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Trends in Opioid Overdose & Suicide Mortality in Young Adults in Australia 1964-1997

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EXECUTIVE SUMMARY

Aims:
This report compares trends in the rates of deaths attributed to opioid overdose and suicide among young Australia adults over the period 1964 to 1997.

Method:
Data on the age at death and gender for deaths attributed to suicide and opioid overdose were obtained from the Australian Bureau of Statistics for the years 1964 to 1997. Suicide and opioid overdose mortality rates for each year were estimated for males and females aged 15-24 years, 25-34 years, and 35-44 years. Proportional mortality analyses were used to examine differences between each of eight five-year birth cohorts (1940-44, 1945-49, 1950-54, 1955-59, 1960-64, 1965-69, 1970-74, 1975-79) in the proportion of all deaths attributable to opioid overdose and suicide. The cumulative proportional mortality was also estimated for each of the birth cohorts.

Results:
1) *Opioid overdose deaths*
The number of deaths attributed to opioid overdose among Australian adults aged 15-44 years increased from 6 in 1964 to 600 in 1997. The proportion of all deaths attributed to opioid overdose in this age group increased from 0.1% in 1964 to 7.3% in 1997, while the mortality rate per million population increased from 1.3 in 1964 to 71.5 in 1997. There were marked differences between birth cohorts in the proportion of deaths that were attributed to opioid overdose. Persons born between 1944-49 had a consistently low proportion of deaths attributed to opioid overdose throughout the period 1964-1997, while successive birth cohorts showed progressively higher proportions of deaths due to opioid overdose. The onset of the increase in overdose mortality began at progressively younger ages in each successive cohort.

2) *Suicide deaths*
The number of suicide deaths among Australian adults aged 15 to 44 years increased from 720 in 1964 to 1718 in 1997. The rate per million in this age group increased from 152.3 in 1964 to 204.6 in 1997, while the proportion of all deaths attributed to suicide increased from 9.7% to 20.8%.

3) *Opioid overdose compared with suicide*
The pattern of age-related mortality trends differed between these two causes: suicides occurred among younger adults than opioid overdose deaths, and the average age at death has been decreasing for suicide, while it increased for opioid overdose, with both converging around 30 years. The cumulative proportion of all deaths attributed to suicide increased over the eight birth cohorts in a similar way to opioid overdose deaths, but with one difference, namely, the increase in the proportion of deaths attributable to suicide peaked at an earlier age than that for overdose in each birth cohort.

Discussion:
There has been a steep increase in the number and rate of opioid overdose deaths among young Australian adults between 1964 and 1997, an increase that was much steeper than the increase in suicide deaths. Opioid overdose deaths now account for 1 in 11 deaths, while suicide deaths

account for 1 in 5 deaths. Together, these two causes account for almost 30% of deaths among Australian adults aged 15-44 years.

Explanations of trends in opioid overdose:
The increase in the rate of fatal opioid overdose in Australia between 1964 and 1997 is unlikely to be an artefact of changes in the way in which deaths among young adults have been classified. Any such change in diagnostic practice would have to be very marked to explain the fifty six-fold increase in mortality rate from these causes between 1964 and 1997. These changes would also need to have varied markedly with age and sex to explain the observed trends.

The increase in overdose mortality, and the striking birth cohort differences in mortality, are most plausibly explained by an increase in the prevalence of heroin use among subsequent birth cohorts between 1964 and 1997. This hypothesis is supported by historical data on trends in illicit heroin use over the period.

An increase in average heroin purity between 1992 and 1995 has probably contributed to the recent increase in opioid overdose mortality. The higher the blood morphine level, all else being equal, the easier it will be for a heroin user to overdose. Nonetheless, purity is unlikely to be the sole explanation of the increase because mortality increased steadily throughout the study period, rather than being confined to the last three years. If increased heroin purity was the sole explanation of the increase one would expect more deaths among new recruits to heroin use who would have the lowest tolerance for opioid drugs and be the least experienced in judging the purity of street drugs. But the typical overdose fatality in 1997 was a 30 year old male with a 12 year history of regular heroin use.

A number of changes in patterns of drug use may have contributed to the increased rate of opiate overdose deaths between 1979 and 1995. These include: more risky patterns of heroin use, such as injecting alone, or in the street; and an increase in the use of CNS depressant drugs among opioid users, especially by injection. Some of these trends have been observed in New South Wales but it is uncertain how widespread they have become. It may also be that more risky drug use patterns are adopted as opioid users age.

A steady expansion in methadone maintenance treatment over the study period is unlikely to be the explanation of the increase in overdose deaths. This is due to the fact that 80% of opioid overdose deaths in New South Wales between 1990 and 1995 were due to heroin, and methadone maintenance also reduces clients' risk of overdose mortality.

Implications:
Public concern about suicide deaths has prompted national efforts to prevent these deaths among young adults. There has not been a similar concern about nor effort to prevent opioid overdose deaths. There is an urgent need for: education of drug users and their peers about safer drug use practices and effective responses to overdose; increased treatment options for heroin users; and interventions to reduce initiation of heroin use by young persons at high risk of doing so.

1. INTRODUCTION

Suicide is a major cause of premature death among young Australian adults (Cantor et al, 1999; Hassan, 1995). Its prevalence among young adults has increased over the past three decades in Australia, Europe and North America (Diekstra et al, 1995). In 1996 suicide accounted for 19% of deaths among young Australian adults aged 15-24 (Lynskey and Hall, 1998a). Suicide by young adults has appropriately raised societal concern and prompted governments to attempt to prevent its occurrence (National Advisory Council for Youth Suicide Prevention, 1998).

The rate of opioid overdose deaths among young Australian adults aged 15 to 44 years increased six-fold between 1979 and 1995 (Hall and Darke, 1998; Lynskey and Hall, 1998b). The rate of increase in fatal overdoses has been greater than that for suicide so that opioid overdose deaths now account for a substantial fraction of the number of deaths caused by suicide among young Australian adults aged 15 to 34 years (Lynskey and Hall, 1998b).

In this report we compare trends in rates of deaths among young Australia adults attributed to suicide and opioid overdose over the period 1964 to 1997. During this 33 year period, heroin use has become a major public concern and, as we shall see, a substantial public health and public order issue (Manderson, 1993; McCoy, 1980). The aim of the comparison was to investigate the similarity in trends in deaths attributed to opioid overdose and suicide.

There were several reasons for making the comparison. First, opioid overdose deaths and suicide share a number of risk factors. Males are more likely than females to commit suicide (Hassan, 1995) and to die of a heroin overdose (Hall and Darke, 1998). Persons with a history of social disadvantage and poor family relationships are at greater risk of dying from both causes (Beautrais Joyce and Mulder, 1996; Darke and Zador, 1996). Second, there is a substantial correlation between heroin use and suicide. Persons with a history of a substance use, including heroin use, are over-represented among persons who suicide or make serious suicide attempts (Beautrais et al, 1996), and suicide is a cause of death that is elevated among persons who are dependent on heroin (English et al, 1995). Third, there is also some uncertainty about the classification of cause of death in the case of opioid overdose deaths. In cases where the deceased's intent is unclear, it may be difficult to decide if a drug overdose death should be regarded as a suicide or as an accidental opioid overdose (Cantor et al, 1999).

1.1 AIMS

This report examines trends in the population rates and in the proportion of all deaths attributable to suicide and opioid overdose in Australians aged between 15 and 44 over the period 1964 to 1997.

2. METHOD

Data were obtained from the Australian Bureau of Statistics on sex and age at death for opioid overdose and suicide deaths among Australian adults aged 15-44 years, between 1964 and 1997 inclusive. Data were also obtained on the number of deaths from all causes in each of these years for adults in the same age group. The age range was selected on the basis of previous analyses of illicit drug mortality (English et al, 1995) and trends in opioid overdose deaths in Australia (Hall and Darke, 1998), which suggest that most heroin use and opioid overdose deaths occur among Australians in these age groups.

Between 1964 and 1967 opioid overdose deaths were defined as deaths due to opioid dependence (ICD-7 code 323) and accidental opioid poisoning (ICD-7 codes E870, E872). Between 1968 and 1978 ICD-8 codes for opioid dependence (304.0) and opioid poisoning (E853.0, E853.1) were used. Between 1979 and 1997 opioid overdose deaths were defined as deaths due to drug dependence (ICD-9 codes 304.0 and 304.7) and accidental opioid poisoning (ICD-9 codes E850.0, E850.1). Suicide deaths were coded as E970 – E979 between 1964 and 1967, as E950 – E959 between 1968 and 1978 and as E950 – E959 between 1979 and 1997.

Suicide and opioid overdose mortality rates were estimated for each year between 1964 and 1997 for males and females in each of three age groups: 15 to 24 years; 25 to 34 years, and 35 to 44 years. Cumulative proportional mortality were estimated for each of eight five-year birth cohorts of Australians born between 1940 and 1979 (1940-44, 1945-49, 1950-54, 1955-59, 1960-64, 1965-69, 1970-74, 1975-79). The proportional mortality analyses (the percentage of all deaths attributed to suicide or overdose) were used to examine differences between birth cohorts in the proportion of all deaths that were attributable to opioid overdose and suicide over the study period 1964 to 1997. Cumulative proportional overdose mortality was plotted by age at death for each of these eight birth cohorts to examine differences between birth cohorts in the rates of these causes of death.

The statistical analyses reported are primarily descriptive and graphical. Many of the changes are so substantial that statistical tests provide more sanctification than discovery. Odds ratios and 95% confidence intervals are reported where appropriate.

3. RESULTS

3.1 Trends in Opioid Overdose Deaths

The number of deaths attributed to opioid overdose among Australian adults aged 15-44 years increased from 6 in 1964 to 600 in 1997. The rate (per million adults aged 15 to 44 years) increased 56-fold from approximately 1.3 in 1964 to 71.5 in 1997 (95%CI: 24.9, 124.5) (see figure 1). The proportion of all deaths among adults aged 15 to 44 years attributed to opioid overdose increased 90-fold from 0.08% in 1964 to 7.26% in 1997 (95%CI: 40.1, 200.5) (see figure 2). There has been a substantial increase in opioid overdose deaths between 1964 and 1997, whether this is assessed by rate per million of population at risk, or as the proportion of all deaths in the 15 to 44 year age group that are attributable to opioid overdose.

Figure 1: Overdose death rate per million adults aged 15 to 44 years from 1964 to 1997

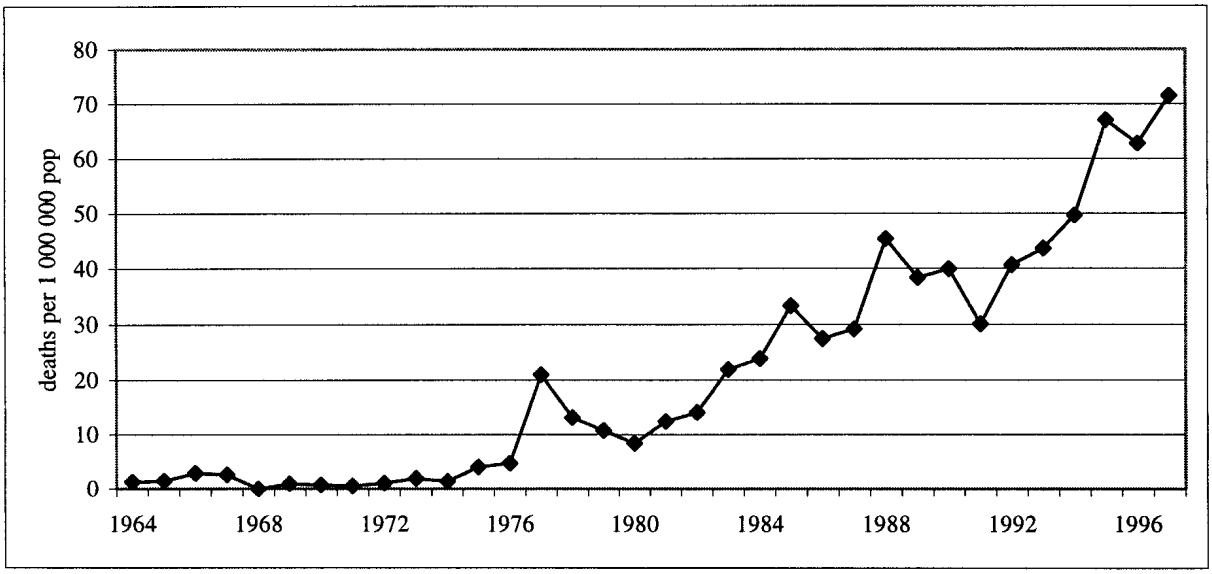
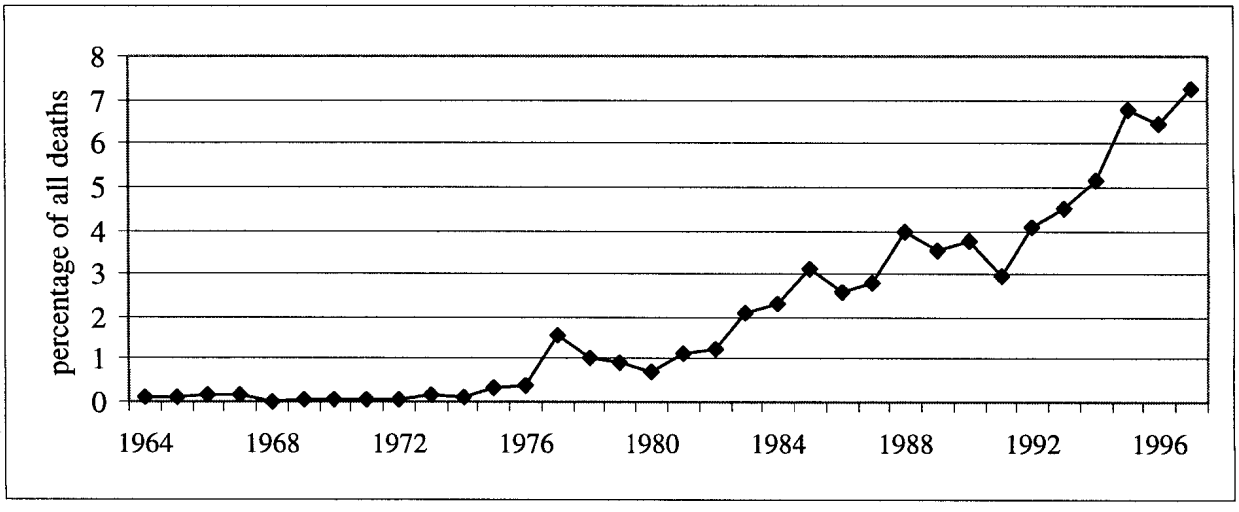


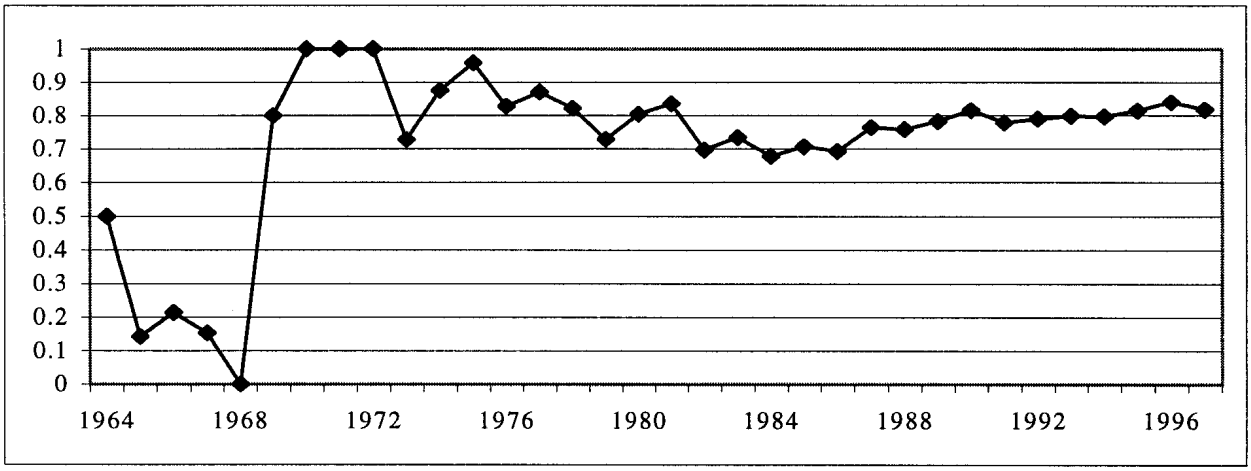
Figure 2: Proportion of all deaths due to overdose among adults aged 15 to 44 years from 1964 to 1997



As shown in Appendix A, in 1997 opioid overdose accounted for 80% of all deaths attributed to illicit drugs in Australians aged 15-44 years. Opioid overdose deaths represented 60% as many deaths as were attributed to alcohol in this age group. It contributed 27% of all deaths attributed to alcohol, tobacco and illicit drugs among young Australians in this age group.

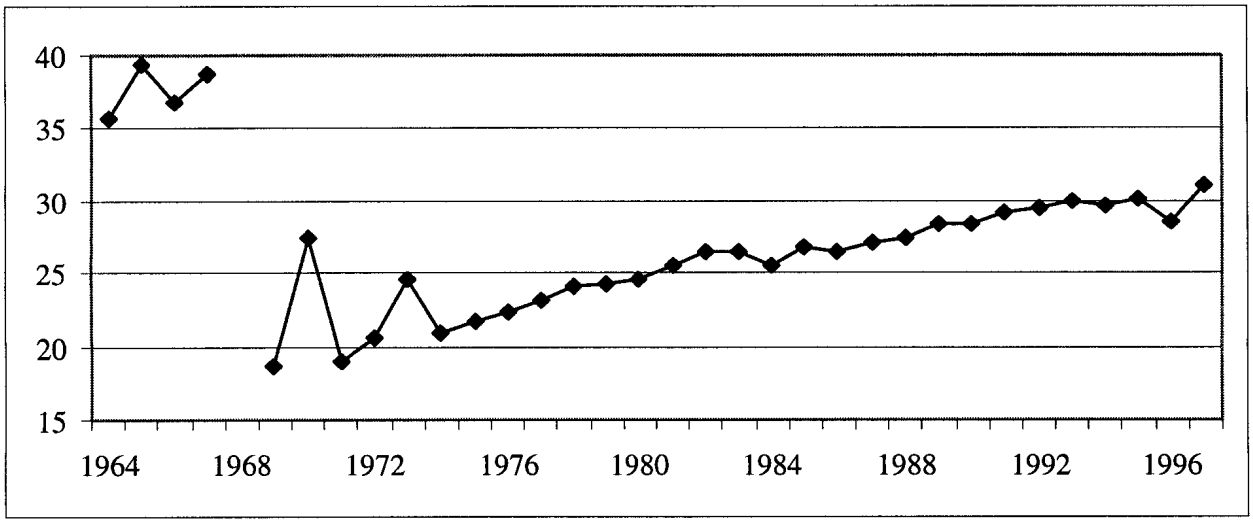
Data presented in Figure 3 and Figure 4 suggests that 1969 was the year in which illicit opioid overdose deaths began to overtake overdose deaths from iatrogenic opioid dependence. Although the number of deaths was small, in this year there was an abrupt change in the proportion of deaths that were male (Figure 3) and in the average age at death (Figure 4). Iatrogenic opioid dependence has primarily been found among middle aged and older females who become dependent on opioids as a result of their use for chronic pain (Ball, 1970; Courtwright, 1982). Illicit opioid dependence, by contrast, has primarily been found among younger, anti-social males who initiate use in the late teens and begin to die of overdoses in their 20s (Courtwright, 1982).

Figure 3: Proportion of opioid overdose deaths in 15-44 years occurring among males, 1964-1997



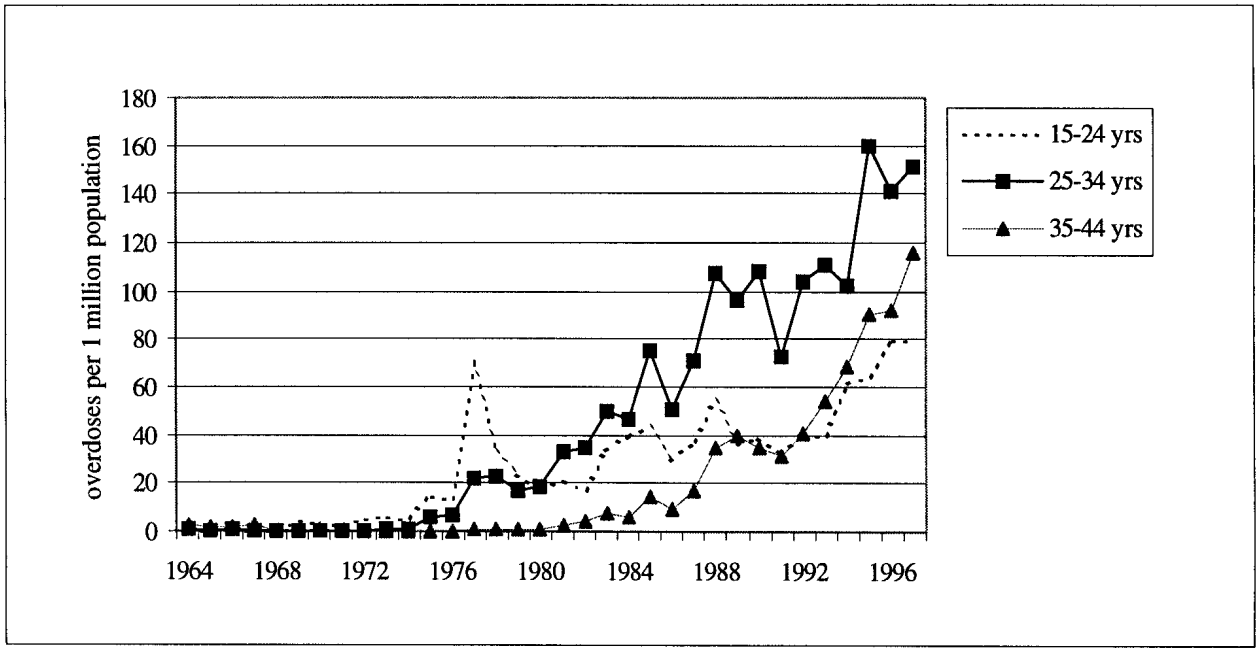
Figures 3 and 4 show that between 1964 and 1967 the proportion of deaths involving males was less than 50% and the average age at death (for adults aged 15-44 years) was between 35 and 40 years. In 1969 the average age at death dropped dramatically to the mid 20s (with some instability because of the small number of deaths involved in the late 1960s). Thereafter, the average age at death steadily increased. In 1969 the proportion of deaths involving males also began to increase, reaching almost 80% in 1976 where it has remained throughout the study period.

Figure 4: Average age of opioid overdose deaths among persons 15-44 years, 1964 to 1997



The increase in the rate of opioid overdose death in the 15 to 44 year age group masks some interesting differences in rates between the 15 to 24, 25 to 34 and 35 to 44 year age groups (see figure 5). Only rates for males are discussed because males accounted for 80% of deaths and female rates are unstable because of the small number of female deaths for much of the 1964 to 1997 period. All three age groups have shown an increase over the study period in the rate of opioid overdose deaths but the largest rate of increase has been among persons aged 25 to 34 years, followed by persons aged 35 to 44 years. Earlier analyses indicated that this reflected opioid overdose deaths occurring among an aging cohort of heroin users who initiated their heroin use in the late 1970s and early 1980s (Hall and Darke, 1998).

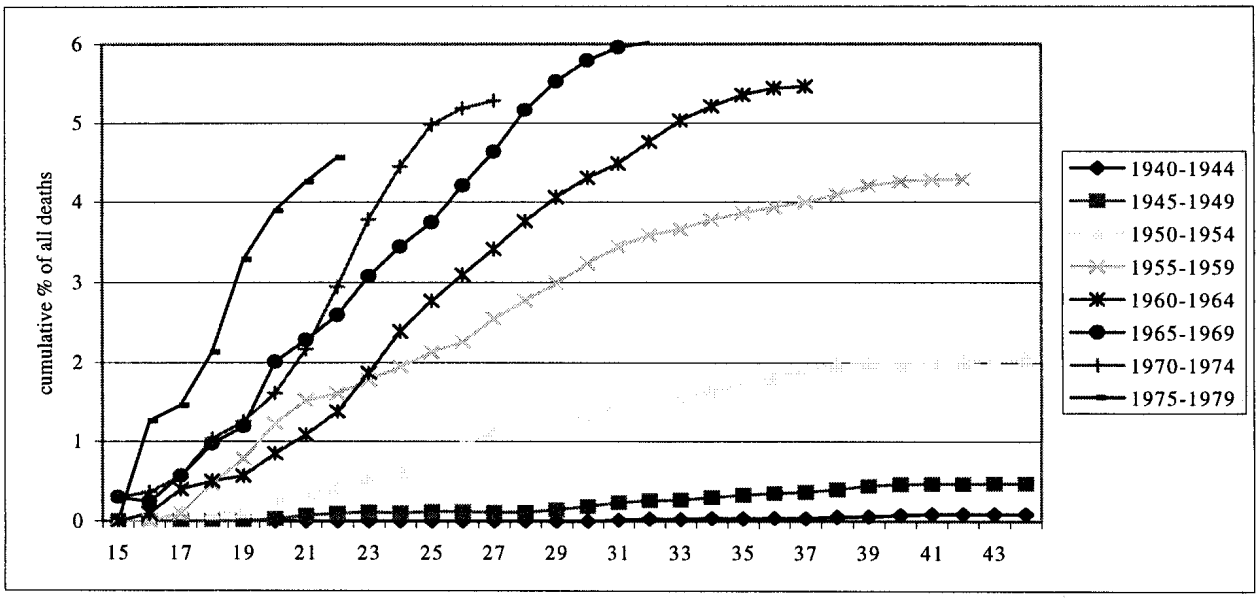
Figure 5: Overdose rate per million males aged 15-24, 25-34 and 35-44 years, 1964 to 1997



3.1.1 Birth Cohort Trends in Opioid Overdose Mortality

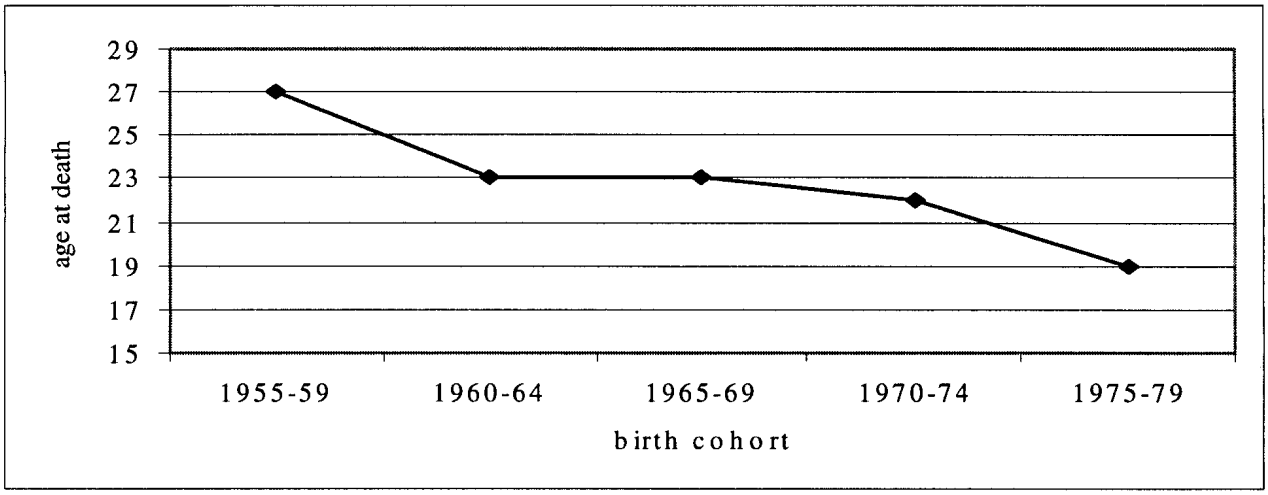
The analysis of cumulative proportional overdose mortality revealed marked differences between birth cohorts in the proportion of deaths that were attributed to opioid overdose (see figure 6). Males born between 1944-49 had a consistently low proportion of deaths attributed to opioid overdose throughout the period 1964-1997. Males in this birth cohort were in their mid to late 20s at the beginning of this period (1964) and so were at much lower risk than later birth cohorts of initiating heroin use. The two cohorts born in the 1950s (1950-54 and 1955-1959) showed a proportional overdose mortality rate which exceeded that of the two preceding birth cohorts born in the 1940s. Each of the subsequent birth cohorts (1960-64, 1965-69, 1970-74) showed a higher proportion of all deaths attributed to opioid overdose than its immediate predecessor did. The 1975-1979 cohort has yet to complete the period of highest risk of initiating heroin use (15 to 25 years) (Chen and Kandel, 1995).

Figure 6: Cumulative proportional mortality attributed to opioid overdose by age at death and birth cohort for males



The other trend in the data is that the proportional overdose mortality rate in each birth cohort began to increase at a progressively earlier age than that of the immediate preceding cohort. This was of the order of one to two years earlier in each succeeding birth cohort between 1955-59 and 1975-79 (see Figure 7).

Figure 7: Age at which the proportion of male deaths attributed to opioid overdose reached 5% of deaths in that year



3.2 Trends In Suicide Deaths

The number of suicide deaths among young Australian adults aged 15 to 44 years increased from 720 in 1964 to 1718 in 1997. The rate per million in this age group increased from 153.9 in 1964 to 204.6 in 1997 (see figure 8). The proportion of all deaths in this age group that were attributed to suicide also increased from 9.7% to 20.8% over the same period (figure 9).

Figure 8: Suicide rate per million adults aged 15 to 44 years from 1964 to 1997

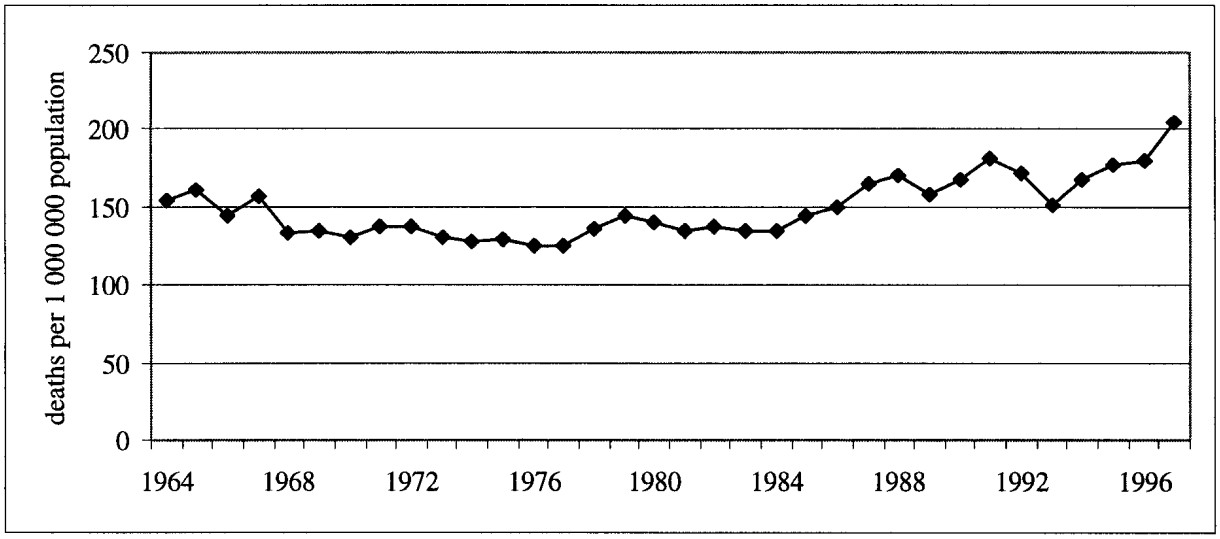


Figure 10 shows that there were some interesting trends in suicide rates among males in the three age groups that have previously been noted (Harrison, Maller & Dolinis, 1994; Hassan, 1995). The rate among 35 to 44 year olds declined somewhat while the rate among 15 to 24 and 35 to 34 year olds year olds increased steeply. Appendix B indicates that the average age at deaths among persons whose death was attributed to suicide declined from approximately 35 years in 1964 to approximately 30 years in 1997. The proportion of deaths that were male increased from 70% in 1964 to 80% in 1997.

Figure 9: Proportion of all deaths attributed to suicide among adults aged 15-44 years 1964-1997

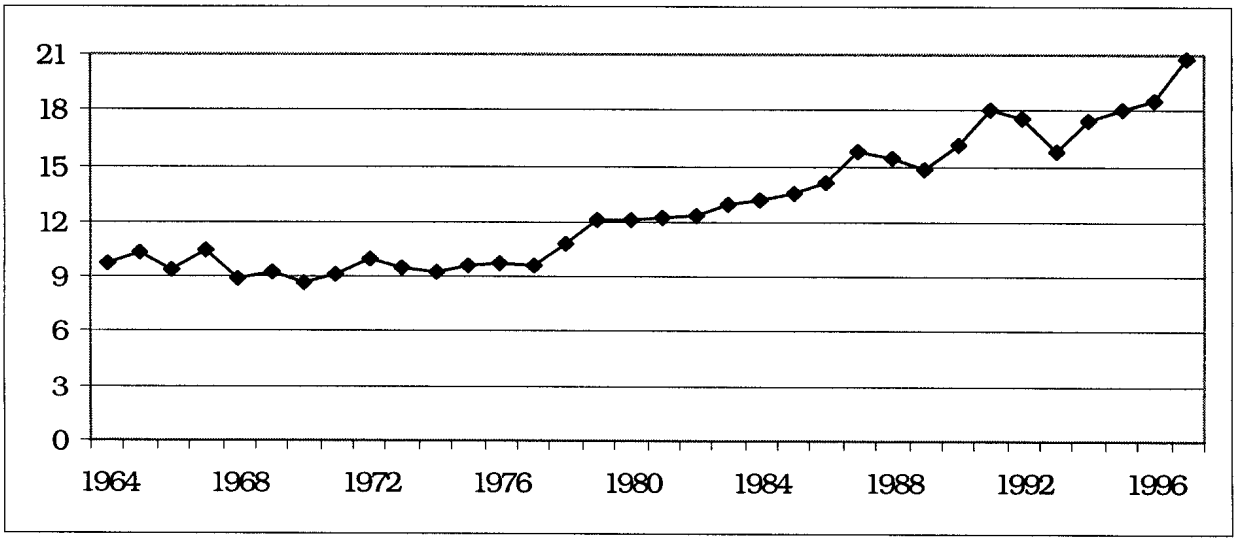
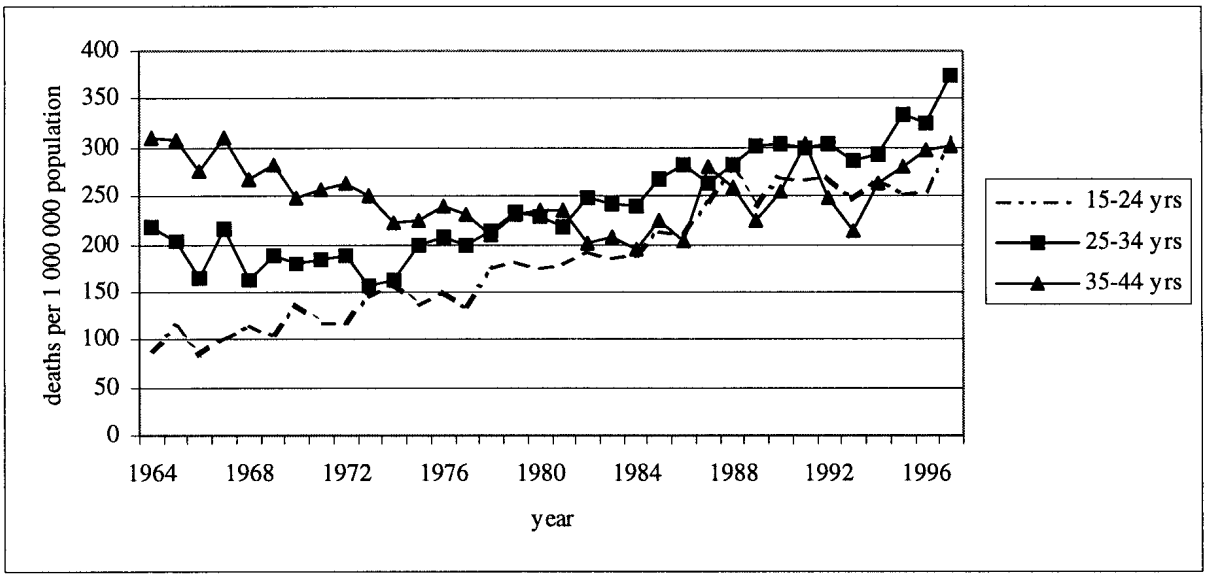


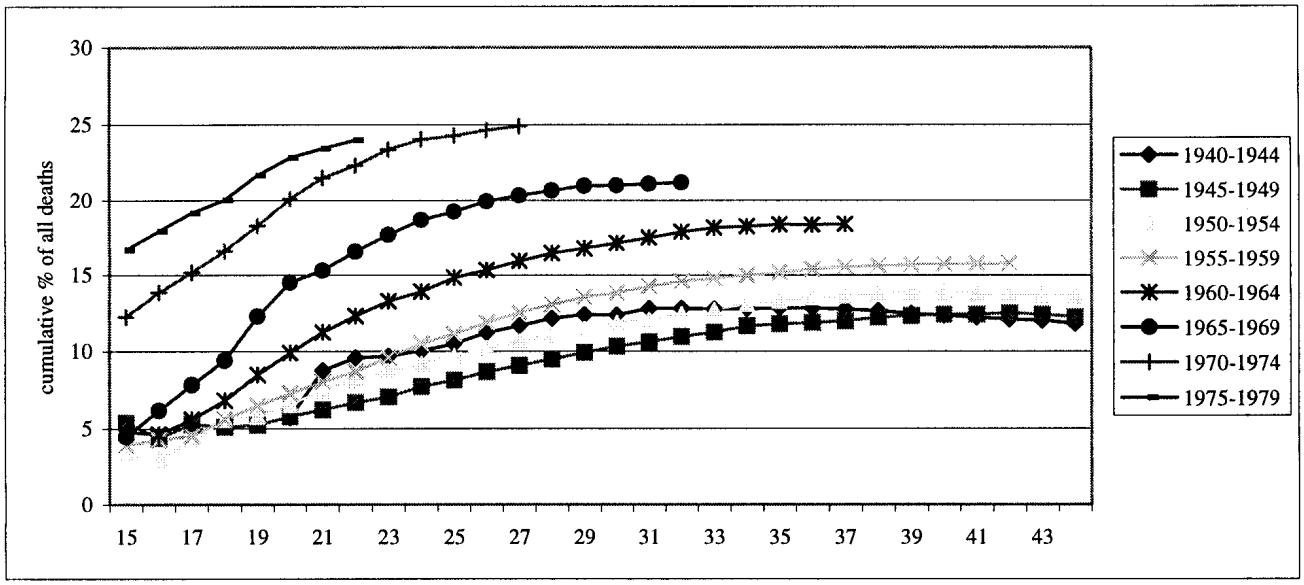
Figure 10: Suicide rate per million males aged 15-24, 25-34, and 35-44 years from 1964 to 1997



3.2.1 Birth Cohort Trends in Suicide Mortality

The cumulative proportion of all deaths attributed to suicide increased over the eight birth cohorts in a similar way to opioid overdose deaths but with two interesting differences (see Figure 10). First, the proportional mortality for suicide begins at a higher level for the 1940-44 birth cohort than it did for opioid overdose. Second, the increase in proportion of deaths attributable to suicide peaked at an earlier age than that for overdose in each birth cohort. It also typically began to decline by the late 20s, the age at which the proportion of deaths attributable to opioid overdose was continuing to increase (see Figure 11). This suggests that the shared risk factors for suicide and opioid overdose deaths in young adults may operate at different ages.

Figure 11:Cumulative proportion of deaths attributed to suicide among persons by age at death and birth cohort for males

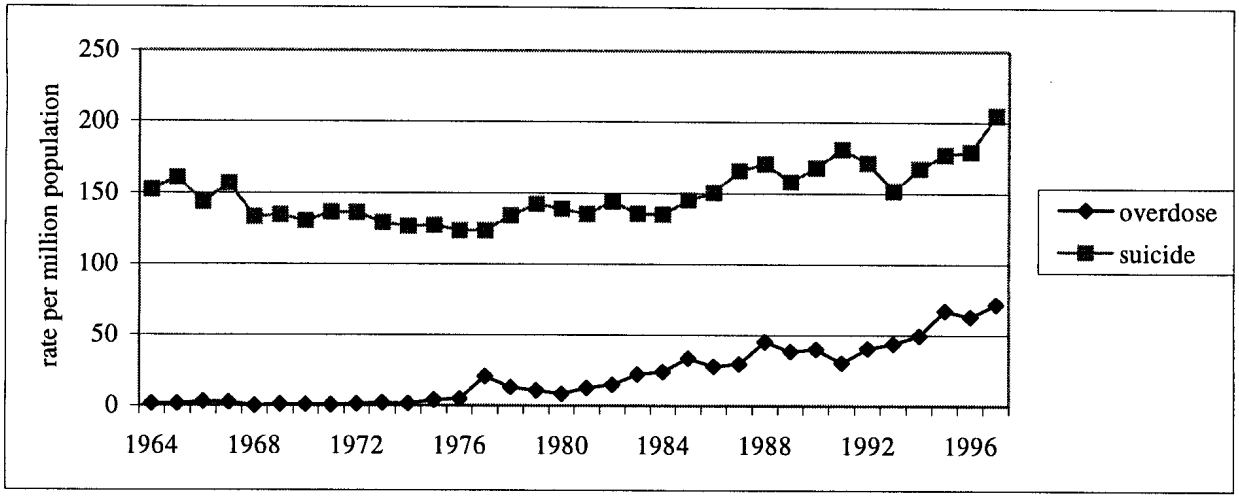


3.3 Comparison Of Trends In Opioid Overdose And Suicide

The analyses of opioid overdose and suicide mortality data showed the following. First, there was a steep increase between 1964 and 1997 in the rate of opioid overdose deaths among young Australian adults aged 15 to 44 years. The rate of increase in opioid overdose deaths has been much steeper than the increase in the rate of suicide deaths in the same age group over the same period (see Figure 12). The average increase per annum in the rate of suicide deaths was 1.3 per million population (95%CI: 0.8, 1.8), compared to an average increase in the rate of opioid overdose deaths of 2.0 per year (95%CI: 1.7, 2.3). Suicide mortality was higher at the beginning of the study period and remained higher throughout whereas opioid overdose deaths began at a very low level in 1964 and increased steeply during the study period.

Suicide deaths account for just under one in five deaths in young Australian adults and opioid overdose deaths now account for one in eleven deaths in the same age group. Suicide and opioid overdose deaths jointly account for nearly 30% of deaths among young adults aged 15 to 44 years. Suicide deaths in young adults deservedly prompt substantial public concern and efforts to prevent them; these data suggest that opioid overdose deaths deserve more public attention than they have hitherto received.

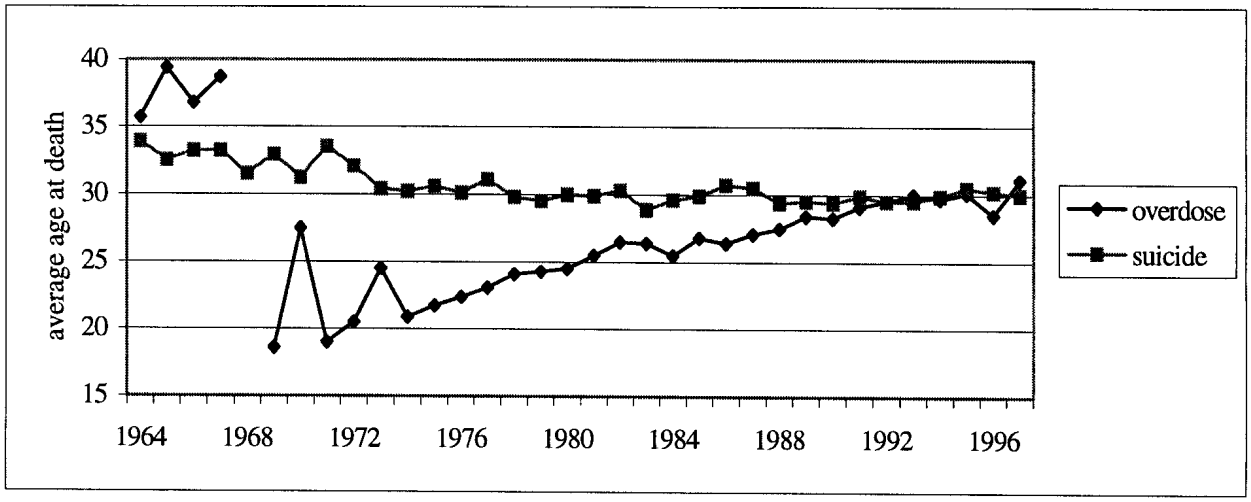
Figure 12: Rate per million population of overdose and suicide deaths among those aged 15-44 years, 1964-1997



Second, both causes of death showed a male preponderance of a similar magnitude (approximately 80%) throughout the study period (see Figure 3, Appendix B).

Third, there were some interesting differences in the patterns of opioid overdose and suicide deaths over this period. The age at death among suicides *decreased* marginally while that among opioid overdose deaths *increased* steadily throughout the period (see Figure 13). This pattern reflected differences in rates of the two causes of death between age groups. For suicide deaths, the steepest rate of increase was among persons aged 15 to 24. Both causes of death showed an increase in rate among adults aged 25 to 34 years but there were opposite trends among adults aged 35 to 44 years: the rate of these deaths decreased for suicide while increasing for opioid overdose deaths.

Figure 13: Average age of suicide and overdose deaths among those aged 15-44 years, 1964-1997

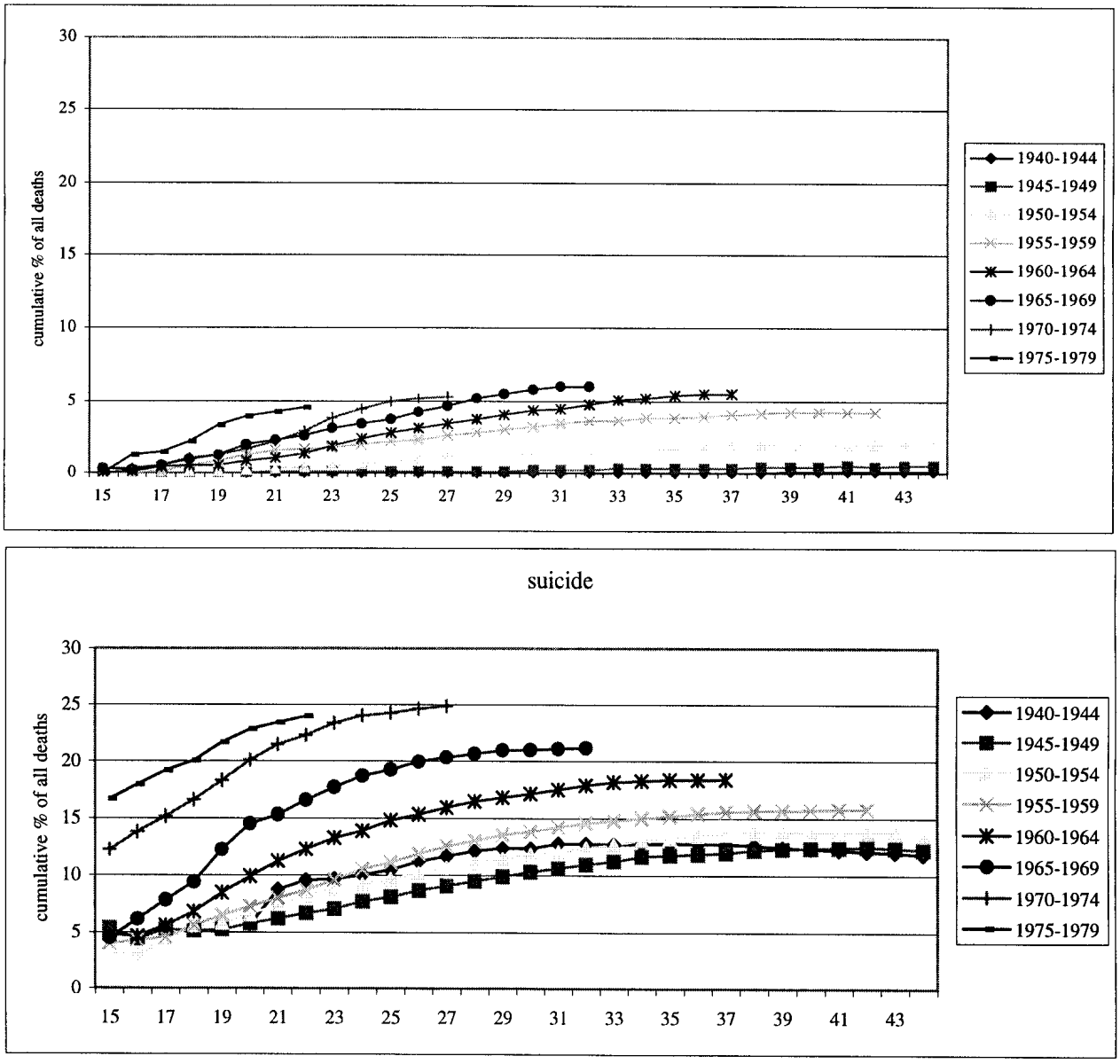


Fourth, the birth cohort analyses revealed some interesting differences in age of onset and offset of mortality from opioid overdose and suicide (see Figure 14). The onset and offset of suicide

mortality occurred at an earlier age: it began to increase in the early to mid teens and reached a plateau in the late 20s, before beginning to decline. Opioid overdose mortality, by contrast, began to increase in the mid to late teens and continued to increase throughout the twenties and into the thirties.

The different trends and birth cohort patterns in opioid overdose and suicide deaths suggest that although it may be difficult to distinguish these causes of death in individual cases, the two causes of death appear to have behaved differently over the period 1964 to 1997.

Figure 14: Comparison of cohort trends in overdose and suicide, males 1964 to 1997



The different trends and birth cohort patterns in opioid overdose and suicide deaths suggest that that although it may be difficult to distinguish these causes of death in individual cases, the two causes of death appear to have behaved differently over the period 1964 to 1997. The excess of

causes of death appear to have behaved differently over the period 1964 to 1997. The excess of males in deaths from both causes is very similar but the pattern of age-related mortality trends is very different. Suicides occur among younger adults on average than opioid overdose deaths, and the trends in age have been opposed over the period 1964 to 1997. The average age at death for suicide decreased while that for opioid overdose increased, although each has now converged around a mean of 30 years.

4. DISCUSSION

4.1 Explaining Trends in Opioid Overdose Deaths 1964-1997

The magnitude of the increase in opioid overdose deaths in Australia between 1964 and 1997 makes it unlikely to be an artifact of changes in diagnosis. Similar increases have also been observed in other countries (Sanchez et al, 1995). The steady increase in age at death and the striking birth cohort differences are also unlikely to reflect an increased propensity for coroners and forensic toxicologists to diagnose opioid overdose as a cause of death; any such diagnostic errors would have to be strongly related to age at death and to birth cohort to explain the striking patterns reported here.

These birth cohort trends in proportional opioid overdose mortality are also consistent with historical data on post-war illicit heroin use in Australia (Manderson, 1993; McCoy, 1974). These historical data suggest that illicit heroin use first came to police attention in Sydney and Melbourne in the late 1960s after Australia began to host Rest and Recreation visits by US servicemen who were on active service in Vietnam. US servicemen in Vietnam were subsequently shown to have high rates of exposure to heroin in Vietnam where the drug was cheap, pure and freely available (Robins, 1973, 1993).

Dependent heroin use had become sufficiently widespread by the beginning of the 1970s to prompt the funding of treatment services for heroin dependent persons. Methadone maintenance treatment was first introduced into Australia in 1970 (Ward et al, 1992) and the first therapeutic communities were established around the same time (Mattick and Hall, 1993). The young adults who initiated heroin use in the late 1960s and early 1970s were members of the birth cohorts born between 1950-54 and 1955-59, (assuming an age of initiation between 15 and 25 years). The proportion of deaths attributable to opioid overdose began to increase in the late 1970s, in the case of the 1950-54 cohort, and in the early 1980s for the 1955-59 birth cohort (see table 1).

A further cycle of recruitment to heroin use occurred in the late 1970s and early 1980s among the 1960-64 and 1965-69 birth cohorts. Public concern about this cycle of recruitment prompted the launch of the National Campaign Against Drug Abuse (NCADA) in 1985. Funding under the NCADA was used to establish needle and syringe exchange programs to prevent HIV transmission among injecting drug users. It also prompted a rapid increase in the number of heroin dependent persons who were enrolled in methadone maintenance treatment, an increase that was sustained over the next decade (Ward et al, 1992).

Overdose mortality in the 1960-64 and 1965-69 birth cohorts began to increase in the middle 1980s. These deaths, from a larger cohort of heroin users, were added to overdose deaths that occurred at a somewhat later age, and at a lower rate, among the smaller number of older heroin users from the two preceding birth cohorts. The high rate of overdose deaths in the two 1960s birth cohorts has continued throughout the study period 1979-1996. During this time deaths in this birth cohort accounted for half of all overdoses deaths (Hall and Darke, 1997).

These data suggest that we may be in the midst of a new cycle of recruitment to heroin use that began in the early 1990s among the 1970-74 and 1975-79 birth cohorts. Since the latter cohort is in the midst of the period of highest risk of recruitment to heroin use, the number of users and subsequently the rate of overdose deaths can be expected to continue to increase; it may even surpass that of the two preceding birth cohorts.

4.1.1 A Declining Age of Initiation of Heroin Use?

Apart from the time trend in mortality, the other noteworthy feature of these data is the progressively earlier onset of the increase in overdose death rates with each successive birth cohort. This trend is consistent with data on self-reported age of first heroin use among these birth cohorts (Lynskey and Hall, 1998a). This has shown a decrease of 1-2 years in the self-reported age of first heroin use in three ten-year birth cohorts (1940-49, 1950-59; and 1960-69). This finding suggests that the opportunities to use heroin have increased with each birth cohort.

A plausible explanation of the increasing proportion of deaths attributable to opioid overdose in each birth cohort is that the substantial number of dependent heroin users in the immediately preceding birth cohort has sustained a heroin market that has, in turn, made it easier for members of later birth cohort to use heroin at an earlier age. The earlier onset of overdose mortality is consistent with the finding that earlier initiators of any drug are more likely to develop dependence on the drug. Other data suggests that overdose deaths begin to occur after a period of continuous heroin use which would be reached at an earlier age in persons who initiate use at an earlier age (Lynskey and Hall, 1998a).

4.1.2 Increasing Heroin purity

According to the popular media, the recent rise in opioid overdose deaths is the result of an increase in heroin purity; more sophisticated observers emphasise the role of variations in heroin purity. It is not simply variability in heroin purity that matters; this has probably always been a feature of illicit heroin markets in Australia and elsewhere. The average level around which heroin purity varies is also important, e.g. a 10% variation around a mean heroin purity of 50% (i.e. +/- 5%) is more likely to be lethal than a 20% variation around an average purity of 5% (+/- 1%). Time trend data on heroin purity and overdose fatalities in South Western Sydney between 1991 and 1993 (Darke et al, 1999) confirms that both the mean and variance of heroin purity were moderately correlated with opioid overdose fatalities.

There is reasonable evidence that average heroin purity increased between 1992 and 1995 (Australian Bureau of Criminal Intelligence, 1996). The average purity of heroin samples collected in Sydney in 1993-1995 was 60%, two to three times that reported earlier in the decade (Weatherburn & Lind, 1995). There was also a doubling between 1992 and 1995 in the average blood morphine levels in fatal heroin overdoses in South Western Sydney (Darke et al, 1997).

Increased heroin purity has, in all probability, made a contribution to the increase in opiate-related mortality, since the higher the blood morphine level, all else being equal, the easier it will be for a heroin user to overdose. Nonetheless, purity is unlikely to be the major explanation of the

increase. First, mortality increased steadily throughout the study period, rather than being confined to the last three years. Second, retrospective analyses of overdose fatalities in 1995 found that it was still the case that a large proportion of fatalities had blood morphine levels that were below the conventionally defined fatal range (Darke et al, 1997). Moreover, although the average blood morphine level doubled, the proportion of users who had used heroin in combination with other respiratory depressants, such as alcohol and benzodiazepines, was unchanged (Darke et al, 1997).

Third, if increased heroin purity was the sole explanation of the mortality increase one would expect that most of the increase would be among newer recruits who would have the lowest tolerance for opioid drugs and are the least experienced in judging the purity of street drugs. But deaths among young, inexperienced users in the 15-24 age group were rare. The typical overdose fatality towards the end of the study period was a 30 year old male with a 12 year history of regular heroin use. It is seems more likely that increased heroin purity has increased the risk of overdose by amplifying the risks of pre-existing polydrug use (Darke and Zador, 1996).

4.1.3 Changes in patterns of opioid and other drug use

A number of changes in patterns of drug use may have contributed to the increased rate of opiate overdose deaths in recent years. The first possibility is that opioid users may have adopted more risky patterns of heroin use. The simplest possibility is that because it is so cheap, they are using heroin more often each day. Other risky injecting practices include injecting alone or in the street. There is some evidence that street injecting increased in South Western Sydney in the early 1990s (Maher, 1996), and this has been reflected in a doubling of the number of fatal overdoses in public places that have occurred in that region between 1992 and 1995 (Darke et al, 1997). It remains to be discovered to what extent these trends have occurred in other areas of Australia.

A second possibility is that there has been an increase in polydrug use among opioid users, especially an increased use of CNS depressants that are used in riskier ways. The majority of Australian opioid users have traditionally used a wide range of other drugs, including alcohol and benzodiazepines (e.g. Darke & Hall, 1995), but there is no evidence that the *prevalence* of polydrug use has increased among persons who have died of opioid overdoses over the study period. In the Darke et al (1997) study, the proportions of cases in 1992 and 1995 in which alcohol, benzodiazepines and other drugs were detected were the same, as was the mean blood alcohol level.

A third possibility is that changes in the route of administration of other CNS depressant drugs over the period have increased the risk of opioid overdose deaths. There has been, for example, a trend in New South Wales in recent years for heroin users to inject preparations intended for oral consumption, such as, benzodiazepines tablets (Darke et al, 1995) and methadone syrup (Darke et al, 1996a). Injectors of these substances are more likely to report a drug overdose (Darke et al, 1996 a, b), as would be expected because the peak plasma level of benzodiazepines and methadone is higher when they are injected rather than taken orally. When combined with heroin, the risk of overdose would be considerably increased by the injection of benzodiazepines or long-acting opioids like methadone.

A fourth possibility is that these more risky drug use patterns may be adopted as opioid users age. If older heroin users find it more difficult to sustain a high rate of daily heroin injection, their tolerance for opioids would be lower and more variable than that of younger, regular heroin users. This would make older heroin users more vulnerable to the respiratory depressant effects of purer heroin. This risk would be increased if they were also more likely to use benzodiazepines and alcohol. It also may be that liver disease in older users (caused by chronic hepatitis) could make them less able to metabolise opioids, alcohol and other drugs, and hence, more vulnerable to polydrug toxicity. Older users may also be more likely to use alone, reducing the chance of being assisted by others in the event of an overdose. It may also be that users who initiated and used heroin with a purity about a third to a half of current street heroin are less familiar with the risks of overdose and more likely to under-estimate the risks of reduced opioid tolerance when resuming use after a period of abstinence.

These changes in drug use patterns may have contributed to increased rates of opioid overdose deaths in some locations in New South Wales. The extent of their contribution is difficult to estimate because it is uncertain how widespread the adoption of riskier drug use and injection practices has been. It also remains to be discovered whether there has been an increased resort to polydrug use as the heroin users who initiated their use in the early 1980s have aged.

4.1.4 More methadone-related deaths?

The increase in opioid overdose deaths has been accompanied by a steady expansion in methadone maintenance treatment. The number of heroin users enrolled in methadone treatment has increased over the study period from approximately 2000 in 1985 to an estimated 20,000 in 1996. The rate of increase in the number of persons receiving methadone treatment has also been highest in New South Wales, which has the highest rate of overdose deaths. There is also evidence that oral methadone syrup is being injected by Sydney heroin users enrolled in methadone programs, and that diverted methadone is being injected by heroin users who are not enrolled in methadone programs (Darke et al, 1996a).

This hypothesis cannot be tested on our data because the ABS mortality data do not distinguish between deaths attributed to heroin use and those attributed to methadone. Nonetheless, an increase in methadone-related deaths is unlikely to explain the increase in opioid overdose mortality. First, Zador, Sunjic and Darke (1996) data on methadone deaths in New South Wales between 1990 and 1995 found that 80% of opioid related deaths were due to heroin. Second, Sunjic, Zador's and Basili's (1998) study of deaths among patients in the NSW methadone program found that methadone maintenance had a protective effect on mortality from overdose, a finding that is consistent with the literature (e.g. Caplehorn et al, 1994; Ward et al, 1992). Sunjic, Zador and Basili (1998) also found that the increase in the number of deaths among methadone program participants reflected an increase in the number of patients enrolled in the program.

4.1.5 HIV/AIDS related mortality

A final possibility is that the increase in overdose deaths among older heroin users is related, directly or indirectly, to HIV infection or AIDS. It could be, for example, that HIV infection

increased older users' vulnerability to opioid overdose, or it may be that HIV infected drug users are using opioid overdose to commit suicide. Neither is a likely explanation of the increased overdose death rate in Australia. Rates of HIV infection among injecting drug users have remained in the range of 2% to 5% for over a decade and there has been no change in the small percentage of AIDS deaths attributed to injecting drug use between 1985 and 1995 (Feacham, 1995). Suicide is also an unlikely explanation of the increase because blood morphine levels in many cases are not in the conventionally accepted fatal range (Zador et al, 1996).

4.2 Explaining Trends in Suicide deaths 1964-1997

It is not the primary purpose of this report to review what is known about the epidemiology and explanations of secular trends in suicide mortality. This has been reviewed elsewhere for Europe and North America (Diekstra et al, 1995) and for Australia (Beautrais, 1999; Cantor et al, 1999; Hassan, 1995). In this section we summarise the main conclusions derived from these analyses.

First, the major risk factors for suicide death among adolescents and young adults are a history of depressive illness and anti-social behaviour, including drug use and drug use disorders (Beautrais et al, 1996; Beautrais, 1999; Diekstra et al, 1995). Second, the prevalence of depressive disorders, antisocial behaviour and drug use among adolescents and young adults has increased since the end of World War II in most countries in Europe, in North America and in Australasia (Diekstra et al, 1995). Third, the prevalence of depressive disorders and substance use disorders has increased in each successive birth cohort since World War II (Diekstra et al, 1995). This has been accompanied by a decreasing age of onset of each type of disorder in each subsequent birth cohort (Diekstra et al, 1995). Diekstra et al (1995) have argued that these trends provide part of the explanation for the increase in suicide mortality among adolescents and young adults in the post-war period. The explanation of these trends in the prevalence of depressive and substance sue disorders is beyond the scope of this report (see Rutter and Smith, 1995).

4.3 Prevention

4.2.1 Preventing Suicide Deaths

Rising suicide rates among young adults have created public concern that has been expressed in a variety of efforts to prevent suicide among adolescents and young adults. These have included school-based educational programs, suicide hotlines, and interventions with youth identified at high risk (Diekstra et al, 1995; Patton and Burns, 1999). To date none of these methods has been shown to reduce suicide rates (Diekstra et al, 1995; Patton and Burns, 1999). The failure to demonstrate the effectiveness of these strategies in preventing suicide cautions against optimism about the prospects of similar strategies substantially reducing opioid overdose deaths. It also reflects common difficulties in preventing suicide and fatal opioid overdoses.

First, suicide prevention programs are attempting to prevent a form of behaviour that is relatively rare in the age group at risk. Suicidal ideation may be more common but serious suicide attempts are still rare (Diekstra et al, 1995). This is also true for heroin dependence which affects less than 1% of the population (Hall, 1996), and fatal opioid overdose affects perhaps 1% of heroin dependent persons per annum (English et al., 1995). Second, there is a concern that preventive educational programs for suicide and drug use may be unintentionally counterproductive.

Educational programs about suicide may, for example, inadvertently destigmatise and normalise suicide in an attempt to increase help-seeking by troubled adolescents. This may counterproductively suggest that suicide is more common than it is and imply that suicide is a form of behaviour that may solve problems (Diekstra et al, 1995). Similar concerns have been expressed about drug education programs. Third, preventive programs for both suicide and drug use often don't reach those who are at highest risk, young males who have left school or are more likely to be truant from school (Diekstra et al., 1995).

4.2.2 Preventing Opioid Overdose Deaths

The steep increase in opioid overdose among persons in the 1970-1974 and 1975-1979 birth cohorts suggest that we are in the midst of a new cycle of recruitment to heroin use that began in the early 1990s. This is consistent with other contemporary data that suggest an increase in heroin use and a decline in the age of new heroin users. These data include: decreases in the age of offenders appearing before courts on heroin offences (Australian Bureau of Criminal Intelligence, 1997); increases in treatment-seeking among young adults who initiated heroin use in the past three years (Hando et al, 1997); and ethnographic research on "new" heroin users in South Western Sydney (Maher et al, 1998). Since the 1975-1979 birth cohort is in the midst of the period of highest risk of recruitment to heroin use, the overdose mortality rate in this cohort is likely to continue increasing. Given this, there is a need to implement and evaluate programs to prevent overdose deaths (Hall, 1996).

A first prevention priority must be to reduce the frequency of drug overdoses. We should inform heroin users about the risks of combining heroin with alcohol and other depressant drugs and of the risks of resuming heroin use after a period of voluntary or involuntary abstinence. A potential impediment to the success of such an initiative is suggested by research suggesting that heroin users' perceptions of risk behaviours may reduce behaviour change (Darke and Ross, 1997). Although not all users will act on such information, if similar behavioural changes occur as those that occurred with needle sharing, then overdose deaths could be substantially reduced. Heroin users also need to be discouraged from injecting alone, thereby denying themselves assistance in the event of an overdose (Hall and Darke, 1998).

Increasing the number of heroin users enrolled in opioid maintenance treatment is another useful strategy for reducing overdose deaths because the risk of such deaths is substantially reduced while heroin users are enrolled in methadone treatment (Caplehorn et al, 1994). An increased range of alternative maintenance agents may make this option more attractive to users (Ward, Mattick and Hall, 1998).

A second prevention priority is to reduce the number of fatal overdoses by improving heroin users' responses to the overdoses of their peers (Hall, 1996). Heroin users could be taught simple resuscitation skills so that they can keep comatose users alive until help arrives. Users also need to be encouraged to call an ambulance sooner than is the case at present (Darke et al, 1996c). Their understandable fears of police involvement need to be addressed, and relations between ambulance officers and heroin users need to be improved. Serious consideration should also be

given to a controlled evaluation of the impact of naloxone distribution on overdose fatalities among heroin users (Darke and Hall, 1997).

Peer-based health education programs and the increased availability of clean needle and syringes appear to have maintained low rates of HIV infection among Australian injecting drug users (Feachem, 1995). The public health challenge is to ensure that information about the causes of heroin "overdose" is acted upon so that drug overdose deaths can be reduced.

5. CONCLUSIONS

Opioid overdose mortality among young Australian adults has increased substantially between 1964 and 1997. Suicide mortality has also increased over this period but much less dramatically than opioid overdose deaths. Overdose and suicide deaths have both increased among adults aged 25 to 34, but have showed a different pattern among younger and older adults. Suicide increased more among younger adults aged 15 to 24, while overdose deaths increased more among older adults aged 35 to 44 years.

Overdose and suicide deaths accounted for increasing proportions of deaths among successive birth cohort in persons born between 1940 and 1979 but the rate of increase was much more marked for opioid overdose deaths than for suicides. Opioid overdose deaths were rare among persons born before 1950, reflecting the introduction of illicit heroin use into Australia in the late 1960s and early 1970s. The proportion of deaths attributable to opioid overdose has increased with each birth cohort since 1950, and the rate of increase has begun at a progressively earlier age. This probably reflects increased heroin use, and an earlier age of heroin initiation, in each succeeding birth cohort.

These and other data suggest that there has been an increased rate of initiation to heroin use in persons born since 1975, indicating that the rate of opioid overdose deaths will remain high and possibly continue to increase. There is an urgent need to implement and evaluate a variety of measures to reduce the unacceptable toll of opioid overdose deaths among young adults which now account for almost 10% of all deaths among young Australians aged between 25 and 34 years (Lynskey and Hall, 1998a).

6. REFERENCES

Australian Bureau of Criminal Intelligence (1997). *Australian Illicit Drug Report 1996-97.* Canberra: Australian Bureau of Criminal Intelligence.

Ball, J.C. (1970). Two patterns of opiate addiction. In Ball, J.C. & Chambers, C.D. (eds) *The Epidemiology of Opiate Addiction in the United States.* C.C. Thomas, Springfield, Illinois.

Beautrais, A., Joyce, P. & Mulder, R. (1996). Risk factors for serious suicide attempts among youths aged 13 through 24 years. *Journal of the Academy of Child and Adolescent Psychiatry, 35,* 1174-1182.

Beautrais, A. (1999). Risk factors for suicide and attempted suicide amongst young Australians. In *Youth suicide literature review: setting the evidence-based research agenda for Australia.* Report prepared for the Strategic Research Development Committee of the National Health and Medical Research Council and the Commonwealth Mental Health Branch of the Commonwealth Department of Health and Aged Care.

Cantor, C., Neulinger, K., Roth, J., & Spinks, D., (1999). The epidemiology of suicide and attempted suicide among young Australians. In *Youth suicide literature review: setting the evidence-based research agenda for Australia.* Report prepared for the Strategic Research Development Committee of the National Health and Medical Research Council and the Commonwealth Mental Health Branch of the Commonwealth Department of Health and Aged Care.

Caplehorn JRM, Dalton SYN, Cluff MC et al. (1994). Retention in methadone maintenance and heroin addicts' risk of death. *Addiction, 89,* 203-207.

Chen, K. & Kandel, D.B. (1995). The natural history of drug use from adolescence to the mid-thirties in a general population sample. *American Journal of Public Health, 85,* 41-47.

Courtwright, D.T. (1982) *Dark Paradise: Opiate Addiction in America Before 1940.* Harvard University Press, Cambridge.

Darke, S., & Hall, W. (1997). The distribution of naloxone to heroin users. *Addiction, 92,* 1195-1199.

Darke, S., Hall, W., Weatherburn, D., & Lind, B. (1999). Fluctuations in heroin purity and the incidence of fatal heroin overdose. *Drug and Alcohol Dependence, 54,* 155-161.

Darke, S., & Ross, J., (1997). Overdose risk perceptions and behaviours among heroin users in Sydney, Australia. *European Addiction Research, 3,* 87-92.

Darke, S., Ross, J., & Hall, W., (1995). Benzodiazepine use among injecting heroin users. *Medical Journal of Australia, 162,* 645-647.

Darke, S., Ross, J., & Hall, W., (1996a). The injection of methadone syrup in Sydney, Australia. *Drug and Alcohol Dependence, 43*, 191-198.

Darke, S., Ross, J., & Hall, W. (1996b). Overdose among heroin users in Sydney, Australia: I. Prevalence and correlates of non-fatal overdose. *Addiction, 91*, 405-411.

Darke, S., Ross, J., Cohen, J., and Hall, W (1996c). Overdose among heroin users in Sydney, Australia: II. Responses to non-fatal overdoses. *Addiction*, 91, 413-417.

Darke, S., & Zador, D. (1996). Fatal heroin overdose: A review. *Addiction, 91,* 1757-1764.

Darke, S., Zador, D., & Sunjic, S. (1997). *Toxicological findings and circumstances of heroin-related deaths in South Western Sydney, 1995.* National Drug and Alcohol Research Centre Technical Report No. 40, Sydney.

Diekstra, R.F.W., Kenhorst, C.W.M. and de Wilde, E.J. (1995) Suicide and suicidal behaviour among adolescents. pp 686-761. In M. Rutter and D.J. Smith (eds) *Psychosocial Disorders in Young People: Time Trends and Their Causes.* John Wiley and Sons, Chichester.

English, D., Holman, C.J.D., Milne, E., Winter, M.G., Hulse, G.K., Codde, J.P., Corti, B., Dawes, V., De Klerk, N., Knuiman, J.J., Lewin, G.F., & Ryan, G.A. (1995). *The quantification of drug caused morbidity and mortality in Australia 1995 edition.* Commonwealth Department of Human Services and Health, Canberra.

Feacham, R. (1995). *Valuing the Past...Investing in the Future.* Canberra: Commonwealth of Australia.

Hall, W. (1996) How can we reduce the number of heroin "overdose" deaths*? Medical Journal of Australia* , 164, 197-198.

Hall, W., & Darke, S., (1997). *Trends in Opiate Overdose Deaths in Australia, 1979-1995.* NDARC Technical Report No. 49. Sydney: National Drug and Alcohol Research Centre.

Hall W, & Darke S. (1998). Trends in opiate overdose deaths in Australia 1979-1995. *Drug and Alcohol Dependence, 52,* 71-77.

Hando J, & Darke S. (1998). *NSW Drug Trends, 1997: Findings from the Illicit Drug reporting System (IDRS).* National Drug and Alcohol Research Centre Technical Report No. 56. Sydney: National Drug and Alcohol Research Centre.

Harrison, J., Maller, J., & Dolinis, J., (1994). Suicide in Australia: past trends and current patterns. *Australian Injury Prevention Bulletin, 5,* 1-4. Adelaide: National Injury Surveillance Unit.

Hassan, R (1995). *Suicide Explained: The Australian Experience.* Melbourne University Press.

Lynskey, M. & Hall, W. (1998a). Cohort trends in age of initiation to heroin use. *Drug and Alcohol Review, 17,* 289-297.

Lynskey M, & Hall W. (1998b). Jurisdictional trends in opioid overdose deaths 1988-1996. *Australian and New Zealand Journal of Public Health,*

Maher, L., (1996). *Illicit Drug Reporting System (IDRS): Ethnnographic Component.* NDARC Technical Report No. 36. Sydney: National Drug and Alcohol Research Centre.

Maher L, Dixon D, Lynskey M, et al. (1998*). Running the risks: Heroin, health and harm in South West Sydney.* National Drug and Alcohol Research Centre Monograph No. 38. Sydney: National Drug and Alcohol Research Centre.

Manderson, D. (1993). *From Mr Sin to Mr Big: A History of Australian Drug Laws.* Oxford University Press, Melbourne.

Mattick, RPM, Hall W. (1993). *A treatment outline for approaches to opioid dependence.* National Drug Strategy Monograph Number 21. Canberra: Australian Government Publishing Service.

McCoy, (1980). *Drug Traffic: Narcotics and Organised Crime in Australia.* Sydney: Harper and Rowe.

National Advisory Council for Youth Suicide Prevention (1998). *National Action Plan for Suicide Prevention. Consultation Draft.* Canberra: Commonwealth Department of Health and Aged Care.

Patton, G., & Burns, J. (1999). Preventive interventions for youth suicide: a risk factor based approach. In *Youth suicide literature review: setting the evidence-based research agenda for Australia.* Report prepared for the Strategic Research Development Committee of the National Health and Medical Research Council and the Commonwealth Mental Health Branch of the Commonwealth Department of Health and Aged Care.

Robins LN. (1993). The sixth Thomas James Okey Memorial Lecture. Vietnam veterans' rapid recovery from heroin addiction: a fluke or normal expectation? *Addiction, 88,* 1041-1054.

Rutter, M. &. Smith D.J. (eds) (1995) *Psychosocial Disorders in Young People: Time Trends and Their Causes.* John Wiley and Sons, Chichester.

Sanchez, J., Rodriguez, B., De La Fuente, L., Barrio, G., Vicente, J., Boca, J., & Royeula, L., the State Information System in Drug Abuse (SEIT) Working Group (1995). Opiates or cocaine: Mortality from acute reactions in six major Spanish cities. *Journal of Epidemiology and Community Health 49,* 54-60.

Sunjic, S., Zador, D., & Basili, H., (1998). Methadone syrup-related deaths in New South Wales, July 1990-December 1995. In W. Hall (ed), *Proceedings of an International Opioid Overdose Symposium, Sydney, Australia, 14-15 August 1997.* NDARC Monograph No. 35. Sydney: National Drug and Alcohol Research Centre.

Tagliaro, F., Battisti, Z.D., Smith, F.P., and Marigo, M. (1998). Death from heroin overdose: findings from hair analysis. *Lancet, 351*, 1923-1925.

Ward, J., Mattick, R., & Hall, W. (1992). *Key Issues in Methadone Maintenance Treatment.* University of New South Wales Press, Sydney.

Ward J, Mattick R, & Hall W. (1998). *Methadone Maintenance Treatment and Other Opioid Replacement Therapies.* Amsterdam: Harwood Academic Press.

Weatherburn, D., & Lind, B. (1995). *Drug Law Enforcement and Its Impact on the Heroin Market* NSW Bureau of Crime Statistics and Research, Sydney.

Zador, D., Sunjic, S., & Basili, H. (1998). All-cause mortality rate and risk of dying in methadone maintenance treatment in New South Wales in 1990-1995. In W. Hall (ed.) *Proceedings of an international opioid overdose symposium, Sydney, Australia, 14-15 August 1997.* NDARC Monograph No. 35. Sydney: National Drug and Alcohol Research Centre.

Zador, D., Sunjic, S., & Darke, S. (1996). Heroin-related deaths in New South Wales, 1992: Toxicological findings and circumstances. *Medical Journal of Australia 64*, 204-207.

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APPENDIX A: ESTIMATED MORTALITY ATTRIBUTED TO ALCOHOL, ILLICIT DRUGS AND TOBACCO AMONG THOSE AGED 15-44 YEARS IN 1997

Table 1: Estimated mortality attributed to illicit drugs, alcohol and tobacco in 1997*

	15-44 years			All ages		
	Male	**Female**	**Persons**	**Males**	**Females**	**Persons**
Illicit drugs						
Opiate dependence	426	99	525	443	107	550
Accidental opiate poisoning	64	11	75	73	12	85
Suicide	105	24	129	105	24	129
Hepatitis/AIDS	8	3	11	31	21	52
Other	6	5	11	8	9	17
All illicit drug related	**609**	**142**	**751**	**660**	**173**	**833**
Alcohol						
Cirrhosis	83	44	127	539	144	683
Road injury	277	68	345	370	80	450
Other accidents	73	14	87	259	240	499
Suicide	176	39	215	246	41	287
Assault	57	0	57	90	42	132
Other	111	59	170	961	656	1617
All alcohol related	**777**	**224**	**1001**	**2465**	**1203**	**3668**
Tobacco						
Lung cancer	37	33	70	3853	1350	5203
Ischaemic heart disease	147	26	173	2977	930	3907
Stroke	43	32	75	851	493	1344
Other cancer	32	20	52	1256	401	1657
Other heart/circulatory problems	23	16	39	879	818	1697
Other	22	11	33	3235	1999	5234
All tobacco related	**304**	**138**	**442**	**13051**	**5173**	**18224**
Total drug related deaths	**1690**	**504**	**2194**	**16176**	**6549**	**22725**

* Using the attributable fractions derived by English et al., (1995).

APPENDIX B: TRENDS IN PROPORTION OF TOTAL SUICIDE DEATHS IN 15-44 YEAR AGE GROUP OCCURRING AMONG MALES AND AVERAGE AGE AT DEATH, 1964 TO 1997

Figure 15: Proportion of total suicide deaths in 15-44 year age group occurring among males, 1964 to 1997

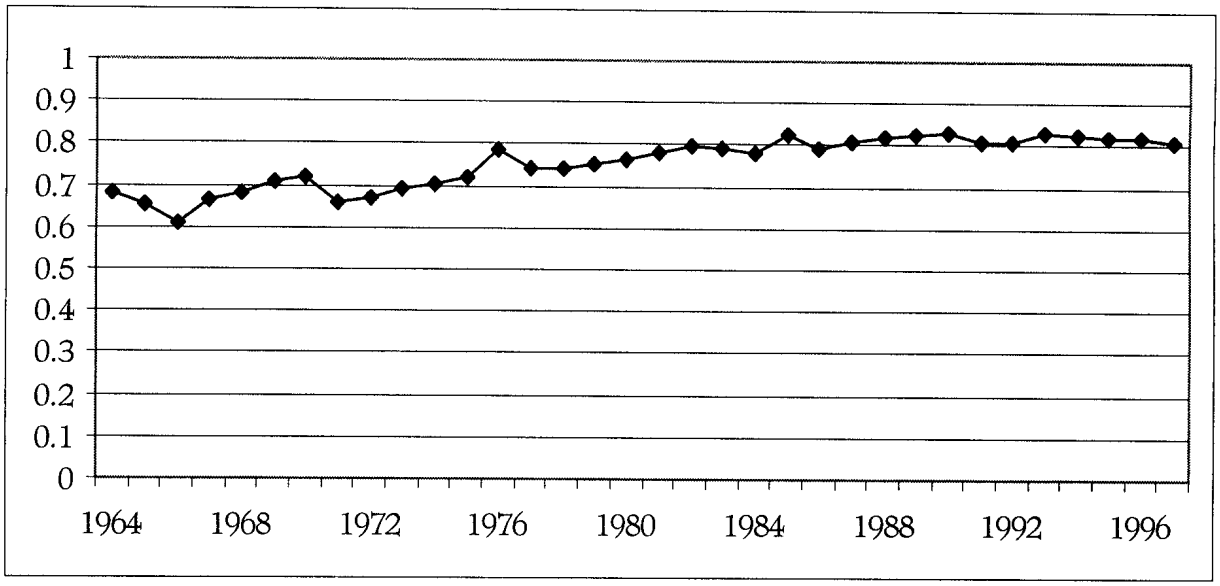

Figure 16: Average age at death of suicides among persons aged 15-44 years, 1964 to 1997