Paracetamol self-poisoning: epidemiological study of trends and patient characteristics from the Multicentre Study of Self-harm in England

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Abstract

Background: Paracetamol is frequently used for intentional self-poisoning, especially in the UK, despite pack size restrictions introduced in 1998. Knowing more about paracetamol self-poisoning may identify further approaches to prevention.

Methods: We used data from the Multicentre Study of Self-harm in England for 2004-2014 to calculate incidence rates of presentations to Emergency Departments following self-poisoning with pure paracetamol alone. National estimates for England for 2011-2014 were extrapolated using indirect age-standardised rates. The characteristics of individuals taking paracetamol overdoses and the size of the overdoses were investigated.

Results: A third of 54,863 intentional overdoses presenting to the five Emergency Departments involved paracetamol without other drugs (N=18,011), taken by 13,171 individuals (63.4% female). The proportion of paracetamol self-poisonings was similar in the three centres. Extrapolation suggested there were approximately 50,000 paracetamol overdoses in England annually during 2011-2014. Females had higher rates of paracetamol overdose than males. Males and older individuals took larger overdoses. Nearly a quarter of individuals (24.2%) consumed more than 32 tablets. Alcohol was involved in 53.7% of paracetamol overdoses.

Limitations: Data were collected in three centres with predominantly urban populations. Extrapolation from local to national rates should be interpreted with caution.

Conclusions: Paracetamol overdose remains a major problem in the UK. It is more common in females and younger patients, but males and older patients consume larger overdoses. Consideration should be given to further restriction in pack sizes and sources of sales, in keeping with those of several other European countries.

1. Introduction

1.1 Background

1.1.1 Paracetamol is one of the most widely used drugs worldwide owing to its analgesic and antipyretic properties and is generally safe if taken in the recommended therapeutic dose. However, it can be toxic in overdose: for some individuals at levels only just above the recommended dose (Burns et al., 2018). Despite the fact that treatment with n-acetylcysteine is usually very effective in protecting the liver if treatment following an overdose is started early enough after initial ingestion of the paracetamol, one in every 500 paracetamol overdoses results in liver failure (Public Health England, 2017). National mortality figures from the Office for National Statistics (ONS) indicate there were 218 paracetamol-linked deaths in England and Wales in 2017 (Office for National Statistics, 2018), although not all of these were intentional overdoses.

1.2 General epidemiology in the UK and internationally

1.2.1 Studies in England have shown paracetamol in some form was involved in 43% of all overdoses presenting to an emergency department in Nottingham (Prescott et al., 2009) and in 33% of overdoses in three other centres (Hawton et al, 2011). In Ireland the proportion of overdoses involving paracetamol ranged from 21% to 29% (Griffin et al., 2018; Hawton et al., 2011) and in an Australian hospital paracetamol was involved in 24% of first-time overdoses, and in 31% of repeat presentations (Martin et al., 2014). A study in the USA found that acetaminophen (paracetamol) was involved in 0.06% of all emergency department (ED) visits over a five year period: an estimated 56,000 to 78,000 ED attendances, 26,000 to 34,000 general hospital bed admissions annually, and around 500 deaths (Budnitz et al., 2011). Acetaminophen overdose was a particular problem in young females up to 20 years of age.

1.2.2 Paracetamol is readily available in a range of retail outlets in the United Kingdom. Since legislation in September 1998, it may be sold in non-pharmacy outlets in pack sizes of

up to 16 tablets, whereas pharmacies may sell packs of up to 32 tablets. The Medicines and Healthcare products Regulatory Agency (MHRA) guidance on non-pharmacy sales of analgesics recommends that retailers limit analgesics to a maximum of two packs per transaction (Medicines and Healthcare products Regulatory Agency, 2009).

1.2.3 A comparison of paracetamol overdoses taken before and after the 1998 legislation to limit pack sizes in the UK showed that there was a small reduction (of one to two tablets) in the mean number of tablets taken in the three years after the legislation and a significant reduction in the number of overdoses involving 32 or more tablets, with an associated reduction in deaths (Hawton et al., 2004). A study examining the long-term effect of reduced pack sizes of paracetamol in the UK indicated it significantly reduced the number of deaths due to paracetamol overdose in England and Wales (Hawton et al., 2013). The effect of legislation to reduce the pack size to 12 tablets in Ireland was that hospital admissions for paracetamol overdoses reduced significantly, not only in the 5 years following the legislation but also further over the next five years (Donohoe et al., 2006).

1.2.4 A recent survey of countries in Europe has shown wide variation in both availability of paracetamol from pharmacy and non-pharmacy outlets and, where pack size limits have been introduced, in the maximum pack sizes permitted (Morthorst et al., 2018). In Sweden, paracetamol had only been available from pharmacies until 2009 and paracetamol poisonings had been declining. From November 2009, over-the-counter sales from non-pharmacy outlets were permitted, and there was an increase of over 40% in paracetamol poisonings between 2009 and 2013. From November 2015 the country returned to pharmacy only sales (Gedeborg et al., 2017). Furthermore, a recent evaluation of Danish legislation found that restricting paracetamol sales to those aged 18 years and over led to a 17% reduction in non-opioid analgesic poisonings in those age 10 to 17 years (Morthorst et al., 2020).

1.2.5 The aim of the present study was to provide information on the extent of intentional paracetamol poisonings in England by focussing on attendances to Emergency Departments for overdoses of pure paracetamol alone. The majority of hospital-presenting overdoses in England are for pure paracetamol alone and we sought to exclude paracetamol compounds (often with opiates) because of the more complex clinical management that may be involved. The study aimed to identify characteristics of this group in terms of age, gender and size of overdose taken as well as examining changes in paracetamol self-poisoning over time. This allowed us to estimate, by means of extrapolation, the number of individuals presenting to Emergency Departments in England following overdose of pure paracetamol and the number of times they present within a year. This information will be relevant to planning hospital services and for consideration of possible future regulatory practice.

2. Method

2.1 This is an observational study.

2.1 Data sources

2.1.1 This study was undertaken using data from the Multicentre Study of Self-harm in England, which has been described in detail elsewhere (Hawton et al., 2007). In this study data are collected on all self-harm presentations to five emergency departments: in Oxford (one hospital), Manchester (three hospitals) and Derby (two hospitals that merged into one in 2009). For attendances resulting in a psychosocial assessment (of the patient's mental state, needs and risks), the assessing psychiatric clinicians complete bespoke data collection forms. For attendances not resulting in a psychosocial assessment, trained research and clinical staff scrutinise ED records to ensure all self-harm episodes are identified. We thus have information on all episodes of hospital attendance for self-harm.

2.1.2 The data collected for all attendances include core variables, such as demographic information, date of self-harm, method of self-harm and number of tablets taken in

overdose (paracetamol only), hospital admission, and local authority area (to ascertain those living within specific catchment areas). For attendances resulting in a psychosocial assessment, further variables are collected, for example, alcohol use, previous self-harm, and current and/or previous psychiatric treatment.

2.1.3 Data used included attendances occurring between 1st January 2004 to 31st December 2014 inclusive, a period for which detailed information on analgesics taken in overdose and the number of pure paracetamol tablets ingested was available from all three study centres. We included individuals where both gender and age were known, and excluded patients under 10 years of age. We restricted the study to self-poisoning alone (i.e. excluding self-injuries alone or those which occurred in combination with overdose). Since the majority of hospital-presenting overdoses in England which involve paracetamol are of pure paracetamol alone and we excluded paracetamol compounds (which often include opiates) because of the more complex clinical management that may be involved.

2.1.4 Mid-year population estimates, by gender and age, for the years 2004 to 2014 were obtained from the Office for National Statistics (ONS) for the relevant catchment areas for each centre, and also for England.

2.2 Analysis

2.2.1 We calculated the proportion of pure paracetamol overdoses as a percentage of all hospital-presenting self-poisonings by centre and by gender with 95% confidence intervals (CI).

Person-based incidence rates We estimated the incidence of pure paracetamol self-poisoning in the three centres combined using the first presentation of a pure paracetamol overdose by each individual per calendar year as the numerator and the mid-year population estimates as the denominator.

Episode-based incidence rates We also estimated episode-based rates using all paracetamol overdoses presenting each year as the numerator, and using the same denominator as for the person-based rates.

For these incidence rates, we included patients who lived within defined catchment areas for each hospital for which mid-year population estimates could be reliably identified.

2.2.2 Trends in the incidence of pure paracetamol self-poisoning over time for the three centres combined were examined using the Chi-square test for linear trend. We also estimated the overall incidence of pure paracetamol poisoning in the population in England by means of extrapolation. This was based on indirect age-standardised annual incidence rates of pure paracetamol overdoses in the present study during the period 2011 to 2014 applied to the mid-year population estimates for England for 2011 to 2014 (i.e. the last four years of the study period) for the same age groups .

2.2.3 We compared the proportions of pure paracetamol overdoses between males and females on the following characteristics: admission to a general hospital bed (such as short stay units, medical assessment units, or to a ward), the proportion receiving a psychosocial assessment, and age groups (10-19 years, 20-34 years, 35-54 years and > 55 years). Patient characteristics were those recorded during each patient's first presentation to hospital where they had taken pure paracetamol in the study period.

2.2.4 We calculated the odds ratios and confidence interval comparing pure paracetamol overdoses in each age group with those in the patients aged 10-19 years of age. This age group was used as the reference group because this is the group in which pure paracetamol overdoses were most common.

2.2.5 For patients who received psychosocial assessment by the hospital psychiatric services, we compared the proportion of patients who had ingested alcohol (in the six hours

before or during the overdose) with pure paracetamol, previous self-harm, and current or previous psychiatric treatment.

2.2.6 To compare patients on the quantity of paracetamol tablets consumed, we divided the number of tablets consumed by 16 to derive paracetamol pack-equivalents (up to 1 pack [up to 16 tablets]); >1-2 packs [17-32 tablets], >2 packs [33 or more tablets]). We compared the proportion of patients who took one pack-equivalent, two pack-equivalent and so on between the age groups and by gender. In this analysis we used broad age groups (10-24 years, 25-54 years and 55+ years). We calculated risk ratios to examine how the categories of numbers of tablets varied by age group. We used chi-squared tests to explore the association between the number of tablets taken and gender. Gender differences in the proportion of patients who had taken the equivalent of two or more packs of paracetamol were estimated using Z scores. Number of missing values are provided in the relevant tables.

2.2.7 Statistical analyses were carried out using Excel 2013, SPSS v25 and Stata 14.

2.3 Ethical approval

2.3.1 The monitoring systems in both Oxford and Derby have approval from NHS Research Ethics Committees to collect data on self-harm for local and multi-centre projects. Self-harm monitoring in Manchester is part of a local clinical audit system and has been ratified by the local Research Ethics Committee. All three systems are compliant with the General Data Protection Regulation 2018 and all three centres have support under Section 251 of the National Health Services Act 2006 to process patient-identifiable information without explicit patient consent.

3. Results

3.1 Dataset

3.1.1 The initial dataset included 75,132 episodes of self-harm by 42,258 individuals presenting to the three centres during the period 2004-2014. Of these, 56,489 episodes (75.2%) were self-poisoning alone (34,768 individuals). There were 24,874 overdoses involving some form of paracetamol (44.0%), of which 22,472 (39.8%) included only paracetamol or paracetamol compounds. Of these, 18,011 episodes involved pure paracetamol (80.1%), 2,847 paracetamol compounds (12.7%) and 1,614 (7.2%) both pure and compound paracetamol in the same overdose (Fig 1). Thus the dataset used for the study included 18,011 episodes of pure paracetamol overdose: 11,420 (63.4%) by females; 6,591 (36.6%) by males.

(Fig 1 here)

3.2 Epidemiology

3.2.1 Of all presentations to emergency departments for overdoses, 32.8% were for pure paracetamol, 34.3% in females and 30.5% in males (Table 1).

(Table 1 here)

3.2.2 As a proportion of all overdoses, there was no change in the trends over time in those involving pure paracetamol for males ($X^2_{(1)}$ for linear trend = 2.51, p=0.113). In females there was a small but significant decrease over time (X^2 for linear trend $_{(1)}$ = 7.88, p<0.01). Person-based incidence rates of pure paracetamol poisoning showed a downward trend over the study period in both genders (males: $X^2_{(1)}$ = 8.73, p<0.01; females: $X^2_{(1)}$ = 15.29, p<0.0001. Similarly, episode-based rates followed the same trend (males: $X^2_{(1)}$ = 8.09, p<0.01; females: $X^2_{(1)}$ = 26.33, p<0.0001). These downward trends mainly appear to be related to declines during the last two years of the study period in males and just the last

year in females. This drop in rate at the end of the study period was not associated either with any specific centre, nor any specific age group. Both person-based and episode-based rates were significantly higher in females than males across all years (Figure 2).

(Figure 2 here)

3.2.3 While the proportion of all overdoses that involved paracetamol varied very little between the three centres, there was marked variation between the centres in rates of paracetamol overdoses (Table 1). The lowest rates were in Oxford, while Derby had the highest rate of paracetamol overdoses in both genders. Assuming the average rate of pure paracetamol overdoses, by age group, across the three centres is representative of England as a whole (see Discussion for details) we estimate that the annual number of hospital presentations for pure paracetamol overdoses is likely to be around 50,000 per year, involving approximately 36,000 individuals (Table 1). In addition, we estimate from our data (Figure 1) that there are likely to be a further 8,600 (95% CI 7,300 to 8,750) episodes by 7,500 (95% CI 7,300 to 7,650) individuals involving paracetamol in some form, i.e. compounds and/or with other drugs and/or self-injury.

(Table 2 here)

3.3 Patient characteristics

3.3.1 Patients aged 10-19 years were more likely to have used pure paracetamol in overdose (37.9%) than other age groups. Compared with the youngest age group (10-19 years), older age groups were less likely to have taken paracetamol in overdose, especially those aged 35 years or older (Table 2). More than two-thirds of patients (68.8%) were admitted to a general hospital bed following an overdose of pure paracetamol and 62.7% received a full psychosocial assessment. Of those who were assessed, 53.7% used alcohol either shortly before or as part of their self-harm act, this being more frequent in males (62.2%) than females (51.1%; $X^2_{(1)} = 72.36$, $p<0.0001$). The majority (59.7%) were known to

have self-harmed before, 38.7% were receiving psychiatric treatment at the time of their overdose and half (49.4%) had received psychiatric care in the past (Table 2).

3.4 Size of overdose

3.4.1 Overall, information on the number of tablets was available for 86.5% (15,587/18,011) of overdoses where paracetamol was the only drug taken. Where the number of tablets was not recorded this was usually because the information was not available from patient assessments, but in some cases because the drug was not taken in tablet form. The mean number of tablets ingested was 24.5 (95% CI 24.2-24.9); the median was 18 (IQR 10-32) with the maximum number of tablets taken in a single act recorded as 400. Nearly a quarter (24.2%, 95% CI 23.3% to 25.1%) of individuals consumed the equivalent of more than two packs (>32 tablets) of paracetamol. This applied to a third (32.3%, 95% CI 28.8%-34.8%) of males compared with 19.6% (95% CI 17.6%-21.6%) of females ($Z=7.71$, $p<0.001$). The number of tablets consumed (by category) increased linearly by age group, rho = 0.143, $p<0.001$. Overall, 40.2% of overdoses involved the equivalent of up to one pack (16 tablets).

3.4.2 Males took significantly larger overdoses of paracetamol than females across all age groups. The proportion of people taking more than two packets also increased with age, with males aged 25-54 years being 1.47 times more likely, and males aged 55 years and over being 2.19 times more likely, to take more than two packs of paracetamol than males aged 10-19 years. Females aged 55 years and over were 1.30 times more likely to take more than two packets of paracetamol than females aged 10-24 years (Table 3). Furthermore, 26.3% (4,101/15,587) of patients took an exact multiple of 16 tablets, i.e. they consumed the equivalent of whole packs of paracetamol. The largest overdose in this group was equivalent to 25 packs.

(Table 3 here)

4. Discussion

4.1.1 In this study of paracetamol overdoses based on data from the Multicentre Study of Self-harm in England, overdoses of pure paracetamol without other drugs accounted for 34.3% of all overdoses by females and 30.5% by males. There was little change in rates of overdoses involving paracetamol for the first nine years of the study period. However, there was a decline in rates during the last two years for males while for females a decline was observed in the last year, the reason for which is not clear. Paracetamol continues to be the most common drug taken in overdose in England (Geulayov et al., 2016). This most probably reflects the ready availability of this medicine and the ease with which it can be purchased from pharmacy and non-pharmacy outlets (Molloy et al., 2016). Both episode-based and person-based rates were significantly higher in females than in males.

4.1.2 Compared with those aged 10-19 years, the proportion of patients taking paracetamol alone in overdose decreased with age group in both genders. Thus, as in other studies (Budnitz et al., 2011; Graudins, 2015; Prescott et al., 2009), we found that paracetamol is more commonly used by young patients who self-harm, especially females. This may be because younger patients are less likely to have access to prescribed medications. Over half of patients used alcohol in association with their self-harm act. This is relevant because alcohol can increase the risk of liver damage following paracetamol overdose in individuals using alcohol chronically (Graham et al., 2004; Prescott, 2000). The majority of patients (60%) were known to have self-harmed previously, 39% were receiving psychiatric treatment at the time of their overdose, and 49% had received psychiatric care in the past.

4.1.3 The median number of tablets taken per overdose was 18 (IQR 10 to 32), with 40% of overdoses involving up to 16 tablets (one pack). Nearly a quarter (24.2%) of individuals consumed the equivalent of more than two packs (>32 tablets) of paracetamol. This applied

to more males (32%) than females (20%). The mean number of tablets taken increased linearly by age group, with males taking larger overdoses than females across all ages.

4.1.4 By extrapolating from our figures for 2011-2014, we estimated that the annual number of emergency department presentations for pure paracetamol self-poisoning was almost 50,000 nationally, involving more than 36,000 individuals. These numbers are an under-estimate and if we were to include overdoses in which paracetamol was taken in compounds and/or with other drugs and/or self-injury for the last four years of the study this indicates that there might be an additional 8,600 episodes per year involving 7,500 individuals. Restriction of access to means to reduce suicidal behaviour, while extremely important (Hawton, 2005) is just one component of broad suicide prevention policies. Examples of other initiatives focussed specifically on self-harm, which is the strongest risk factor for suicide, include development of evidence-based psychosocial treatments (Hawton et al., 2016), provision of psychological help through specific suicide prevention clinics (Erlangsen et al., 2014), and school-based prevention programmes (Wasserman et al., 2015). Thus a broad range of strategies need to be considered to address self-harm and suicide. Moreover, it is also important to address the major impact that both suicide and self-harm have on relatives, friends and other individuals (Ferrey et al., 2015; Pitman and Erlangsen, 2014), as well as the other costs to society (Tsiachristas, 2017).

4.1.5 A study of the economic costs of self-harm estimated that a hospital presentation for paracetamol overdose, with or without other drug involvement, incurred an average medical cost of £938 (Tsiachristas, 2017). Therefore we estimate the annual national cost of paracetamol overdoses in England in 2011-2014 to have been £46.6 million. With regard to particularly severe paracetamol overdoses, approximately one in 300 people who take a paracetamol overdose is referred for a liver specialist opinion and around one in 500 paracetamol overdoses result in liver failure (Public Health England, 2017). Although absolute numbers are relatively small, the costs for patients admitted to liver units are very high. Personal correspondence with Professor Will Bernal of Kings College, London, suggests that, in the UK, such patients who survive cost an average of £13,500, those who do not

survive cost around £20,000 and a liver transplant costs up to £120,000 per patient. Thus the overall costs of paracetamol overdoses are extremely high.

4.2 Strengths and limitations of the study

4.2.1 The data on paracetamol in this study came from a large cohort, with information on all overdoses presenting to the hospitals, whether or not they resulted in admission or a psychosocial assessment. We also have information on the number of tablets taken for most overdoses, although data rely heavily on patient recall which could result in some misclassification, both of drugs taken and size of overdose.

4.2.2 These probably represent the best available detailed data on hospital-presenting self-harm in the UK (Clements et al., 2016). The three centres can identify individuals who live within defined geographic areas, permitting us to produce person-based and incidence-based rates of paracetamol overdoses.

4.2.3 The data were collected in five general hospitals in three different regions. Whilst we cannot be certain that these hospitals are representative of others across the country, because the catchment areas are mostly urban, they cover a wide range of levels of socio-economic deprivation, with Manchester at the lower end, Oxfordshire at the higher end, and Derby in between (Geulayov, 2016; Tsiachristas, 2017).

4.2.4 The proportion of overdoses involving paracetamol found in this study is consistent with those found by Prescott et al (2009) in Nottingham, suggesting that the situation is likely to be broadly similar across the country. We found that 52.2% of paracetamol overdoses involved patients taking up to the equivalent of one packet of tablets, compared with the 43.7% found in Nottingham, which included paracetamol compound overdoses.

4.2.5 We have used data for those individuals taking only pure paracetamol overdoses because of the possible differing characteristics of those who also self-injure or who take other specific types of drugs in overdose in addition to paracetamol.

4.3 Implications for research and policy

4.3.1 The UK was one of the first countries to restrict availability of paracetamol through introduction of reduced pack sizes. Many other European countries have now introduced policies to restrict sales of large amounts of paracetamol. A recent survey of European countries showed that the UK permits a larger pack size in sales from non-pharmacy outlets than most other European countries, where typically packs of 10 or 12 tablets per pack are available over-the-counter (instead of the 16 tablets per pack in the UK) (Morthorst et al., 2018). Also, paracetamol is available through a wide range of non-pharmacy outlets, including corner shops, petrol stations, newsagents, discount stores and supermarkets (as well as online sales). The same survey also showed that in countries where non-pharmacy sales are available, there is an increased level of calls to toxicology units about paracetamol poisoning compared to countries with sales restricted to pharmacies (12 of the countries surveyed). In the UK, anyone over the age of 16 years can purchase two packets of 16 tablets in one transaction. In the rest of Europe non-pharmacy sales are restricted to 10 tablets in Denmark and Norway and to 12 tablets in Ireland and Poland. Where paracetamol sales are pharmacy-only, the amounts that can be purchased vary from 16 tablets in Switzerland, 20 tablet packs in Norway, Slovenia, Germany, and 24 tablets in Ireland (Morthorst et al., 2018).

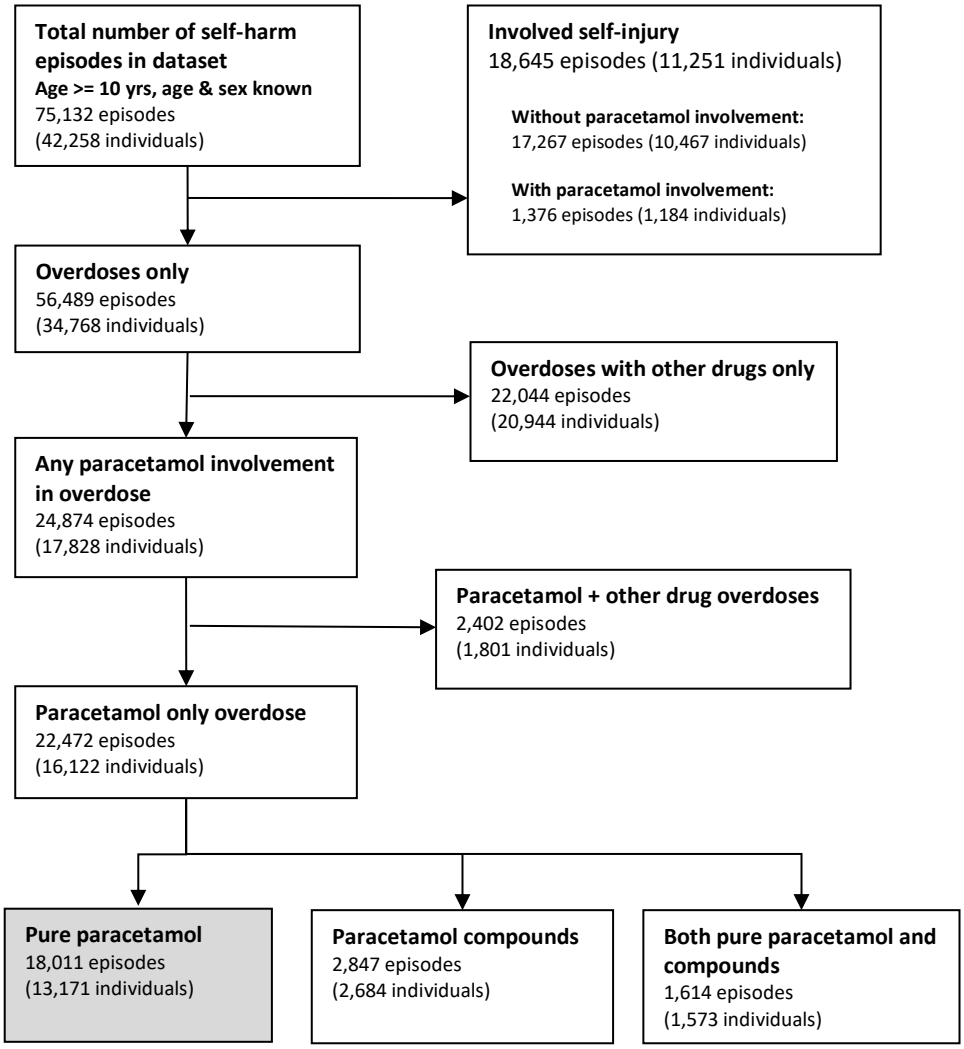
4.3.2 In one study in England, 36 out of 52 retail outlets visited by trained medical students sold more than two packs of paracetamol in one transaction and almost a quarter of the stores tested sold six packs at a time (Molloy et al., 2016). This ready availability of paracetamol may contribute to its greater use in overdose by younger rather than older individuals as shown in the present study, combined with the recognised frequently impulsive nature of paracetamol overdoses (Simkin et al., 2012). It may also be a factor

contributing to the apparent greater use of paracetamol in overdose than in other countries (Morthorst et al., 2018)., However, availability of relatively large amounts in households may be another contributory factor (Simkin et al., 2012).

4.3.3 Some of the most effective strategies for reducing suicides have involved restricting access to means (Hawton, 2005). As noted earlier, a comparison of paracetamol overdoses taken before and after the legislation to limit pack sizes in the UK in 1998 showed a small reduction in the mean number of tablets taken in the three years after the legislation and a significant reduction in the number of overdoses involving 32 or more tablets (Hawton et al., 2004). A longer-term study added evidence that the legislation had beneficial effects in terms of reduced numbers of deaths from paracetamol overdose (Hawton et al., 2013).

4.3.4 It is acknowledged that paracetamol is a relatively low lethality method of self-harm, but there are still substantial numbers of deaths from paracetamol overdose in the UK. The findings from this study suggest that further restrictions on access to paracetamol in the UK should be considered. In view of the finding that nearly half of all overdoses in under 18 year olds are of pure paracetamol alone, one option would be to change MHRA guidance to limit sales in non-pharmacy outlets to one pack per transaction and raise the age limit for purchase to 18 years. This policy has been effective in Denmark in reducing overdoses in young people (Morthorst et al, 2020). Another option would be to further reduce the number of tablets available per pack from non-pharmacy sales to 10 or 12 tablets in line with other European countries. Consideration might also be given to a return to pharmacy-only sales of this medicine.

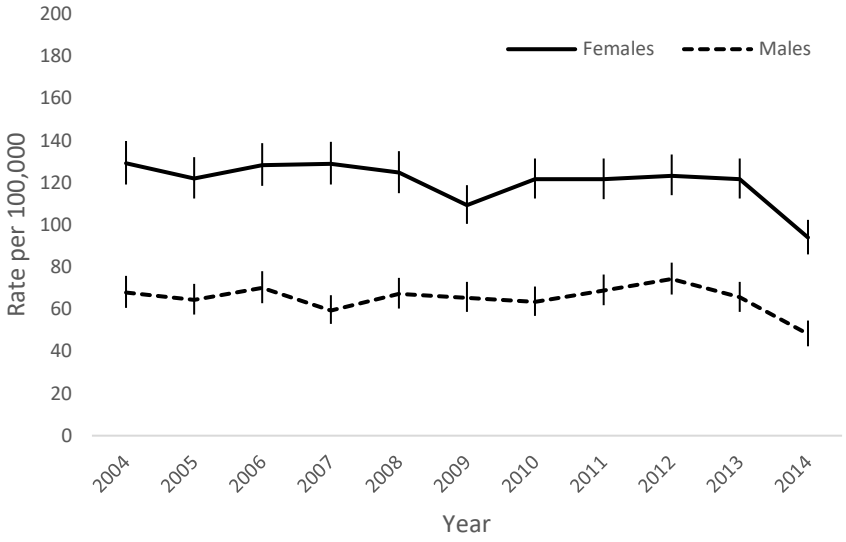
Figure 1: Numbers of episodes and persons over the study period 2004-2014



NB: Individuals in each category are not mutually exclusive: a person may take multiple overdoses using different drugs at each overdose over the study period

Figure 2: Rates per 100,000 population of pure paracetamol overdose

a) Person-based rates (with 95% confidence intervals)



b) Episode-based rates (with 95% confidence intervals)

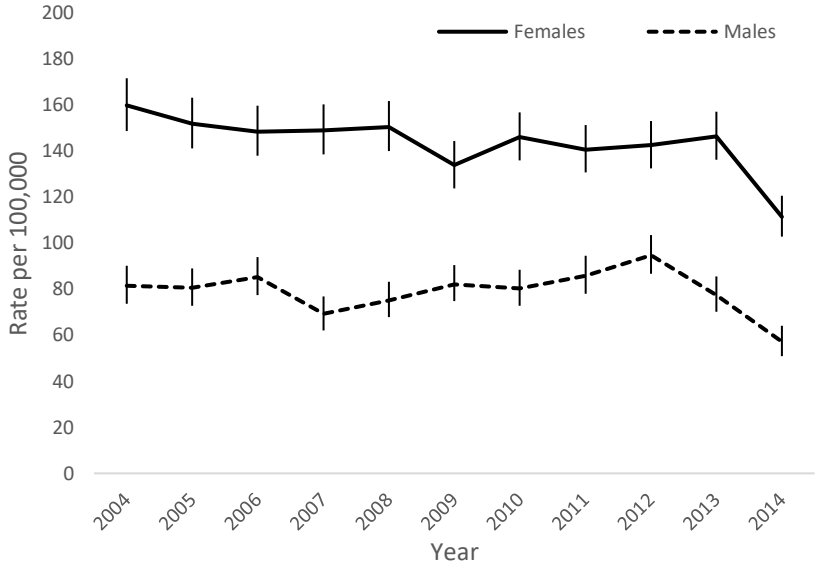


Table 1: Pure paracetamol overdoses as a percentage of all overdoses presenting to hospital and rates of pure paracetamol overdoses for the years 2011-2014, by centre, along with estimated numbers of hospital-presenting pure paracetamol overdoses in England, using the population of England for the same period

	Males			Females			Both Males and Females		
Paracetamol overdoses as a percentage of all hospital-presenting self-poisonings									
	n/N	**(%)**	**[95% CI]**	**n/N**	**(%)**	**[95% CI]**	**n/N**	**(%)**	**[95% CI]**
Oxford	1396/4641	(30.1)	[28.5 to 31.7]	2817/8164	(34.5)	[33.2 to 35.8]	4213/12805	(32.9)	[31.9 to 33.9]
Manchester	3203/10705	(29.9)	[28.9 to 31.0]	4920/14826	(33.2)	[33.3 to 34.1]	8123/25531	(31.8)	[31.1 to 32.5]
Derby	1992/6256	(31.8)	[30.5 to 33.3]	3683/10271	(35.6)	[36.4 to 38.8]	5675/16527	(34.3)	[33.5 to 35.2]
Overall	***6591/21602***	***(30.5)***	***[29.8 to 31.3]***	***11420/33261***	***(34.3)***	***[33.7 to 35.0]***	***18011/54863***	***(32.8)***	***[32.4 to 33.3]***
Episode-based rates[1] of pure paracetamol poisoning by Centre									
	Rate/100,000	**[95% CI]**		**Rate/100,000**	**[95% CI]**		**Rate/100,000**	**[95% CI]**	
Oxford	45.4	[36.3 to 56.1]		94.2	[80.9 to 108.8]		69.9	[61.8 to 78.8]	
Manchester	88.1	[76.3 to 101.4]		141.9	[126.6 to 158.5]		114.8	[105.1 to 125.2]	
Derby	118.5	[99.1 to 141.5]		197.9	[172.5 to 226.0]		158.96	[142.2 to 176.2]	
Overall episode-based rate	***78.8***	***[71.3 to 86.7]***		***136.1***	***[126.2 to 146.4]***		***107.5***	***[101.3 to 114.0]***	

Estimated numbers of pure paracetamol overdoses in England (Average for 2011-2014) using indirect age-standardisation to the population of England

	Males		Females		Both Males and Females	
	Estimated N	**[95% CI]**	**Estimated N**	**[95% CI]**	**Estimated N**	**[95% CI]**
Hospital Presentations	17,423	[15,729 to 19,226]	32,774	[30,372 to 35,354]	49,615	[46,697 to 52,691]

Person-based rates[1] of pure paracetamol poisoning by Centre

	Rate/100,000	**[95% CI]**	**Rate/100,000**	**[95% CI]**	**Rate/100,000**	**[95% CI]**
Oxford	37.6	[29.3 to 47.3]	79.0	[66.9 to 92.6]	58.7	[51.23 to 66.9]
Manchester	73.0	[62.2 to 85.1]	126.9	[112.4 to 142.6]	99.5	[90.4 to 109.2]
Derby	92.7	[75.3 to 112.9]	157.9	[135.3 to 183.3]	125.8	[111.3 to 141.7]
Overall person-based rate	***64.1***	***[57.4 to 71.4]***	***115.8***	***[106.7 to 125.4]***	***90.0***	***[84.3 to 96.0]***

Estimated numbers of individuals taking pure paracetamol overdoses in England (Average for 2011-2014)

	Estimated N	**[95% CI]**	**Estimated N**	**[95% CI]**	**Estimated N**	**[95% CI]**
Number of individuals	**12279**	[10,883 to 13,831]	24,213	[22,127 to 26,416	36037	[33,548 to 38,665]

[1] *Based on indirect age-standardised rates for 2011 to 2014 applied to the average annual population of England for the same period and age groups*

Table 2: The characteristics of those who presented with paracetamol in overdose

	Missing	Males		Females		Total	
Overdoses	*%*	**N**	**(%)**	**N**	**(%)**	**N**	**(%)**
Proportion of individuals presenting with self-poisoning who took a pure paracetamol overdose (within age group)							
10-19 yrs	*0.0*	803	(35.2)	2,928	(38.8)	3,731	(37.9)
20-34 yrs	*0.0*	2,124	(24.7)	3,094	(24.6)	5,236	(24.6)
35-54 yrs	*0.0*	1,525	(16.1)	1,996	(17.0)	3,521	(16.6)
55+ yrs	*0.0*	362	(19.1)	481	(21.2)	843	(20.2)
Overall	*0.0*	4,832	(21.6)	8,449	(24.9)	13,331	(23.6)
Odds ratios (OR) for taking pure paracetamol in overdose							
		OR	**[95% CI]**	**OR**	**[95% CI]**	**OR**	**[95% CI]**
10-19 yrs		1.000	-	1.000	-	1.000	-
20-34 yrs		0.596	[0.539 to 0.659]	0.515	[0.484 to 0.548]	0.534	[0.507 to 0.562]
35-54 yrs		0.353	[0.318 to 0.391]	0.324	[0.303 to 0.347]	0.325	[0.308 to 0.344]
55+ yrs		0.435	[0.376 to 0.504]	0.425	[0.379 to 0.475]	0.415	[0.381 to 0.619]
Of those taking pure paracetamol only (N= 13,171)							

Hospital admission	*11.7*	2,843	(67.4)	5,250	(69.5)	8,093	(68.8)
Psychosocial assessment	*0.0*	2,985	(61.8)	5,368	(63.2)	8,353	(62.7)
Assessed Patients[1] (N=7420)							
Alcohol use in association with self-harm[2]	*13.6*	1,432	(62.2)	2,010	(51.1)	3,442	(53.7)
Past self-harm[2]	*11.7*	1,375	(57.9)	2,535	(60.7)	3,910	(59.7)
Current psych treatment[2]	*9.8*	848	(35.8)	1,743	(40.3)	2,591	(38.7)
Past psych treatment[2]	*9.4*	1,193	(49.5)	2,128	(49.3)	3,321	(49.4)

[1] *Assessed patients who took paracetamol*

[2] *Percentages are those within those patients who took paracetamol and were assessed*

Table 3: Size of pure paracetamol overdose (where known) by age group and gender

	Overall		Males		Females		Males v Females
Number of tablets by age group	**N**	***%***	**N**	**%**	**N**	**%**	**X^2 p**
Age 10-24 yrs							
<= 16 tablets (up to 1 pack)	2,530	*45.1*	633	*39.8*	1,897	*47.3*	165.69
17-32 tablets (1-2 packs)	2,021	*36.1*	554	*34.8*	1,467	*36.5*	<0.001
> 32 tablets (more than 2 packs)	1,053	*18.8*	403	*25.3*	650	*16.2*	
Total	5,604	100.0	1,590	*100.0*	4,014	100.0	
Age 25-54 years							
<= 16 tablets (up to 1 pack)	1,870	*35.7*	656	*28.8*	1,214	*41.1*	129.35
17-32 tablets (1-2 packs)	1,836	*35.1*	793	*34.8*	1,043	*35.3*	<0.001
> 32 tablets (more than 2 packs)	1,526	*29.2*	832	*36.5*	694	*23.5*	
Total	5,232	100.0	2,281	*100.0*	2,951	*100.0*	
Age 55+ yrs							
<= 16 tablets (up to 1 pack)	238	*34.6*	75	*26.0*	163	*40.9*	18.81
17-32 tablets (1-2 packs)	237	*34.5*	104	*36.1*	133	*33.3*	<0.001
> 32 tablets (more than 2 packs)	212	*30.9*	109	*37.8*	103	*25.8*	
Total	687	100.0	288	*100.0*	399	*100.0*	
All ages							
<= 16 tablets (up to 1 pack)	4,638	*40.2*	1,364	*32.8*	3,274	*44.5*	253.97
17-32 tablets (1-2 packs)	4,094	*35.5*	1,451	*34.9*	2,643	*35.9*	<0.001
> 32 tablets (more than 2 packs)	2,791	*24.2*	1,344	*32.3*	1,447	*19.6*	
Total	11,523	*100.0*	4,159	*100.0*	7,364	*100.0*	

Risk ratios (RR) for size of overdose by age groups and gender							
		MALES			**FEMALES**		
Size of overdose	**Age Group**	**%**	**RR**	**95% CI**	**%**	**RR**	**95% CI**

Up to 1 pack	**10-24 yrs**	39.81	1.00	-	47.26	1.00	
	25-54 yrs	28.76	0.81	0.76 to 0.86	41.14	0.87	0.82 to 0.92
	55+ years	26.04	0.58	0.45 to 0.74	40.85	0.79	0.65 to 0.95
1-2 packs	**10-24 yrs**	9.89	1.00	-	26.18	1.00	
	25-54 yrs	15.16	1.26	1.20 to 1.32	19.94	0.83	0.78 to 0.87
	55+ years	15.14	1.53	1.26 to 1.85	19.36	0.70	0.59 to 0.84
More than 2 packs	**10-24 yrs**	7.19	1.00	-	11.60	1.00	
	25-54 yrs	15.90	1.47	1.41 to 1.54	13.26	1.08	1.02 to 1.14
	55+ years	15.87	2.19	1.77 to 2.56	14.99	1.30	1.07 to 1.58

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