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Suicide in England and Wales 1861-2007: A time trends analysis

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Abstract

Background

Suicide is one of the leading causes of premature mortality worldwide. Few studies have assessed long term trends or sex differences in its incidence over time. We have investigated the age-, sex- and method-specific trends in suicide in England and Wales from 1861-2007.

Methods

Overall age-standardised suicide rates using the European Standard Population and age-, sex- and method-specific rates were calculated for ages 15 and over from 1861-2007.

Results

Rates in males were consistently higher than females throughout the 19th and 20th centuries, although the male: female sex ratio fluctuated from 4:1 in the 1880s to 1.5:1 in the 1960s. Suicide rates increased in all age groups in the 1930s, coinciding with the Great Depression. The highest male rates (30.3 per 100 000) were recorded in 1905 and 1934 and have since been declining. Female rates peaked in the 1960s (11.8 per 100 000), declining afterwards. In both sexes the lowest recorded rates were in the 21st century.

There was a rapid rise in the use of domestic gas as a method of suicide in both sexes following its introduction at the end of the 19th century. There was no evidence that this rise was accompanied by a decline in the use of other methods. Self-poisoning

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also increased in popularity from the 1860s (5% of suicides) to the 1990s (22% of suicides).

Conclusions

The epidemiology of suicide in England & Wales has changed markedly over the past 150 years. The rapid rise in gas suicide deaths in the 1920s highlights how quickly a new method of suicide can be established in a population when it is easily available. The increase in suicides during the Great Depression has implications in relation to the current economic crisis. Changes in the acceptability and lethality of various suicide methods may account for the large variations in sex ratios over time.

Keywords

Suicide, epidemiology, secular trends

Introduction

Suicide is one of the three leading causes of death amongst 15 to 44 year olds worldwide and is the cause of almost one million deaths each year in people of all ages¹. Between 2004 and 2006, it accounted for 5.2% and 2.3% of potential years of life lost before 75 years of age in men and women respectively in England and Wales². There were marked declines in suicide rates in the last 50 years of the 20th century in England and Wales^{3,4}. With a few exceptions^{4,5}, previous analyses of secular trends in suicide in England and Wales and other countries have largely focussed on discrete time periods. Earlier analyses have not investigated changes in the relative incidence of suicide in men and women, changes in age patterns or long-term secular trends in commonly used methods of suicide.

Analysis of such trends may shed light on potentially preventable factors such as the impact on overall rates of the changing popularity of certain suicide methods and the risk posed by periods of economic recession^{6,7}. Knowledge of such factors contributes to national suicide prevention strategies. We investigated the age-, sex- and method-specific trends in suicide to quantify the changing patterns of risk over the last 146 years in England and Wales.

Methods

Suicide mortality and population data for England and Wales were obtained for the period 1861-2007 from the Office for National Statistics (ONS). The year 1861 was the earliest year for which complete mortality records were available. Data prior to 1911 were transcribed from paper records provided by the ONS. Yearly age-specific overall suicide mortality rates per 100 000 were calculated within 10-year age bands

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(15-24, 25-34 until 65 plus). Three year moving averages that were centred on the last year of each 3-year period were then calculated to smooth the annual rates. Yearly age-standardised rates using the European Standard Population and 3-year moving averages were calculated for ages 15 and over.

The codes used for suicide in the 20th and 21st century are shown in Table 1 (supporting information). After 1968, a new category of deaths- deaths from injury undetermined whether accidental or purposely inflicted, was included in the International Classification of Diseases (ICD). There is evidence that approximately 75% of undetermined deaths are actually suicides ⁸. Therefore age-standardised suicide rates including undetermined deaths for ages 15 and over were also calculated after 1968. The ICD codes were also used to ascribe deaths to particular methods (Table 1).

All suicide death rates in the figures were expressed as numbers of deaths per 100 000 men or women. The sex ratio was calculated as the ratio of male suicide rates to female suicide rates.

Results

Overall suicide rates

Figure 1 shows the standardised male and female suicide rates in those aged 15 years and over from 1861-2007. The overall trend was similar when undetermined deaths were included for both sexes from 1968.

Suicide rates in males steadily increased by 67% from 1861 to reach a peak of 30.3 per 100 000 by 1905. Rates then decreased to 21 per 100 000 in 1917 (during World War I), increasing to reach a second peak of 30.3 per 100 000 in 1934, coinciding with the Great Depression. Subsequent declines were interrupted by small increases in the 1950s and 1980s. The lowest male suicide rate (11.6 per 100 000) was recorded in 2007. In contrast, suicide rates in females increased gradually from 6.0 per 100 000 in 1861, peaking at 11.8 deaths per 100 000 in 1964, with slight declines during the two world wars. The rates steadily declined in subsequent years and the lowest female rate (3.2 per 100 000) was seen in 2007.

The male rate was consistently higher than the female rate over the entire time period although the male to female (sex) ratio rose from 3.3 in 1861 to 4.0 in 1886 and 1906 and subsequently declined steadily to its lowest level (1.5) in 1966 before increasing again to around 3.9 in the mid 1990s (see Figure 2).

Age specific suicide trends

Figure 3 shows the age specific suicide rates in men and women for all methods of suicide from 1861-2007. The patterns differed markedly in males and females.

Amongst males, the highest suicide rates were seen in those aged 55-64 and over 65 until the late 20th century when they declined steeply and were surpassed by 25-34 and 35-44 year olds. Males aged 15-24 years had the lowest suicide rates over the entire period. Wide (eight fold) differences in age-specific suicide rates were seen from 1861 to the mid 1950s, when rates began to converge. One of the most striking features of male rates is the halving of suicide rates in men aged >45 during the two

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world wars (1914-18 and 1939-45), whereas there were small rises in younger men. However the peaks of suicide rates observed in 1917 in men younger than 35 years are data artefacts due to the disproportionate number of young men who were conscripted and sent to fight in World War I. The population of young men aged 15-24 years dropped by 40% from 1911-1917. Rises in all age groups were seen during the Great Depression (1929-1935). The highest rate (56.6 per 100 000) was observed in males aged 55-64 years in 1933.

In females, age-specific suicide rates widened between 1861 to the mid 1960s from threefold to ten-fold differences in rates between older and younger women. Just as in males, suicide rates in all female age groups converged in the 1990s due to a fall in rates in older women. From 1861 to 1966, 55-64 year old females had the highest rates, peaking at 20.1 per 100,000 in 1965. Rates in the 45-54 year olds were very similar to those aged 55-64 year until the 1930s, when the gap increased. After 1944, the rates in over 65 year olds increased to become almost identical to the rates in the 55-64 year olds. By 2007, the 45-54 year olds had the highest suicide rates. For the entire time period 15-24 year old females experienced the lowest suicide rates. Between 1861 and 1917 their rates were close to those of 25-34 year olds, although the gap widened subsequently. There was a dip in suicide mortality in all female age groups (most marked in those over 45 years) in the two world wars. Peaks in suicide rates were seen during the Great Depression and in the 1950s and 1960s.

Figure 4 shows secular trends in the sex ratio for suicide in four age groups. There were six fold differences in the age-specific sex ratios prior to the 1930s, ranging from 1.1 in 15-24 year olds to 6-7 in those aged 65+. With the exception of 15-24

year olds, there was a decline in the sex ratios of the majority of age groups between the 1900s and 1960s. This was followed by an increase until the 1990s. The male to female ratio was highest in those aged 65 years and over until 1944, when they were surpassed by the ratio in 15-24 year olds. The ranking of the age-specific sex ratios for suicide almost completely reversed between the 1860s and the 1980s- this reversal largely occurred in the 1960s and 1970s. There was a rapid increase in the sex ratios in all age groups from 1975 to 1991 such that by the 1990s the sex ratios for the two youngest age groups were almost double those of the over 65 year olds. However by 2007, the male to female ratio was highest in those aged 25-44 years.

Suicide methods

Figure 5 shows the secular trends in method specific suicide rates for males and females. "Other" methods accounted for more than 50% of overall suicide deaths in the late 19th and early 20th century. In 1910, drowning, cutting and stabbing and firearms contributed to 35%, 31% and 14% respectively of other methods of male suicide. However in females, drowning and cutting and stabbing were most important, accounting for 58% and 21% of other suicides in 1910. Firearms were used in less than 3% of female suicides.

The incidence of suicide by gassing rapidly increased in the 1910s and 1920s due to the increasing popularity of domestic gas poisoning. It became the most common cause of male suicide in the 1950s and 1960s and of female suicide two decades earlier in the 1930s and 1940s. Prior to the 1900s, gassing was not used as a method. The rapid increase in the use of this method was seen in all age groups for both sexes (figure not included). Dips in gassing rates were also noted around World War II in

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both men and women. Suicides by gassing decreased from the early 1960s to reach their lowest levels by mid 1970s; subsequently there were small increases as a result of the increasing use of car exhaust gases, particularly by males. In neither males nor females did the rapid increase in suicides from gassing between 1920 and 1939 correspond with reciprocal declines in the use of other methods of suicide. The exclusion of suicides by gassing from our assessment of overall trends in suicide changed the patterns seen in both sexes (see supplementary figure on web). The peaks in males and females in the 1920-30s and 1950s disappeared. Female suicides excluding gassing showed a general decline until the 1950s, peaked in the 1960s and 1970s and decreased again afterwards to relatively steady levels by the end of the 20th and early 21st centuries.

Suicide by poisoning increased in popularity from the 1860s until the 1960s in both men and women, although troughs were seen during the two world wars (Figure 5). In the 1860s, self-poisoning accounted for 5% of suicides (mainly ingestion of hydrochloric, oxalic and carbolic acid). By the 1990s, it accounted for almost 22% of suicides, mainly from analgesics and antidepressants. There was a particularly steep rise in poisoning amongst females in the 1950s. Poisoning became the most common method of suicide in men from 1971 to 1979 and in women from 1965 to 2004.

The steep drop in the sex ratio observed for all suicides from the 1910s to the 1960s was greatly diminished when poisoning and gassing suicides were excluded (figure not included). For all suicides there was a 59% decrease in the sex ratio from 3.7 in 1910 to 1.5 in 1966, whereas the exclusion of gassing and poisoning suicides resulted

in only a 27% decrease in the sex ratio from 4.4 to 3.2. However their exclusion did not have any impact on the rapid increase in sex ratio seen after the 1960s.

Hanging was the most frequently used method of suicide amongst males in the 1860s and the 2nd most common method amongst women throughout the 19th century. Suicide rates by hanging decreased in males and females in all age groups over the century from the 1860s to the 1960s. In men, suicide by hanging steadily increased from the 1960s to 2000, remaining relatively constant thereafter. Hanging increased in women from the 1960s to the 1980s, followed by a decline from 1985 to 1996 and a subsequent increase to the present day. It is now the most common method used by females.

Figure 6 shows secular trends in the sex ratio for suicide by method. Two main patterns were observed. First, the sex ratio was consistently highest for hanging and it was lowest for poisoning throughout most of the period. Second, there was a striking change in the sex ratio for gassing from the 1960s, which was most marked between the 1960s and 1970s. Gassing retained the highest sex ratio from 1972 to 2007. Of note most gas-related suicides in this latter period were car exhaust suicides; prior to this domestic gas poisoning predominated.

Discussion

Main findings

This time trends analysis revealed five main findings. First, male suicide rates were consistently higher than female suicide rates throughout the 19th, 20th and 21st centuries, although the ratio of male to female suicide rates changed over time. The sex ratio in the middle of the 20th century was almost one-half of its level in the early

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1900s and 1990s. Second, the age patterns of suicide differed markedly in males and females. In males, 25-34 year olds had amongst the lowest suicide rates until the 1990s when, together with the 35-44 and 45-54 year olds they became the highest risk group. In both males and females 15-24 year olds had the lowest suicide rates. Intriguingly, the age specific rankings of the male to female suicide rate ratios reversed between the 19th/early 20th centuries and the period from the 1990s to 2007. Third, there was a rapid rise in the use of gassing as a method of suicide in both sexes from its introduction at the end of the 19th century until the 1930s, 40s and 50s. This trend was not associated with a compensatory fall in the use of other common methods of suicides such as hanging and poisoning. Fourth, there was a striking increase in the sex ratio of suicides by gassing from the 1960s to the 1970s (from 1.6 in 1960 to 9.1 in 1978), with a less significant increase afterwards. Lastly, the sex ratio was consistently lowest for suicides by poisoning and highest for suicides by hanging for the majority of the time period. Other findings that have been previously described include the dips in male and female suicide rates seen during both world wars and the large increases in suicide rates observed during the Great Depression. Of note the declines in suicide in the two World Wars were largely due to reduction in suicide in the over 45s and reductions in poisoning and gassing.

Strengths and Limitations

As far as we know, this is the first study to examine long-term age-, sex- and method-specific trends in suicide mortality in England and Wales up to the present day. Age-standardised and age-specific rates were used so that the results were directly comparable. The use of a single age category for those aged over 65 years was appropriate as the trends among those aged 65-74 years were similar to those observed for the over 75 year olds. However, there are several limitations of this

analysis. Although the data used in this analysis were obtained from one source (the Office for National Statistics), completeness of suicide death recording may have changed over time as stigma associated with suicide has changed (see below). There have also been changes in the ICD classification over the time period studied. From 1901 there were 10 different revisions of the ICD. However, visual inspection of the figures revealed no obvious jumps or discontinuities in the overall, age- and sex-specific suicide rates in the years when successive revisions of the ICD were implemented in England and Wales (figures not shown). The introduction of a new category “undetermined injuries whether accidentally or purposely inflicted” occurred with the 8th ICD revision in 1968. The fact that the overall trends (including undetermined deaths) mirror the suicide only trends is, however, reassuring. Undetermined deaths were excluded from the method-specific analyses. This may have resulted in underestimation of certain methods of suicides since deaths from overdose and drowning are more likely to be coded as undetermined deaths instead of suicides ⁹. The classification of deaths as suicide or open verdict (i.e. undetermined death) is subject to the interpretation of the coroner. In some countries, for example Ireland and Portugal, there is widespread under-reporting of suicides as undetermined or accidental deaths ¹⁰⁻¹². This can affect the reliability of official suicide statistics. Furthermore, changes in the social acceptability of suicide may lead to biased trend estimates if there is an impact on coroners’ verdicts ¹².

Comparison with previous studies

The highest rates of male suicide were in the early 1900s and 1930s. This latter period includes the Great Depression, a time of high unemployment levels. The rises in suicide around the time of the Great Depression has been reported in many other

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developed countries including the USA ¹³, Australia ¹⁴ and New Zealand ¹⁵, as well as previously in the UK ¹⁶. Peak female suicide rates occurred in the 1930s, coinciding with the male peak during the Great Depression. A second female peak in rates in the 1960s has been hypothesised as being due to post war changes in the role of women in society ¹⁷. However a recent systematic review found very little evidence that increasing female labour force participation rates were associated with increasing female suicide rates¹⁸. It is more likely that the female peak in the 1960s is due to the ease of accessibility of specific methods, in particular barbiturate poisoning ¹⁹.

There were marked differences in age-specific trends in suicide rates consistent with findings from Australia and Switzerland ^{17,20}. Also, the dips in suicide mortality rates in 1917 and 1944 seen for over 45 year olds in both sexes coincide with the two world wars and are in keeping with those seen in other countries. The most widely held explanation for this phenomenon is the greater cohesion within society that may occur during wartime ²¹. However it has been suggested that competing outcomes are also important, i.e. individuals who may have otherwise died by suicide are more likely to die of other causes ²². Other hypotheses include changes in cultural attitudes towards suicide during wartime and the less apparent impact of media coverage of suicide on suicide rates in wartime than in peacetime ^{23,24}. In our study, the young male peaks observed are likely data artefacts as there were sudden decreases in the populations of younger men recorded during wartime. During both world wars, the populations recorded by the ONS referred to civilian populations only and younger men would have been disproportionately sent off to war. However, a Scottish study has also recorded large increases in suicide in younger men together with an increase in firearm deaths during the Second World War ²². The authors proposed that younger men would be more likely to be called to arms and have access to guns and suggested

that access to lethal suicide methods, and the stresses of being a potential combatant contributed significantly to the increased rates in young men. Increases in young male suicides in wartime have also been more recently described in Croatia and Serbia ²⁵.

In our analysis there was a fall in the ratio of male to female suicide rates from the 19th century to the mid 20th century, followed by an increase from the 1970s to 1990s. Similar findings have been described for Australia ²⁶ and Switzerland ²⁰. This increase in sex ratio in the 1990s was seen in all age groups but was most prominent amongst people aged less than 45 years. In young men increasing levels of divorce, declines in marriage and inequality in income were most consistently associated with rises in suicides at this time ²⁷. The highest gender ratios were seen in the 1890s; it is unclear which factors in this period were likely to have affected men so disproportionately compared to women. It is possible that socio-economic factors such as high unemployment would be likely to affect men more than women in this era since men would have been the main breadwinners in most family units in the late 19th century. It has also been argued that increasing modernisation led to a decline in a country's male to female ratio ²⁶. Stack and Danieglis (1985) ²⁶ theorised that modernisation increased women's participation in the labour force, which increased the work related pressure faced by women and made them more susceptible to suicide. However, this theory has not been supported by the findings of the most recent systematic review ¹⁸.

The availability of specific methods of suicide affects secular trends. This is of particular importance with respect to gassing. Prior to 1905, gassing accounted for a negligible percentage of all suicides. However, there was a rapid increase in suicides by gassing in the early 20th century and it became the most commonly used method of suicide in the 1930s in women and 1950s in men, before declining after the 1960s

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with the changes in domestic gas supply from coal gas (high carbon monoxide content) to natural gas (low carbon monoxide content) ⁷. Our present analysis provides some evidence of method substitution of gassing with poisoning in the 1960s which has been previously reported ¹⁹.

Trends in suicides by gassing highlight how a new method of suicide can quickly become established within a population. A more recent example of this is shown by the rapid increase in suicides by charcoal burning in Hong Kong and urban Taiwan ²⁸. This method has rapidly increased in popularity following the first case which occurred in Hong Kong in 1998. This is partly due to widespread media reporting, which has unfortunately led to an increase in suicide in both areas. In only six years, charcoal-burning suicides became the 2nd most common method of suicide in Hong Kong ²⁹. Our analysis shows that in the 1920s and 1930s the rapid rise in the use of this method was not offset by declines in the use of other methods.

The sex ratio for gassing remained relatively stable until it increased substantially from approximately 2 male deaths for each female death in the 1960s to 8 or 9 male deaths for each female death in the late 1970s and 1980s. This rise corresponds to the rise in use of car exhaust gasses as a method of suicide. Gassing appears to be an acceptable suicide method for men and women ³⁰. Before the introduction of catalytic converters, motor vehicle exhaust gas accounted for most of the gassing deaths from the 1970s onwards ³¹. It can be speculated that the increased technicality required to use this method (i.e. access to car, attachment of hose to car exhaust) may have acted as a barrier to females.

The age- and sex- specific trends of deaths by poisoning are also noteworthy. With the exception of the 1940s, poisoning suicides increased year on year until the 1960s.

Poisoning became the most common method of suicide in women over the age of 15 years in the 1960s, almost tripling in incidence between the 1950s and 1960s, and subsequently remaining the most frequent method of suicide in females until the end of the 20th century. This finding supports previous evidence that women favour methods such as poisoning as they are generally believed to be relatively painless and less disfiguring^{30,32}. Suicide mortality from poisoning has decreased in all age groups in both sexes after the 1970s. This is likely to be a result of the restrictions in barbiturate prescribing and the replacement of tricyclic antidepressants (TCAs) with less toxic selective serotonin reuptake inhibitors (SSRIs)¹⁹. Further decreases have occurred since the ban on co-proxamol prescribing³³.

The sex ratio was highest for hanging (approximately 5 male deaths for every female death) for the majority of the time period. This ratio decreased from the 1950s to the 1970s as the ratio increased for gassing, indicating some degree of method substitution in men.

Dips in suicide rates were seen in both sexes for poisoning (in both world wars) and gassing (World War II). It is unclear why these dips occurred in the 'softer' or less disfiguring methods that are usually favoured by women. However, it may suggest that particular methods of suicide are influenced by factors that exert a more global influence on population mental health.

Public Health Implications

The epidemiology of suicide is complex. It involves the interplay of social, economic, psychological and cultural factors with other factors such as mental illness and the availability of commonly used methods. Analyses of age- and sex- specific trends,

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such as those presented here, help in the identification of high risk groups and in generating hypotheses concerning changing patterns of risk to inform public health policy and suicide prevention strategies.

Reductions in suicide following the detoxification of the domestic gas supply in the 1950s and 1960s and the increased numbers of cars fitted with catalytic converters in the 1990s highlight the benefits of prevention strategies focussed on reducing access to commonly used suicide methods. Although method restriction is a useful public health tool, it is also important to focus on strategies that limit method substitution and the introduction of novel suicide methods. The rise in coal gas suicides in the 1920s and subsequent decades illustrates how rapidly new methods may be adopted and impact on overall rates of suicide. Changing patterns of method popularity may also impact on the sex ratio of suicides. Therefore trends in the relative incidence of male and female suicide may reflect changes in method popularity as much as changes in factors influencing the mental health and suicide risk of men and women. Lastly, the rise in suicides during the Great Depression has implications in relation to the current and future economic crises- it is important that prompt preventative action is taken to offset the impact of the current economic recession on suicide ³⁴.

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For Review Only

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For Review Only

Reference List

- (1) World Health Organisation. The global burden of disease:2004 update. Geneva, Switzerland: World Health Organisation; 2008.
- (2) Lakhani A, Olearnik H, Eayres D. Clinical and Health Outcomes Knowledge Base. London: The Information Centre for health and social care / National Centre for Health Outcomes Development; 2009.
- (3) McClure GM. Changes in suicide in England and Wales, 1960-1997. *Br J Psychiatry* 2000; **176**: 64-7.
- (4) Charlton J, Kelly S, Dunnell K, Evans B, Jenkins R, Wallis R. Trends in suicide deaths in England and Wales. *Popul Trends* 1992; **69**: 10-6.
- (5) Farmer R. Epidemiology of suicide. *Int Clin Psychopharmacol* 1992; **6**: 1-11.
- (6) Chang SS, Gunnell D, Sterne JAC, Lu TH, Cheng ATA. Was the economic crisis 1997-1998 responsible for rising suicide rates in East/Southeast Asia? A time-trend analysis for Japan, Hong Kong, South Korea, Taiwan, Singapore and Thailand. *Soc Sci Med* 2009; **68**: 1322-31.
- (7) Kreitman N. The coal gas story. United Kingdom suicide rates, 1960-71. *Br J Prev Soc Med* 1976; **30**: 86-93.
- (8) Linsley KR, Schapira K, Kelly TP. Open verdict v. suicide - importance to research. *Br J Psychiatry* 2001; **178**: 465-8.
- (9) Platt S, Backett S, Krietman N. Social construction or casual ascription: distinguishing suicide from undetermined deaths. *Social Psychiatry and Psychiatric Epidemiology* 1988; **23**: 217-21.
- (10) Connolly John F, Cullen Anne. Under-reporting of Suicide in an Irish County. *Crisis* 1995 ; **16**: 34-8.
- (11) Cantor CH, Leenaars A, Lester D. Under-reporting of suicide in Ireland 1960–1989. *Archives of Suicide Research* 1997 ; **3**: 5-12.
- (12) Ferreira Castro E, Pimento F, Martins I. The truth about suicides in Portugal. *Acta Psychiatrica Scandinavica* 1989 ; **80**: 334-9.
- (13) Monk M. Epidemiology of suicide. *Epidemiologic Reviews* 1987; **9**: 51-69.
- (14) Morrell S, Taylor R, Quine S, Kerr C. Suicide and unemployment in Australia 1907-1990. *Social Science & Medicine* 1993; **36**: 749-56.
- (15) Deavoll BJ, Mulder RT, Beutrais AL, Joyce PR. One hundred years of suicide in New Zealand. *Acta Psychiatr Scand* 1993; **87**: 81-5.
- (16) Swinscow D. Some suicide statistics. *BMJ* 1951; 1417-22.

- (17) Donaldson S, Bi P, Hiller JB. Secular Change in Mortality from Suicide in Australia during the 20th Century. *Australian Journal of Primary Health* 2007 ; **13**: 45-51.
- (18) Platt S, Hawton K. Suicidal behaviour and the labour market. In: Hawton K, van Heeringen K, editors. *The International Handbook of Suicide and Attempted Suicide*. John Wiley & Sons Ltd; 2000. p. 309-83.
- (19) Gunnell D, Middleton N, Frankel S. Method availability and the prevention of suicide - a reanalysis of secular trends in England and Wales 1950-1975. *Soc Psychiatry Psychiatr Epidemiol* 2000; **35**: 437-43.
- (20) Ajdacic-Gross V, Bopp M, Gostynski M, Lauber C, Gutzwiller F, Rossler W. Age-period-cohort analysis of Swiss suicide data, 1881-2000. *Eur Arch Psychiatry Clin Neurosci* 2005; **256**: 207-14.
- (21) Durkheim E. Anomic Suicide. In: Simpson Get, Spaulding JAt, editors. *Suicide: A Study in Sociology*. London: Routledge & Keegan Paul Ltd; 1952. p. -276.
- (22) Henderson R, Stark C, Selvaraj S. Changes in Scottish suicide rates during the Second World War. doi:10.1186/1471-2458-6-167. *BMC Public Health* 2006 ; **6**.
- (23) Weiss JM, Perry ME. Transcultural attitudes towards homicide and suicide. *Suicide* 1975; **5**: 223-7.
- (24) Stack S. Suicide:media impacts in war and peace, 1910-1920. *Suicide and Life-Threatening Behavior* 1988; **18**: 342-7.
- (25) Biro M, Selakovic-Bursic S. Suicide, aggression and war. *Arch Suicide Res* 1996; **2**: 75-9.
- (26) Stack S, Danigelis N. Modernization and sex differential in suicide, 1919-1972. *Comparative Social Research* 2009; **8**: 203-16.
- (27) Gunnell D, Middleton N, Whitley E, Dorling D, Frankel S. Why are suicide rates rising in young men but falling in the elderly? - a time-series analysis of trends in England and Wales 1950-1998. *Social Science & Medicine* 2003; **57**: 595-611.
- (28) Liu KY, Beautrais A, Caine E, Chan K, Chao A, Conwell Y, et al. Charcoal burning suicides in Hong Kong and urban Taiwan: an illustration of the impact of a novel suicide method on overall regional rates. *J Epidemiol Community Health* 2007; **61**: 248-53.
- (29) Yip PSF, Lee DT. Charcoal-burning suicides and strategies for prevention. *Crisis* 2007; **28**: 21-7.
- (30) Marks A. Sex differences and their effect upon cultural evaluations of methods of self-destruction. *Omega* 1977; **8**: 65-70.

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- (31) Amos T, Appleby L, Kiernan K. Changes in rates of suicide by car exhaust asphyxiation in England and Wales. *Psychol Med* 2001; **31**: 935-9.
- (32) Lester D. Why do people choose particular methods for suicide? *Activitas Nervosa Superior* 1988; **30**: 312-4.
- (33) Hawton K, Bergen H, Simkin S, Brock A, Griffiths C, Romeri E, et al. Effect of withdrawal of co-proxamol on prescribing and deaths from drug poisoning in England and Wales: time series analysis. *BMJ* 2009; **338**: b2270.
- (34) Gunnell D, Platt S, Hawton K. The economic crisis and suicide. Consequences may be serious and warrant early attention. *BMJ* 2009; **338**: b1891.

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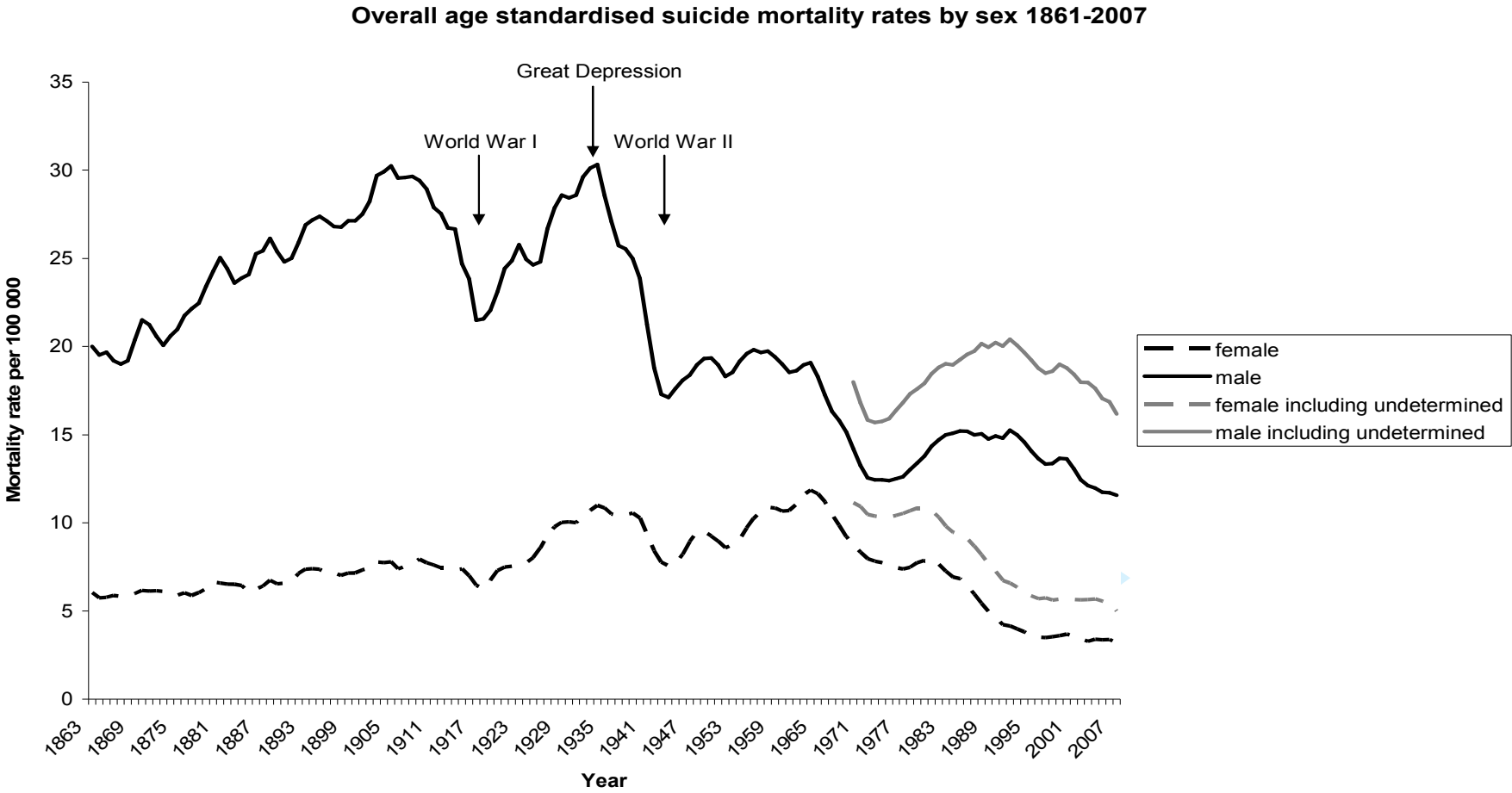


Fig. 1 Age standardised suicide rates for ages 15 and over in England and Wales (3 year moving averages) 1861-2007.

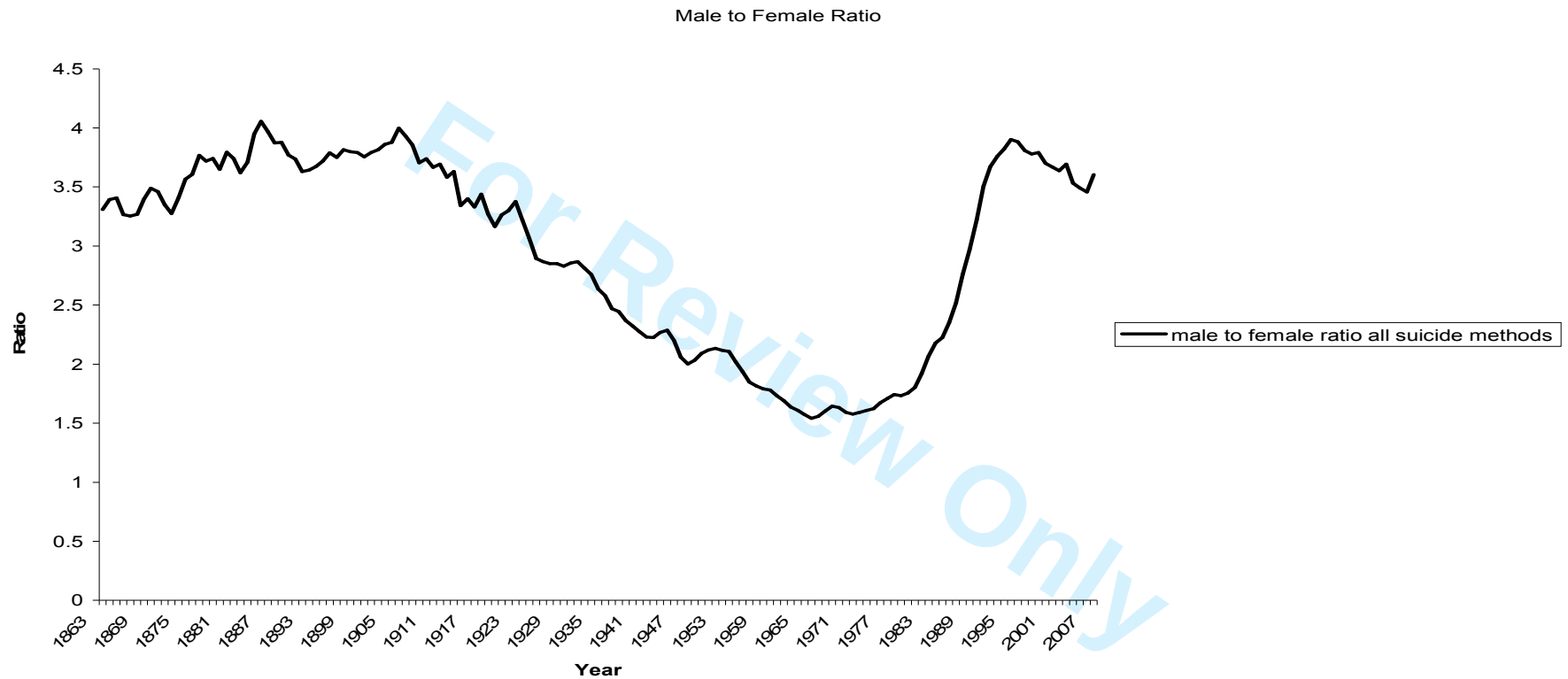


Fig. 2 Male to female sex ratio in England and Wales (3 year moving averages) 1861-2007

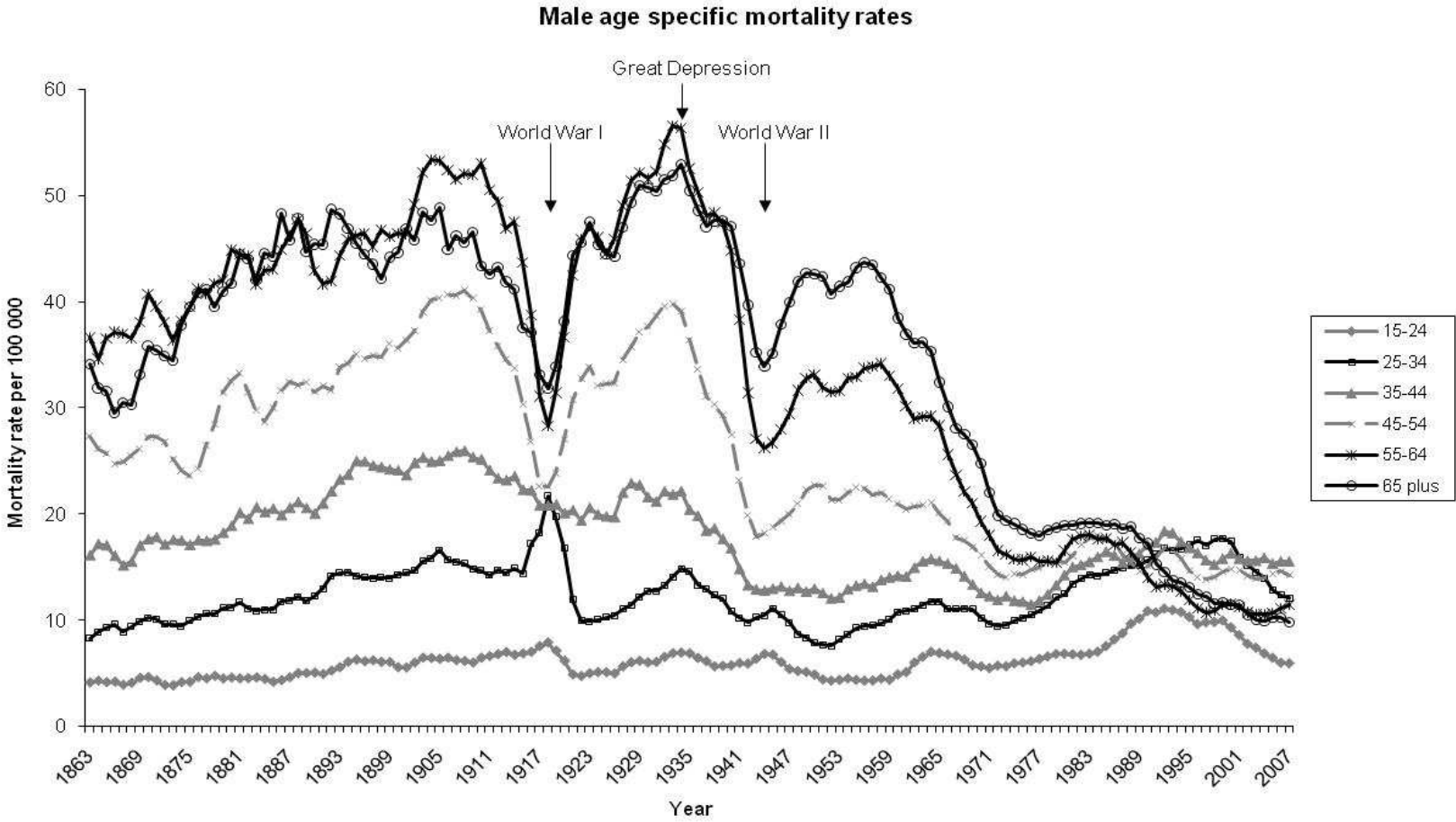


Fig. 3a Age specific suicide mortality rates by sex in England and Wales (3 year moving averages) 1861-2007.

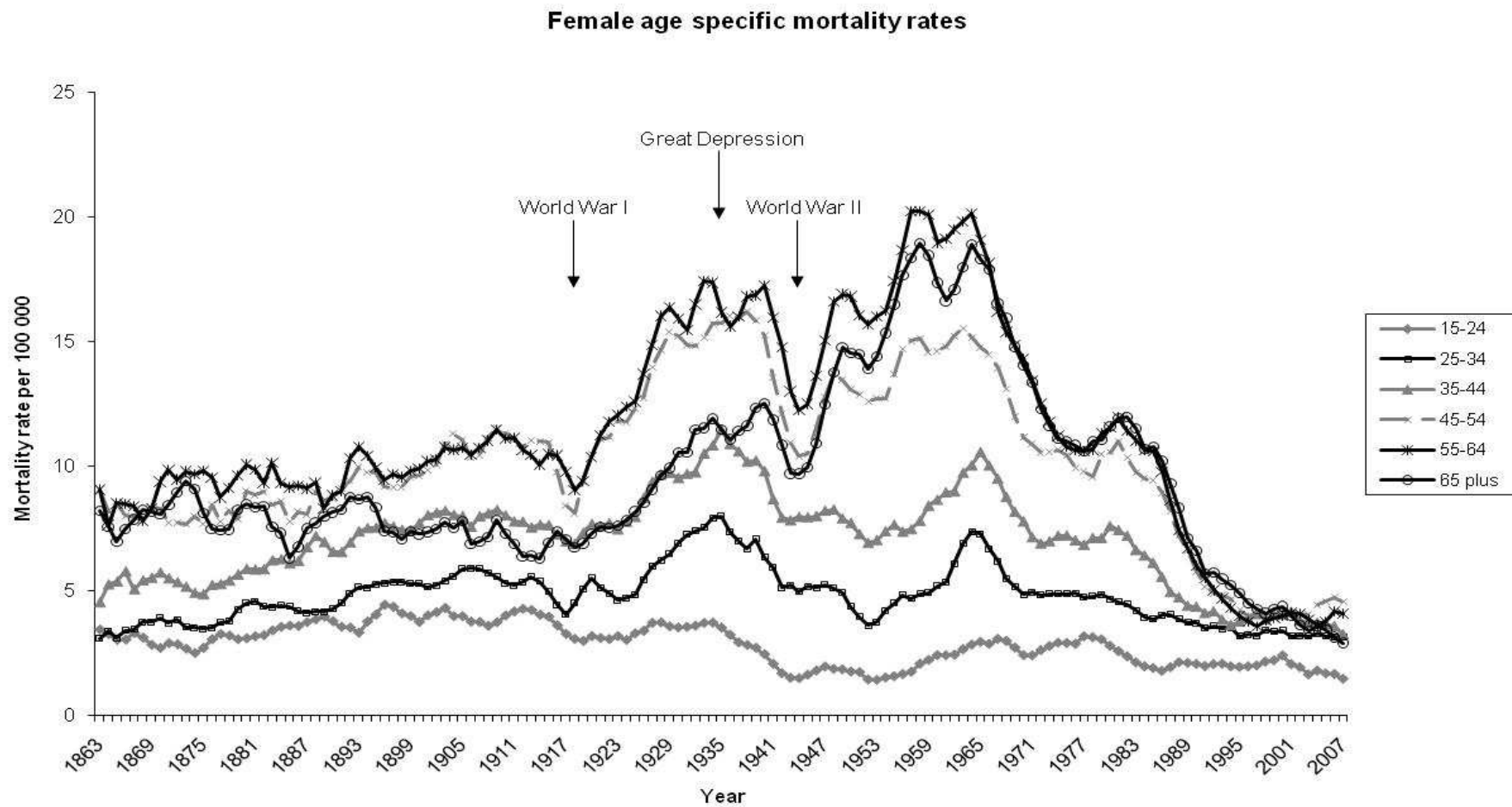


Fig. 3b Age specific suicide mortality rates by sex in England and Wales (3 year moving averages) 1861-2007.

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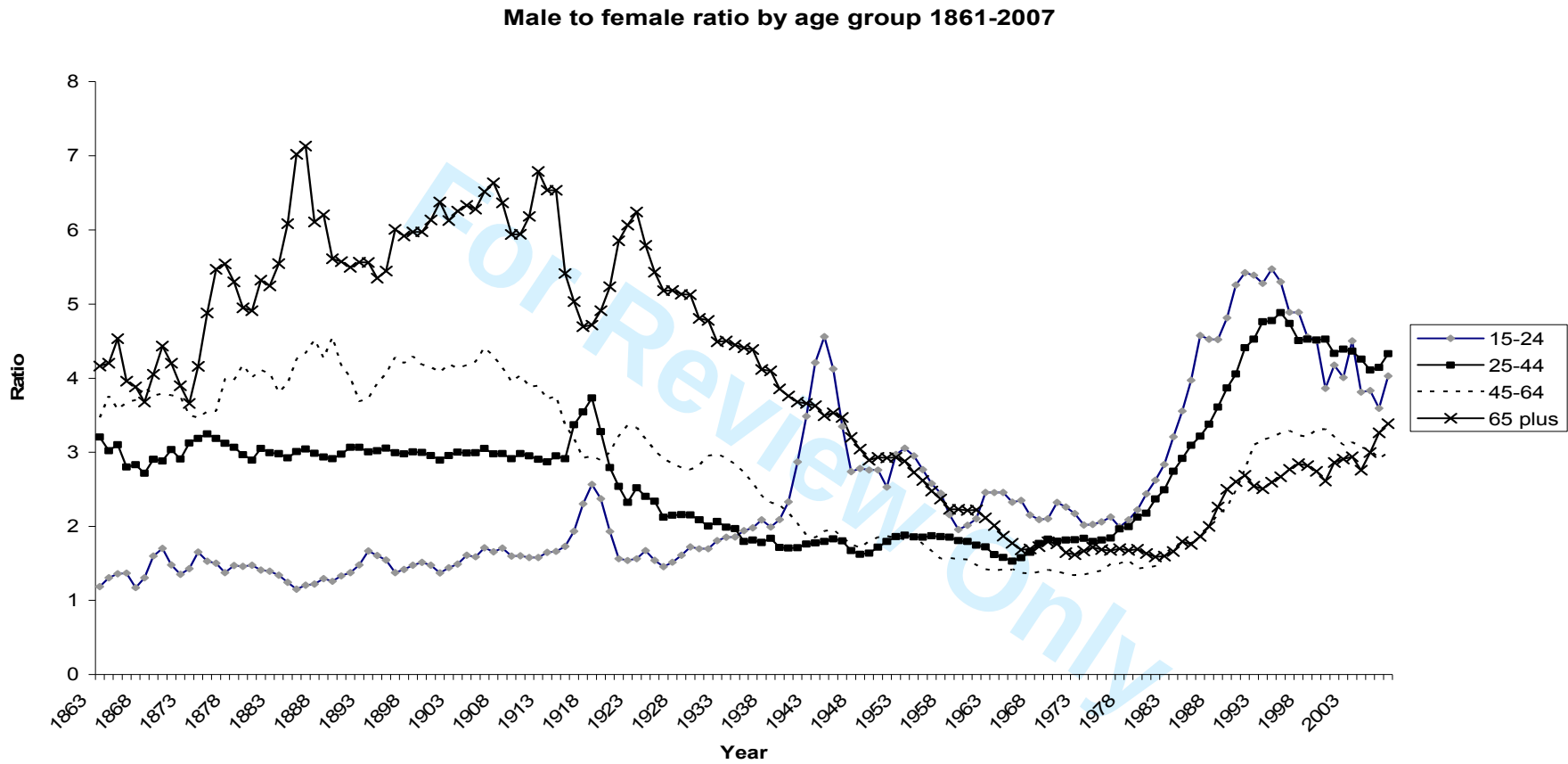


Fig. 4 Age specific sex ratios in England and Wales (3 year moving averages) 1861-2007.

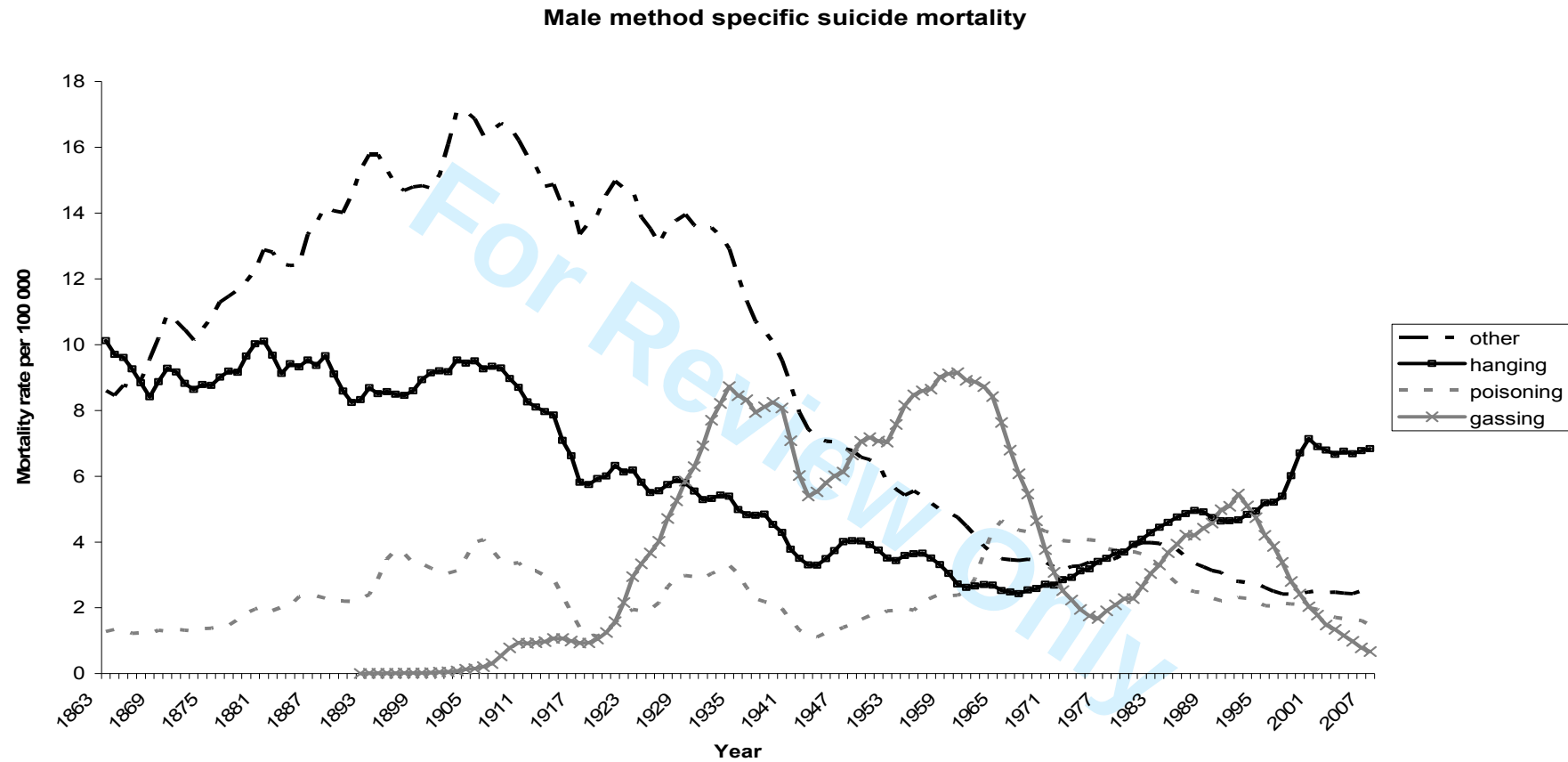


Fig. 5a Sex specific rates of suicide by different methods ages 15 and over in England and Wales (3 year moving averages) 1861-2007.

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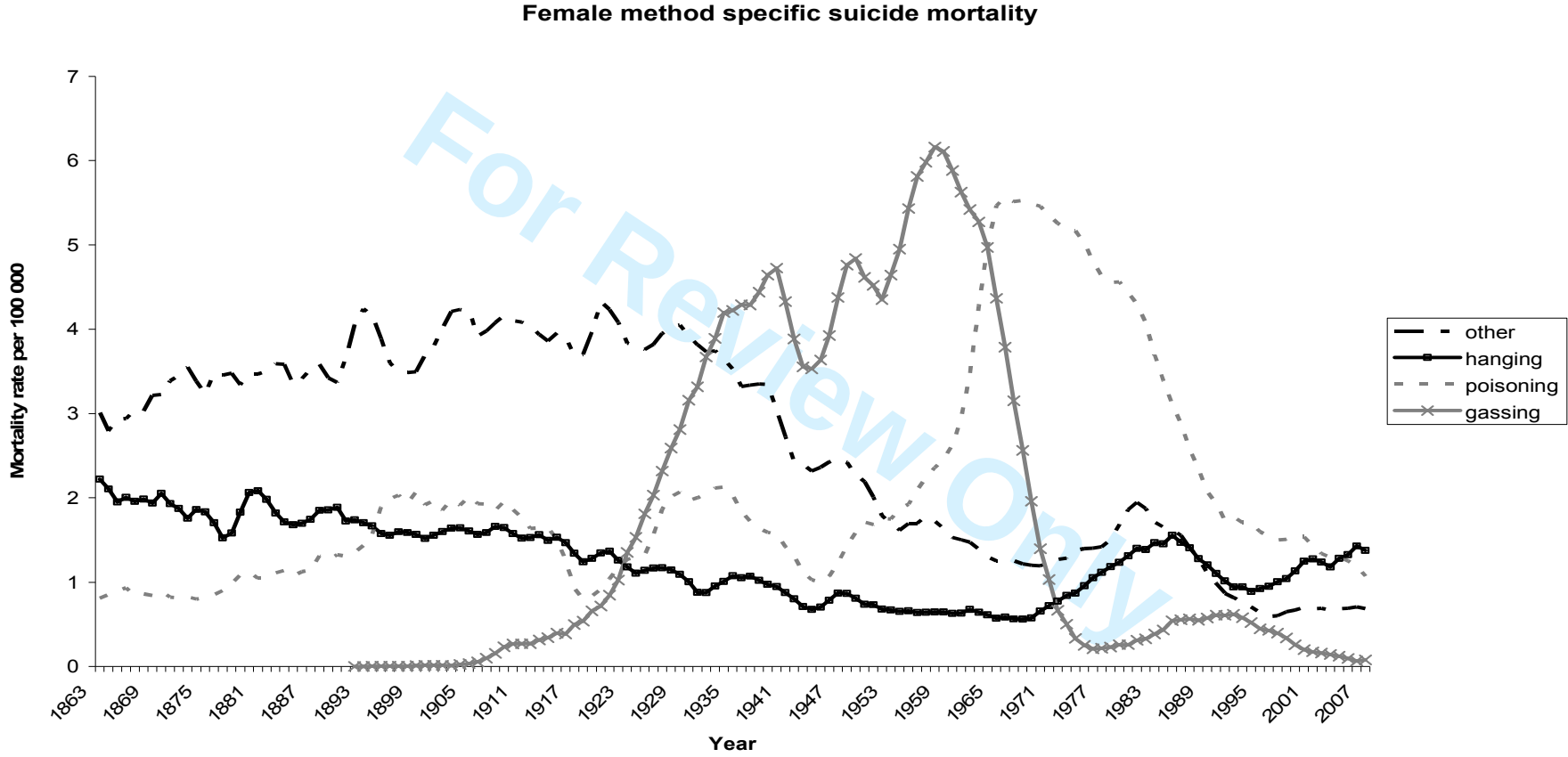


Fig. 5b Sex specific rates of suicide by different methods ages 15 and over in England and Wales (3 year moving averages) 1861-2007.

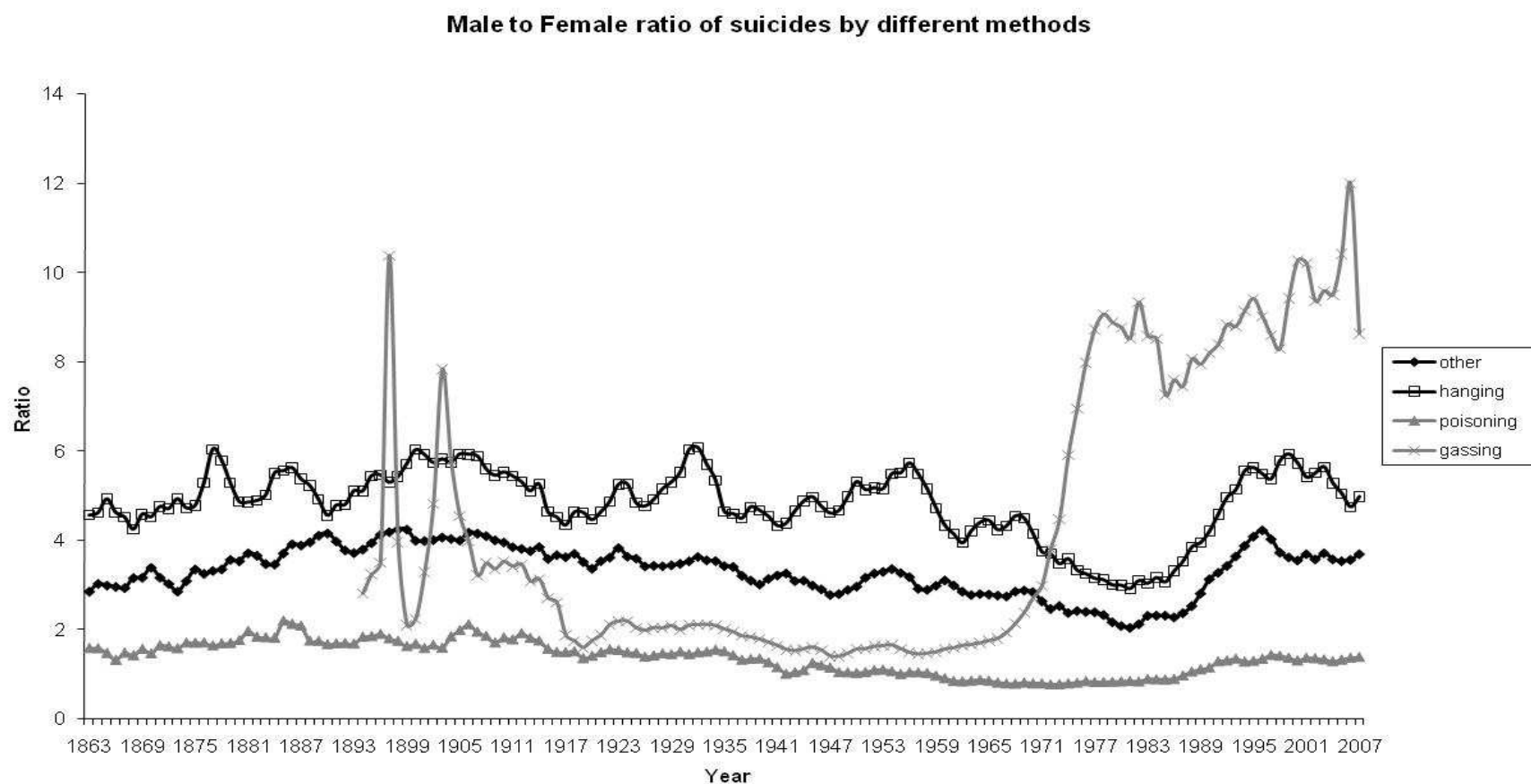
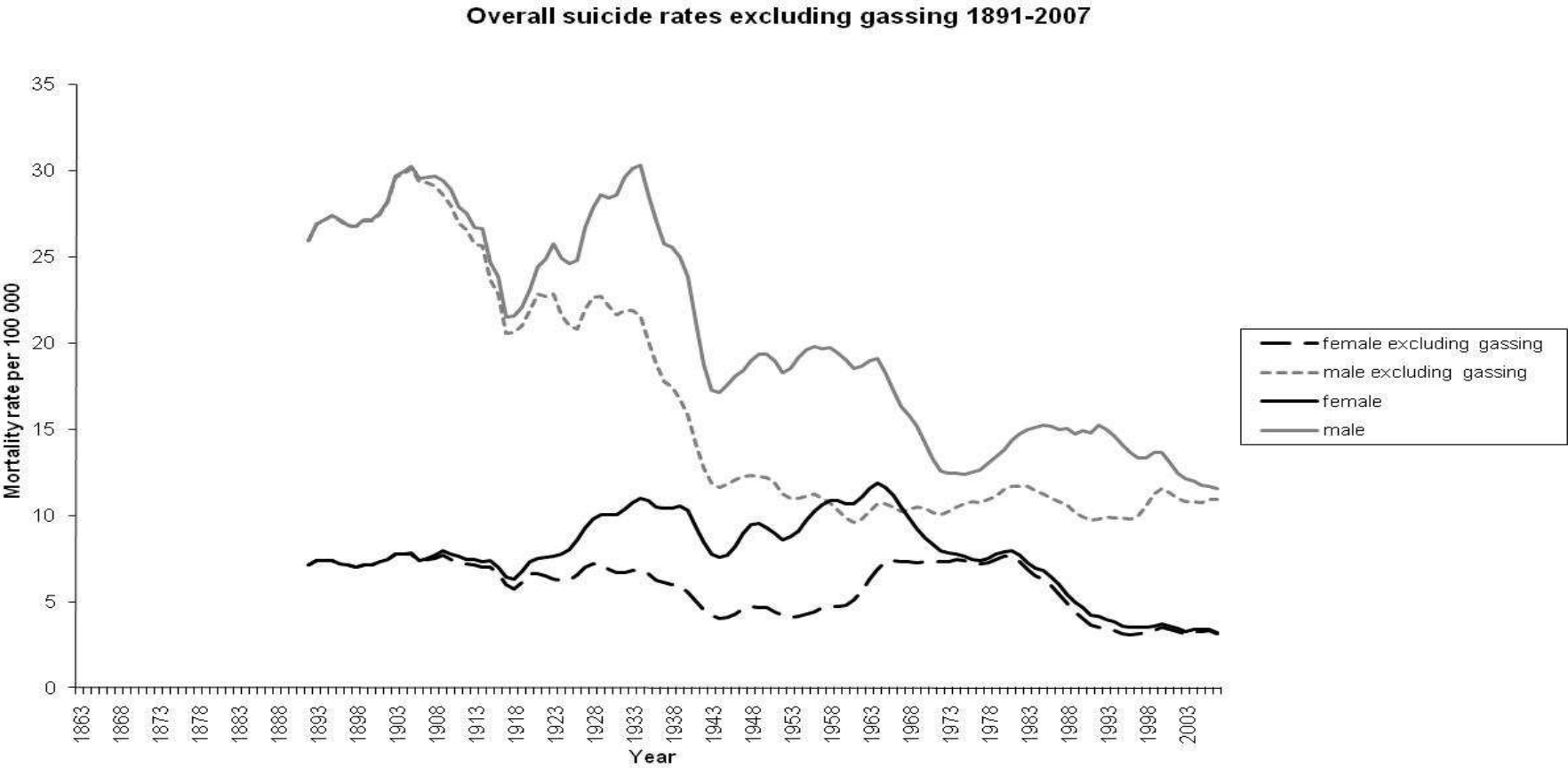


Fig. 6 Male to female ratio of different methods of suicide ages 15 and over in England and Wales (3 year moving averages) 1861-2007.



Supplementary figure Overall suicide rates excluding gassing 1891-2007.

SUICIDE										
	ILCD-1 1900-1908	ILCD-2 1909-1919	ILCD-3 1920-1928	ILCD-4 1929-1937	ILCD-5 1938-1949	ICD-6 1950-1957	ICD-7 1958-1967	ICD-8 1968-1978	ICD-9 1979-2000	ICD-10 2001-2007
Recorded suicides	190	155-163	165-174	163-171	163-164	E970-E979	E970-E979	E950-E959	E950-E959	X60-X84
Undetermined								E980-E989	E980-E989 excluding E988.8	Y10-Y34 excluding Y33.9 where verdict pending

METHOD OF SUICIDE										
	ILCD-1	ILCD-2	ILCD-3	ILCD-4	ILCD-5	ICD-6	ICD-7	ICD-8	ICD-9	ICD-10
Recorded suicides										
Overdose		155	165-166	163	163aa-163ad	E970-E971	E970-E971	E950	E950	X60-X65, X68-X69
Gases		156	167	164	163ba-163bc	E972-E973	E972-E973	E951-E952	E951-E952	X66-67
Hanging		157	168	165	164a	E974	E974	E953	E953	X70
Drowning		158	169	166	164b	E975	E975	E954	E954	X71
Firearms and explosives		159	170	167	164c	E976	E976	E955	E955	X72-X75
Other and unspecified (including jumping from a high place and cutting and piercing)		160-163	171-174	168-171	164d-164f	E977-E959	E977-E959	E956-E959	E956-E959	X76-X84
Undetermined										
Overdose								ICD-8 E980	ICD-9 E980	ICD-10 Y10-15, Y18-Y19
Gases								E981-E982	E981-E982	Y16-Y17
Hanging								E983	E983	Y20
Drowning								E984	E984	Y21
Firearms and explosives								E985	E985	Y22-Y25
Other and unspecified (including jumping from a high place and cutting and piercing)								E986-E988	E986-E988	Y26-Y34

Table 1. ICD codes used for methods of suicide and undetermined injury.

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For Review Only

Key messages

1. The ratio of male to female rates varied from 4:1 to 1.5:1 over the course of the 19th and 20th centuries.
2. The temporal variations in the gender ratio appear to be largely due to variations in the availability and lethality of methods more favoured by women than men.
3. New methods of suicide can become quickly established within a population without impacting on the use of other methods leading to increases in overall suicide rates.
4. Reductions in suicide rates in the two world wars were largely restricted to men and women aged >45 years.