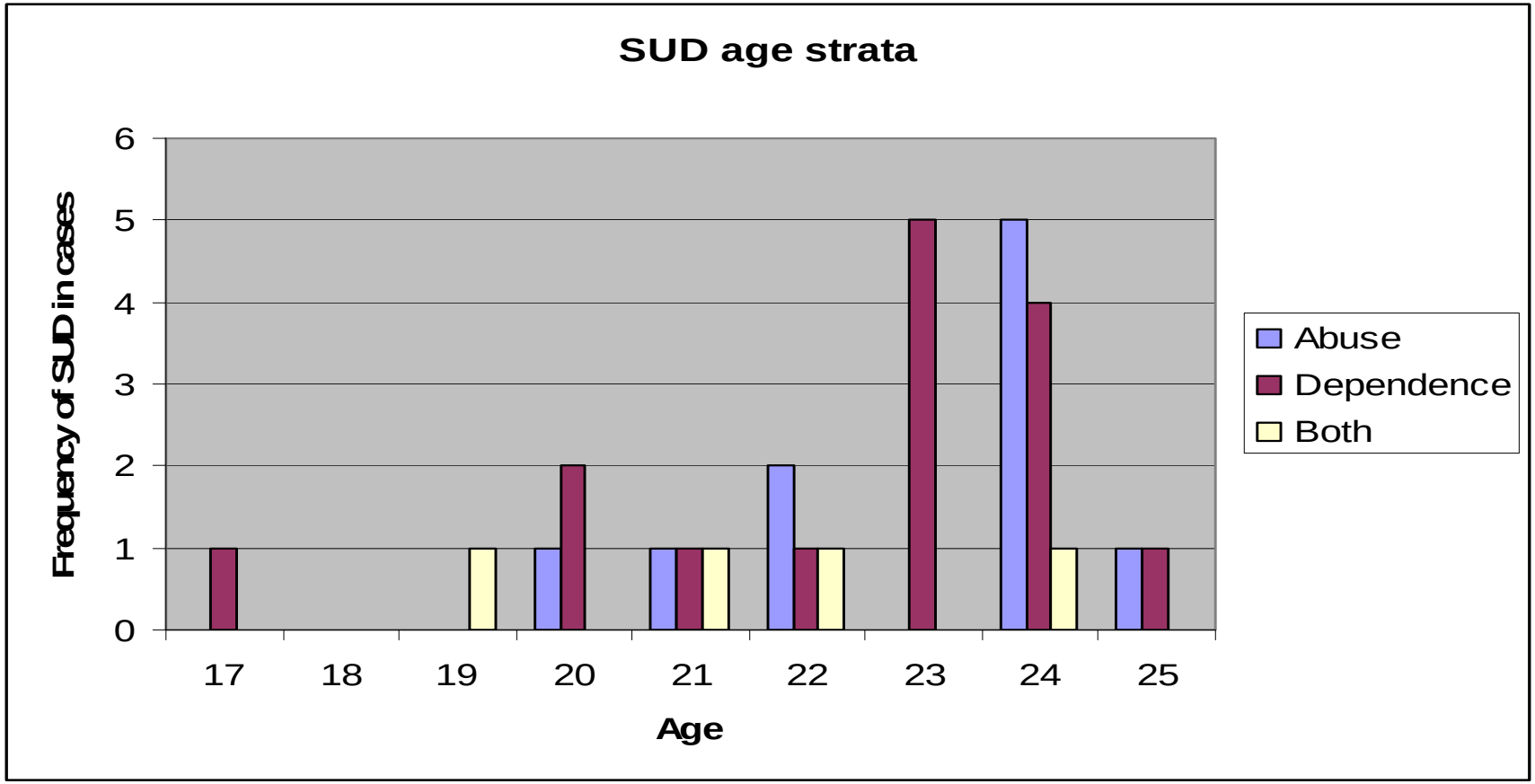


Figure 4: Age strata of those suicide completers with SUD



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CHAPTER 3

DISCUSSION

DISCUSSION

The association that suicide has with psychopathology is very apparent and cannot be questioned. The research in this field is vast and yet not all angles have been investigated. One novel aspect that this paper has investigated is acknowledging what studies have reported about adolescence and adulthood, and comparing these age groups to identify potential risk factors. Another novel aspect was our comparison of those with the mood disorder and SUD comorbidity to those devoid of it.

SCs versus Controls

Outcomes for the first logistic regression analysis were for SCs and controls. Only education level of subjects was significant. Thus, we can suggest those with lower education have a higher risk of completing suicide.

Controls were more likely to be students. SCs on the other hand had employment, student and unemployment status (refer to figure 1). These findings are similar to results reported by Scoliers, Portzky, Van Heeringen, & Audenaert (2009), who investigated multiple suicide attempts and sociodemographic variables. They report that lower education was more prominent in their suicide attempt group compared to the non-suicidal.

In regards to family pathology, it was not surprising to find significantly more psychiatric disorders (depression, alcohol use, number of psychiatric disorder and suicide attempts) within the family members of those who completed suicide, compared to the living controls. Research has found that many individuals with suicide completion or suicidal behaviour come from families with suicidal members (Egeland & Sussex, 1985). Furthermore, children whose parents suffer from

depression (a known risk factor for suicide) are 3 times more likely to be depressed in their adulthood (Birmaher, Ryan, Williamson et al., 1996; Tremeau, Staner, Duval et al., 2005).

There was a higher prevalence of psychiatric disorders in the SC group compared to its controls, supporting our hypothesis. Mood disorders were consistently more prominent in our SC group, a known risk factor of suicide (Brent et al, 1988; Shaffer et al., 1996; Renaud et al., 2008). In fact, majority of those with depression who committed suicide were in a current depressive episode

SUDs followed next in terms of prevalence rates. Much variation occurred. As previously mentioned, studies report substance abuse in 17-30% of their SC group (Brent et al. 1988; Brent et al., 1993; Shaffer et al., 1997; Groholt et al., 1997; Renaud et al., 2008). Those studies reported prevalence rates for substance abuse disorders, and did not find substance dependence. Our study on the other hand did find substance dependence in 22% of our SCs. The studies by Brent et al. (1988; 1993). Shaffer et al. (1996), Renaud et al. (2008) and Groholt et al. (1997) had means of 16-18 years old. We know that substance dependence is considered worse than abuse, and also develops later on, almost a continuation of substance abuse. Perhaps if their substance abusing subjects were older, we might have observed their symptoms of abuse progressing into more severe symptoms of dependence. Thus, this could explain our studies higher prevalence of substance use (which includes both abuse and dependence). Our results maybe best suited to compare to the SUD prevalence found in Fleishmann et al. (2005) and Arsenault-Lapierre et al. (2004), who report higher prevalence of SUD (approximately 40%) in their older SC group Taking into account the idea that abuse in more prevalent in younger age groups, and

dependence occurring more likely in the older age groups, we sub divided our SC group to investigate whether this holds true.

Adolescent (12-18 years old) suicides compared to Early Adult (19-25 years old) suicides.

Mood disorders, SUDs, and number of depressive episodes were all significantly more prevalent in the older SC group than in the younger SC group. At first glance one may assume that older individuals who committed suicide had higher levels of psychiatric disorders. Though this could be the case, our results cannot support this idea without critique. One critique would be the amount of subjects in the adolescent age group. We only had 18 subjects in the adolescent SC group versus 49 in the older SC group.

Some adolescent studies investigate substance abuse but have not found substance dependence. We expected that this maybe a result of the younger ages of the samples studied by researchers. Therefore, one aspect of this study was to investigate how age strata determined type of consumption (abuse versus dependence). Since our study had subjects in both adolescent and adult age ranges, we were able to investigate whether being younger or older resulted in higher prevalence rates of substance dependence. Interestingly, no reports of substance abuse were found in the younger SC group; all substance abuse cases were in the older SC group. Dependence on the other hand was found in low rates in the younger SC group, while significantly more prevalent in the older SC group. Thus, our hypothesis about dependence being more prominent in the older SC group was somewhat supported, however, other studies will be needed to confirm our findings. A problem that may interfere with making firm conclusions on this topic is the fact

that we had 18 suicide completes between 12-18 years old versus 49 suicide completes between 19-25 years old. Thus, our conclusions are limited by the small sample size.

MD/SUDs vs non MD/SUDs

The mood disorder and SUD comorbidity was the comorbid grouping that was most prevalent compared to any other comorbid grouping, in our SC group. Though many studies report that this comorbidity is most noticed (Martunnen et al, 1991; Brent et al., 1993; Renaud et al., 2008) there was some variation in our prevalence rates. Again, this may be due to the age ranges used within studies. A second logistic analysis was conducted for those with the MD/SUDs comorbidity and those not having MD/SUDs grouping. However, no significant risk factors were found.

CONCLUSION

Several questions were addressed within this study. First, asking the association adolescent and young adult suicides had to psychiatric disorders. As expected, our SCs did have significantly more psychiatric disorders compared to our controls. The second question asked whether a certain comorbid grouping was more common among SCs. Once again, as anticipated and repeatedly shown in past research, the MD/SUD grouping was most recorded within SCs compared to any other comorbid grouping. The final question was focused on finding differences between: a) cases and controls, b) comorbid groupings, and c) age strata. We have found some differences, all of which focus on education level, family psychopathology, mood disorders, SUD, aggression, and impulsivity. Our study, not only enhances what other studies have found, but adds a slightly different point of view by taking into account age strata, and comorbid groupings. This study is in

support of a better integration of mental health and addiction services for those youth and young adults at risk of suicide. The accumulated information from our study and those conducted thus far about the risk factors associated with suicide should all be taken into account by intervention programs that account for these factors to better help them prevent suicide. A system that focuses on multimodal treatment intervention with both psychiatric services, addiction services and family intervention would probably be best suited to take on this task.

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APPENDIX