Deaths involving legal highs in England and Wales: between 2004 and 2013

Analysis of drug-related deaths involving legal highs (new psychoactive substances not controlled under the Misuse of Drugs Act 1971) in England and Wales between 2004 and 2013, broken down by sex, age and substances involved.

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1. Background and definition

New psychoactive substances (NPS) started to become more popular on the UK drugs scene around 2008 to 2009, with synthetic stimulants such as benzylpiperazine (BZP) and mephedrone, and synthetic cannabinoids (such as "Spice"), among the first to gain popularity. NPS are sometimes referred to as legal highs, but many are now controlled under the Misuse of Drugs Act 1971, so are no longer legal.

Diagram 1: Relationship between legal highs and all new psychoactive substances

This article focuses on substances that were not controlled under the Misuse of Drugs Act 1971 on the day the person died, and are referred to as legal highs throughout this article. It covers a 10-year time period from 2004 to 2013. Various drugs on our list have been controlled during this period, consequently, the drugs included in our definition of a legal high change throughout the analysis period, as drugs are removed from the list once they become illegal. For example, mephedrone was banned on 16 April 2010, so deaths involving mephedrone are only included if they occurred between 1 January 2004 and 15 April 2010.

We publish an annual statistical bulletin on Deaths related to drug poisoning in England and Wales, which contains statistics on deaths involving a wide range of substances. Figures on NPS deaths in that bulletin are based on a much broader definition and include drugs that are now controlled under the Misuse of Drugs Act 1971.

2. What are legal highs?

Legal highs contain substances which produce similar psychoactive effects to "traditional" illegal drugs like cocaine, cannabis and ecstasy. There is no officially agreed list of substances that are categorised as legal highs, but this article concentrates on the following types of substances:

- stimulants like piperazines (for example, BZP), cathinones (for example, mephedrone), benzofurans and methiopropamine
- sedatives such as benzodiazepine analogues (for example, etizolam) and new synthetic opioids
- hallucinogenic drugs like NBOMes and alpha-methyltryptamine
- dissociatives, such as methoxetamine
- synthetic cannabinoids like 5F-AKB-48
We have not included drugs that are sometimes thought of as legal highs, but have actually been used recreationally for many years, such as GHB/GBL. We have also excluded medicines that are licensed for use in the UK, but which are also used recreationally, such as nitrous oxide. A full list of the substances included is available in the Background notes section.

The majority of legal highs are obtained from someone known to the individual (for example, a friend, family, or acquaintance), or from a "headshop", but some are also bought from drug dealers or from the web (Home Office, 2015a). They are generally labelled as being "not for human consumption", and are often marketed as plant food, bath salts, incense or research chemicals. Legal highs are commonly sold under brand names like "Spice", "Clockwork Orange", and "Ivory wave".

3. Blanket ban on psychoactive substances

The government has already banned a large number of NPS under the Misuse of Drugs Act 1971. However, it has been difficult to control the use of NPS with existing legislation, as when one drug (or group of drugs) is controlled, scientists simply tweak the chemical structure of the drug so that it evades the law. The government, therefore, remains concerned about how quickly NPS are being created and the potential harm they pose. To address this problem they have introduced the Psychoactive Substances Act, which will come into force in spring 2016. This establishes a blanket ban on the importation, production or supply of psychoactive substances, though things like alcohol, tobacco, caffeine and medicines used in healthcare-related activities will be exempt.

Evidence on the harms of a range of NPS are documented in reports by the Advisory Council on the Misuse of Drugs (ACMD), but how many deaths do they actually cause?
4. Deaths involving legal highs, heroin and cocaine

Figure 1: Number of deaths involving selected substances occurring between 2004 and 2013

Source: Office for National Statistics

Notes:

1. Cause of death was defined using the International Classification of Diseases, Tenth Revision (ICD-10) codes shown in the Background notes. Deaths were included where the underlying cause was drug-related and the specified substance was mentioned on the death certificate. If more than one substance was mentioned, the death will be included more than once.

2. Figures include deaths of non-residents who died in England or Wales.

3. Figures are for deaths occurring, rather than deaths registered in each calendar year. ONS is not usually notified of a death until it has been registered, and due to the length of time it takes to complete a coroner’s inquest, it can take months or even years for a drug-related death to be registered. These figures only include deaths that occurred between 2004 and 2013, and were registered by 31 December 2014. Therefore figures for deaths in 2013 presented here will be an underestimate.

4. There is no officially agreed list showing which substances are classed as legal highs, but the full list of substances included in this category within this article can be found in the Background notes.

Number of deaths involving legal highs is very small compared with heroin/morphine and cocaine

Between 2004 and 2013, there were 76 deaths involving legal highs in England and Wales. Specifically, these are drug-related deaths where the death certificate mentioned a legal high. The death certificate may also mention other drugs or alcohol, so the legal high may not have been the primary cause of death in all of these 76 cases.
To put this in context – over the same 10 year period there were more than 100 times as many deaths involving heroin or morphine (7,748) and more than 20 times as many deaths involving cocaine (1,752) than legal highs.

5. Trends in legal high deaths over time

Figure 2: Number of deaths involving legal highs occurring between 2004 and 2013

England and Wales

Deaths involving legal highs increase in recent years

Although the number of deaths involving legal highs is small, they have increased over the last decade, from no deaths in 2004 to an estimated 23 deaths in 2013. There has been a marked rise between 2011 and 2013, when deaths have more than tripled from 7 to 23. However, caution needs to be used when interpreting these trends as they are based on very small numbers.

Despite the relatively small numbers, deaths involving legal highs (like all drug-related deaths), are preventable and each one is a tragedy.
6. Deaths involving legal highs: by sex

Figure 3: Number of drug-related deaths involving legal highs, by sex, deaths occurring 2004 to 2013

England and Wales

Number of deaths

Source: Office for National Statistics

Notes:

1. Cause of death was defined using the International Classification of Diseases, Tenth Revision (ICD-10) codes shown in the Background notes. Deaths were included where the underlying cause was drug-related and a legal high was mentioned on the death certificate.

2. Figures include deaths of non-residents who died in England or Wales.

3. Figures are for deaths occurring, rather than deaths registered in each calendar year. ONS is not usually notified of a death until it has been registered, and due to the length of time it takes to complete a coroner’s inquest, it can take months or even years for a drug-related death to be registered. These figures only include deaths that occurred between 2004 and 2013, and were registered by 31 December 2014. Therefore figures for deaths in 2013 presented here will be an underestimate.

4. There is no officially agreed list showing which substances are classed as legal highs, but the full list of substances included in this category within this article can be found in the Background notes.

Deaths involving legal highs increased in males in the last 3 years, but remain stable in females

The majority of deaths involving legal highs are males (5 out of 6 deaths). This is slightly higher than the male to female ratio seen for drug misuse deaths, where about three-quarters of the deaths are males. The first female death involving a legal high shown in this time series occurred in 2009 and female deaths have been low and stable since then. In contrast, male deaths showed a small peak in 2008, before falling slightly, but have increased quite sharply since 2010.
7. Deaths involving legal highs: by age

Figure 4: Age-specific mortality rate for deaths involving legal highs occurring in 2004 to 2013 combined

England and Wales

Mortality rate per 10 million population

Source: Office for National Statistics

Notes:

1. Age-specific mortality rate per 10 million population.

2. Cause of death was defined using the International Classification of Diseases, Tenth Revision (ICD-10) codes shown in the Background notes. Deaths were included where the underlying cause was drug-related and a legal high was mentioned on the death certificate.

3. Figures include deaths of non-residents who died in England or Wales.

4. Figures are for deaths occurring, rather than deaths registered in each calendar year. ONS is not usually notified of a death until it has been registered, and due to the length of time it takes to complete a coroner’s inquest, it can take months or even years for a drug-related death to be registered. These figures only include deaths that occurred between 2004 and 2013, and were registered by 31 December 2014. Therefore figures for deaths in 2013 presented here will be an underestimate.

5. There is no officially agreed list showing which substances are classed as legal highs, but the full list of substances included in this category within this article can be found in the Background notes.

Most legal high deaths happen in people aged 20 to 29

The average (median) age for deaths involving a legal high is 28, which is younger than for drug misuse deaths, where the average age is 38. The youngest person to die after taking a legal high was aged 18 and 9 teenagers have died from this between 2004 and 2013. In fact, the highest mortality rate is in people aged 20 to 29, at just over 4 deaths per 10 million population. Deaths involving legal highs then decline with age.
8. Legal high deaths involving other drugs or alcohol

One of the difficulties with interpreting drug-related mortality data is that the deaths often involve more than one substance and it is impossible to tell from the death certificate which substance was primarily responsible for the death.

**Figure 5: Percentage of legal high deaths that also involve alcohol or another drug, occurring in 2004 to 2013 combined**

![Pie chart showing percentages of legal high deaths involving other substances](image)

**Source:** Office for National Statistics

**Notes:**

1. Cause of death was defined using the International Classification of Diseases, Tenth Revision (ICD-10) codes shown in the Background notes. Deaths were included where the underlying cause was drug-related and the specified substance was mentioned on the death certificate. If more than one substance was mentioned, the death will be included more than once.

2. Figures include deaths of non-residents who died in England or Wales.

3. Figures are for deaths occurring, rather than deaths registered in each calendar year. ONS is not usually notified of a death until it has been registered, and due to the length of time it takes to complete a coroner’s inquest, it can take months or even years for a drug-related death to be registered. These figures only include deaths that occurred between 2004 and 2013, and were registered by 31 December 2014. Therefore figures for deaths in 2013 presented here will be an underestimate.

4. There is no officially agreed list showing which substances are classed as legal highs, but the full list of substances included in this category within this article can be found in the Background notes.

5. Single legal high deaths are those where only one substance was mentioned on the death certificate, that is, no alcohol or any other drug was mentioned.

6. Figures may not add to 100, due to rounding.
Around 60% of legal high deaths also involve another drug or alcohol

Between 2004 and 2013, alcohol was involved in about 10% of legal high deaths, though none of the 23 deaths in 2013 mentioned it. So alcohol is involved in proportionally fewer legal high deaths compared with drug misuse deaths, where about 1 in 3 also involve alcohol.

Over the same period, 57% of deaths involving legal highs mentioned more than one drug, but in 2013 this proportion dropped to about a third. These deaths could involve a combination of legal highs and illegal drugs or a mixture of different legal highs and the deaths may or may not have also involved alcohol. For drug misuse deaths the proportion involving more than one drug was much lower – 35% between 2004 and 2013; but this proportion has been gradually increasing over time. Forensic testing of NPS has shown that a single tablet or powder can contain a mixture of different NPS and even "traditional" illegal drugs (Home Office, 2015b). This may partly explain the high proportion of legal high deaths which involve multiple drugs, as users may not even be aware that they are taking more than one substance.

As the number of deaths involving legal highs is very small, it is hard to identify clear patterns of drug combinations. Nevertheless, there is an indication that deaths in 2008 and 2009 often involved a combination of piperazines and ecstasy or cocaine. However, the combinations of drugs that lead to death may not be representative of the pattern of drug taking in the population.

More recently, the deaths data suggests a trend for taking several new psychoactive substances together, some of which may have been recently banned – for example, taking methiopropamine and a cathinone. Deaths also happen when legal highs are taken with more traditional stimulants such as amphetamines. An emerging trend in the deaths data is the combination of an opioid drug like heroin/morphine, methadone or tramadol with a novel benzodiazepine such as phenazepam or etizolam. This mirrors the established pattern of taking an opioid drug with a traditional benzodiazepine like diazepam.

9. Impact of banning mephedrone

The previous sections looked at deaths where the substances involved were legal at the time of death. This section contains a case study of mephedrone – one of the first legal highs to catch the media’s attention – and looks at trends in deaths before and after it was banned. Mephedrone, sometimes called "Meow meow" or "M-Cat" is a cathinone which was controlled as a Class B substance under the Misuse of Drugs Act 1971 on 16 April 2010, along with a number of other cathinones.
Deaths involving mephedrone did not immediately fall after it was banned

The first death involving mephedrone occurred in 2009, and deaths continued to rise for several years following the ban, peaking at 22 deaths in 2012, before falling to 12 deaths in 2013. This suggests that banning mephedrone did not immediately reduce the number of mephedrone-related deaths. However, it is possible that mephedrone use would have increased and deaths would have been even higher, had it not been banned.

Mephedrone was first included in the Crime Survey for England and Wales – CSEW – (Home Office, 2015a) in 2010/11, when 1.3% of 16 to 59-year-olds reported using mephedrone in the last year, although the figure was higher for young people – 4.4% of 16 to 24-year-olds. Use had dropped to 0.6% of 16 to 59-year-olds in the 2013/14 CSEW (around 211,000 people) and to 1.9% of 16 to 24-year-olds.

The trend in use of mephedrone is not consistent with the number of deaths, which peaked in 2012, but by then the proportion of people using mephedrone had more than halved. At first glance, this pattern might suggest that people were less willing to admit to taking mephedrone since it was banned. However, the majority of people who reported using mephedrone in the Crime Survey, also reported using another illegal drug, so it's not clear whether banning mephedrone would suddenly lead to under-reporting of its use.

There is unlikely to be a simple explanation of why deaths involving mephedrone continued to increase while use apparently declined. It may be that the drugs that people are now taking with mephedrone are more dangerous; or they are using riskier methods to take mephedrone (for example, injecting instead of snorting); it could be that people are experiencing increasing harm having used mephedrone for a longer period of time, with escalating doses leading to more fatal overdoses; or it is possible that a more vulnerable group of people have begun using mephedrone. In addition, it is possible that people stockpiled mephedrone before it was banned, which may have affected patterns of use after the ban. Any of these factors could have lead to the increases in deaths involving mephedrone seen between 2009 and 2012. The fact that deaths involving legal highs in general continued to rise in 2013, while deaths involving mephedrone fell, may suggest mephedrone is becoming less popular and people are now taking different types of NPS.

These data suggest there is a complex relationship between a drug’s legal status, how widely it is used in the population and the number of deaths that occur. And it will be interesting to see what impact the introduction of the Psychoactive Substances Act 2016 will have on the longer term trends in deaths involving NPS.
10. So why are legal highs dangerous?

Some people think that because these drugs are (or were recently) legal, they are safe, but this isn’t the case. The potential short-term effects of legal highs include agitation, paranoia, psychosis, delirium, tachycardia, hypertension, chest pain, seizures and elevated temperature; and overdoses of legal highs may require emergency hospital treatment. In addition to immediate health effects, use of legal highs can impact on people’s employment and education (ACMD, 2011). More information on the harms associated with use of legal highs can be found in ACMD risk assessments.

Importantly, users cannot be sure what substance they are actually taking, how much to take, what effect it will have or whether it is still legal. In addition, there has been very little research into the long-term harms, so users act as “human guinea pigs”.

As the majority of legal highs have only been used for a few years at most, we don’t know how harmful these drugs could be if a person became dependent and used them in high doses, repeatedly, over a long period of time. It is possible that in these circumstances they may cause significant long-term mental or physical health problems. Moreover, we don’t know whether under the right social conditions an increasing number of people could become dependent on any of these drugs, possibly one of the synthetic opioids like AH-7921, resulting in much greater harm.

So although deaths involving legal highs are small compared with "traditional" drugs, taking them is still very risky.

11. Methodological considerations

Registration delays

Due to the length of time it takes to complete a coroner’s inquest there can be a considerable delay between when a death occurred and when it was registered (5 to 6 months on average for drug-related deaths). All data presented above are based on the date the death occurred, not when it was registered. Due to registration delays, many of the deaths that occurred in 2014 and some of those that occurred in 2013 will not have been registered when this data extract was taken (that is, by 31 December 2014). Therefore figures for 2014 are not presented as they are too incomplete and figures for 2013 should also be treated with caution, as they are likely to be an underestimate of the total number of legal high deaths occurring in that year.

Data on drug-related deaths, registered in 2015 are currently being processed and figures will be published on our website in September 2016.

Other limitations of ONS drug-related deaths data

The figures on deaths involving legal highs reported in this article are likely to be an underestimate of the true numbers and need to be interpreted with caution for the following reasons:
• the number of deaths is very small, making it harder to interpret changes from one year to the next

• these figures are based only on information reported on the coroner’s death certificate so may not include every substance involved in the death

• there may not be toxicology tests available to detect the newest psychoactive substances, and coroners may not be able to afford to test for every new substance: this is especially the case in deaths where a more common substance such as heroin or cocaine has already been found at post-mortem

• alternatively, the increases in legal high deaths in recent years may be due to coroners becoming more aware of these substances and so they are more likely to be tested for at post-mortem

• in around 1 in 10 drug poisoning deaths, only a general description is recorded on the coroner’s death certificate (such as drug overdose or multiple drug toxicity)

• in around 30% of all drug poisoning deaths, the death certificate mentions more than one specific drug; where more than one drug is mentioned, it is not possible to tell which was primarily responsible

• approximately 30% of all drug-related poisoning deaths also contain a mention of alcohol or a consequence of long-term alcohol abuse (for example, cirrhosis) in addition to a drug

12. References


13. Background notes

1. Quality information

Further information about the quality of drug-related deaths data can be found in the Quality and Methodology Information (QMI) report.

2. Mortality metadata

Information about the underlying mortality data, including details on how the data is collected and coded, is available in the mortality metadata.

3. Drug poisoning database

The figures presented in this bulletin have been produced using a special database of deaths related to drug poisoning. This has been developed to facilitate research into these deaths and to aid the identification of specific substances involved. The database is extracted from the national mortality...
database for England and Wales. Deaths are included if the underlying cause of death is regarded as drug-related, according to the National Statistics definition. More information on this definition and issues relating to the interpretation of drug-related deaths data can be found in Christophersen et al (1998).

Almost all deaths on the drug poisoning database had a coroner’s inquest. For each death the database includes the following information:

1. the ICD codes for underlying cause of death and other causes mentioned on the death certificate
2. every mention of a substance recorded by the coroner in the cause of death section or elsewhere on the coroner’s certificate after inquest (up to 7 substances)
3. an indicator to show if alcohol is mentioned – this includes a wide variety of scenarios ranging from evidence of alcohol consumption around the time of death (for example, an empty vodka bottle found at the scene or alcohol found after toxicology tests) to long-term alcohol abuse and cirrhosis of the liver
4. other information recorded at death registration such as age, sex, marital status, occupation and place of usual residence

4. Definition of a drug-related death

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<tr>
<th>Description</th>
<th>ICD-10 Codes</th>
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<tr>
<td>Mental and behavioural disorders due to drug use (excluding alcohol and tobacco)</td>
<td>F11–F16, F18–F19</td>
</tr>
<tr>
<td>Accidental poisoning by drugs, medicaments and biological substances</td>
<td>X40–X44</td>
</tr>
<tr>
<td>Intentional self-poisoning by drugs, medicaments and biological substances</td>
<td>X60–X64</td>
</tr>
<tr>
<td>Assault by drugs, medicaments and biological substances</td>
<td>X85</td>
</tr>
<tr>
<td>Poisoning by drugs, medicaments and biological substances, undetermined intent</td>
<td>Y10–Y14</td>
</tr>
</tbody>
</table>

5. Definition of a death involving legal highs

This article focuses on substances that were not controlled under the Misuse of Drugs Act 1971 on the day the person died, and are referred to as legal highs throughout this article. The list below shows which substances were included at which time points.

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<td>Y10–Y14</td>
</tr>
<tr>
<td>Drug</td>
<td>Deaths occurring on or before</td>
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<td>Desoxypipradrol</td>
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<tr>
<td>Phenazepam</td>
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<td>1-(Benzofuran-5-yl)-propan-2-amine</td>
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<tr>
<td>1-(Benzofuran-6-yl)-propan-2-amine</td>
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<td>2-(1H-Indol-5-yl)-1-methylethylamine</td>
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<td>4-Fluoroephedrine</td>
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<td>5F-AKB-48</td>
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<tr>
<td>Diphenidine</td>
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<tr>
<td>Etizolam</td>
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</tr>
<tr>
<td>Flubromazepam</td>
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</tr>
<tr>
<td>Methoxphenidine</td>
<td>Not banned</td>
</tr>
<tr>
<td>N-Methyl-3-phenyl-norbornan-2-amine</td>
<td>Not banned</td>
</tr>
<tr>
<td>Pyrazolam</td>
<td>Not banned</td>
</tr>
</tbody>
</table>
6. **Definition of a death related to drug misuse**

In 2000, the Advisory Council on the Misuse of Drugs published a report called “Reducing Drug Related Deaths” (The Advisory Council on the Misuse of Drugs, 2000). In response to this report’s recommendations on improving the present system for collecting data on drug-related deaths, a technical working group was set up. This group, consisting of experts across government, the devolved administrations, coroners, toxicologists and drugs agencies, proposed a headline indicator for drug misuse deaths as part of the government’s action plan (Department of Health, 2001), to reduce the number of these deaths. This indicator also takes into account the information needs of the European Monitoring Centre for Drugs and Drug Addiction. The baseline year for monitoring deaths related to drug misuse was set as 1999. The definition of the headline indicator using ICD-10 is shown below.

Cause of death categories included in the headline indicator of drug misuse deaths (the relevant ICD-10 codes are given in brackets):

a) Deaths where the underlying cause of death has been coded to one of the following categories of mental and behavioural disorders due to psychoactive substance use (excluding alcohol, tobacco and volatile solvents):

- opioids (F11)
- cannabinoids (F12)
- sedatives or hypnotics (F13)
- cocaine (F14)
- other stimulants, including caffeine (F15)
- hallucinogens (F16)
- multiple drug use and use of other psychoactive substances (F19)

b) Deaths where the underlying cause of death has been coded to one of the following categories and where a drug controlled under the Misuse of Drugs Act 1971, was mentioned on the death certificate:

- Accidental poisoning by drugs, medicaments and biological substances (X40–X44)
- Intentional self-poisoning by drugs, medicaments and biological substances (X60–X64)
- Poisoning by drugs, medicaments and biological substances, undetermined intent (Y10–Y14)
- Assault by drugs, medicaments and biological substances (X85)
- Mental and behavioural disorders due to use of volatile solvents (F18)

7. **Heroin and morphine**

Heroin (diamorphine) breaks down in the body into morphine, so either heroin and/or morphine may be detected at post mortem and recorded on the death certificate. Therefore a combined figure for deaths where heroin or morphine was mentioned on the death certificate is included in Figure 1.

8. **Cocaine**

The figure for cocaine in Figure 1 also includes deaths where cocaine was taken in the form of crack cocaine. It is not possible to separately identify crack cocaine from other forms of cocaine at post mortem. Other evidence to distinguish the form of cocaine taken is rarely provided on death certificates.

9. **Confidence intervals**

Figure 4 shows age-specific mortality rate for deaths involving legal highs, 95% confidence intervals are available in the downloadable Excel datasets. Confidence intervals are a measure of the statistical precision of an estimate and show the range of uncertainty around the estimated figure. Calculations based
on small numbers of events are often subject to random fluctuations. As a general rule, if the confidence interval around one figure overlaps with the interval around another, we cannot say with certainty that there is more than a chance difference between the 2 figures.

10. **Special extracts**

Special extracts and tabulations of mortality data for England and Wales are available to order (subject to legal frameworks, disclosure control, resources and agreement of costs, where appropriate). Such requests or enquiries should be made to:

Mortality Analysis Team  
Life Events and Population Sources Division  
Office for National Statistics  
Government Buildings  
Cardiff Road  
Newport  
NP10 8XG  
Tel: +44 (0)1633 455341  
Email: mortality@ons.gsi.gov.uk

The [ONS charging policy](https://www.ons.gov.uk) can be found on our website.

11. **Life Events user feedback**

As a user of our statistics, we would welcome your feedback on this publication. Please get in touch either via email at mortality@ons.gsi.gov.uk or telephone on +44 (0)1633 455341.

12. **Revisions**

The [ONS revisions policy](https://www.ons.gov.uk) is available on our website.