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1 **Food Anaphylaxis in the United Kingdom: an analysis of national data,**
2 **1998-2018**

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51 **Abstract**

52 **Objective:** To describe time trends for hospital admissions due to food
53 anaphylaxis in the UK over the past 20 years.

54 **Design:** Analysis of national UK data relating to hospital admissions and fatality
55 data for anaphylaxis and prescription data for adrenaline autoinjector devices
56 in the population as a whole, and by devolved nation.

57 **Setting:** United Kingdom, 1998-2018.

58 **Participants:** UK population.

59 **Main outcome measures:** Time trends, age and gender distributions for
60 anaphylaxis admissions caused by food and, for comparison, non-food triggers,
61 and how these compare to fatalities due to food-anaphylaxis.

62 **Results:** Food-induced anaphylaxis represented 29.4% of reported
63 anaphylaxis admissions, and increased significantly from 1.23 (in 1998) to 4.02
64 admissions per 100,000 population per annum in 2018, an annual increase of
65 5.7% (95% CI 5.5 to 5.9); $p<0.001$. The largest increase was seen in children
66 (an annual increase of 6.6% (95% CI 6.3 to 7.0), $p<0.0001$), compared with
67 adults. There were 152 fatalities identified where the fatal event was very likely
68 due to food-induced anaphylaxis. The case fatality rate (number of fatalities as
69 a proportion of hospital admissions) for food anaphylaxis decreased from 0.7%
70 to 0.19% (confirmed cases, rate ratio 0.931 (95% CI 0.904 to 0.959); $p<0.0001$)
71 and 0.30% (suspected cases, rate ratio 0.970 (95% CI 0.945 to 0.996);
72 $p=0.024$). At least 86 (46%) fatalities were triggered by peanut/tree nuts. Cow's
73 milk was responsible for 26% of fatalities in young people under age 16 years.
74 Over the same time period, prescriptions for adrenaline auto-injectors
75 increased 11% per annum.

Conclusions: Hospitalisations for food-induced anaphylaxis have continued to increase since 1998, however, the case fatality rate is decreasing. In school-aged children, cow's milk is now the commonest single cause of fatal anaphylaxis.

What is already known on this topic

- Hospital admissions due to food anaphylaxis are increasing globally, and doubled between 1998 and 2012 in England and Wales.
- Over the same time-period, the the incidence of fatal anaphylaxis has remained stable.

What this study adds

- Despite an increase in hospitalisation for food-induced anaphylaxis in the UK between 1998 and 2018, the case fatality rate has fallen.
- Cow's milk is increasingly common as a cause of fatal anaphylaxis, and is responsible for over one quarter of anaphylaxis fatalities in children.
- Prescriptions for adrenaline autoinjectors have increased at almost double the rate of hospital admissions. The impact of this on fatal outcomes is unclear.

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96 **Key Words**

97 Anaphylaxis; epidemiology; food allergy; hospitalisation.

98

99 **Abbreviations**

- 100 95% CI 95% Confidence Interval
- 101 HES Hospital Episodes Statistics
- 102 ICD International Classification of Diseases
- 103 ONS Office for National Statistics
- 104 PEDW Patient Episode Database for Wales
- 105 SEM Standard error of the mean
- 106 UKFAR UK Fatal Anaphylaxis Registry

107

108 INTRODUCTION

109 Food allergy continues to attract significant attention at a public health level and
110 in the media. It is the commonest cause of potentially life-threatening allergic
111 reactions (anaphylaxis), a serious systemic hypersensitivity reaction that is
112 usually rapid in onset and may cause death.¹ Significant increases in
113 hospitalisations due to food-anaphylaxis have been reported globally,²
114 however, it is unclear whether this trend is continuing to increase, and if so,
115 how this relates to the incidence of fatal reactions.

116
117 There is an increasing tendency for mainstream media to report routinely-
118 collected data relating to food anaphylaxis,³ but often with little attempt to
119 understand the issues and limitations of using such data; this is partly due to a
120 lack of awareness over the coding systems used, for example admissions due
121 to “allergy” may include day-case admissions for allergy testing, irrespective of
122 whether this results in an allergic reaction. As a consequence, these reports
123 often contrast with the available published data in the scientific literature.

124
125 We have previously reported trends in anaphylaxis in England and Wales
126 between 1992 and 2012.⁴ In the current manuscript, we extend these data up
127 to and including 2018, and also include data from Northern Ireland and Scotland
128 in order to provide a more comprehensive analysis of trends in hospital
129 admissions in the UK which can be matched to UK fatality data. We explore
130 time trends in all-cause and specific-cause anaphylaxis events in different age
131 groups and by gender, and evaluate changes in the case fatality rate for food-
132 induced anaphylaxis in the UK.

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METHODS

Hospital admissions data for England and the devolved administrations (Scotland, Wales and Northern Ireland) are collected in the Hospital Episodes Statistics (HES) database (coordinated through NHS Digital) for England, Patient Episode Database for Wales (PEDW) (NHS Wales Informatics Service, NWIS), Information Services Division (NHS Scotland) and Hospital Activity Statistics (Health-NI), respectively. We extracted data from these datasets relating to hospital admissions from 1998 to 2018, where the primary diagnosis was anaphylaxis. Attendances to the emergency department that did not result in a hospital admission were excluded. The following ICD-10 codes were used: anaphylactic shock due to adverse food reactions (T78.0); anaphylactic shock, unspecified (T78.2); other and unspecified allergy (T78.4); and anaphylactic shock due to adverse effects of correct drug or medicament properly administered (T88.6). Hospitalizations where a primary T78 code was associated with a secondary X23 code were classified as being caused by insect sting-related anaphylaxis. Due to the restrictions on data access, “children” encompassed young people up to 15 years of age.

Fatal food-induced anaphylaxis data

Deaths in England and Wales are recorded by a medical doctor and these data are collected by the Office for National Statistics (ONS). Since 1992, anaphylaxis fatality data have also been collected by the UK Fatal Anaphylaxis Registry (UKFAR). We updated previously published data from UKFAR⁴ using Inquest Reports and reports in the national media, using an identical methodology since the attribution and coding of deaths can be unreliable. For

each death, the probability that it was caused by food-induced anaphylaxis was assessed; deaths caused by an acute asthma exacerbation were included only where there was strong evidence that the episode was triggered by an identified allergen to which the deceased patient had a known allergy. Cases were cross-checked with cases from the ONS database where sufficient information was available to determine the likely cause of death. While we included reports of fatal food-anaphylaxis for residents in Scotland and Northern Ireland, we were unable to cross-check these with the equivalent databases in these nations.

Adrenaline autoinjector prescriptions

Annual prescriptions data for adrenaline autoinjectors were obtained from: NHS Digital (for NHS England); Public Health Scotland; NHS Wales Shared Services Partnership; Health and Social Care Northern Ireland Business Services Organisation.

Statistical Analyses

Hospital admissions data were expressed per 100,000 population for the equivalent ONS population estimate for that year. Age-specific rates for hospital admissions and fatalities were calculated by standardizing to the age distribution of the population to mid-2009 estimates as reported by ONS. Poisson regression was used to estimate the rate ratio (and 95% Confidence Intervals (CIs)) for the annual increase in rates, for the following time periods, as previously described.⁴ All statistical analyses were run in the programming language R. A rate ratio of 1.0 implies no annual change in rate, and a 95% CI that includes 1.0 indicates the observed rate ratio is not statistically significant.

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184 We estimated rate ratios for the overall study period (1998-2018), but also the
185 most recent 5 and 10 year periods in order to assess for possible changes in
186 time trends.

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188 *Patient and public involvement*

189 No patients were involved in setting the research question or the outcome
190 measures, however input was obtained from representatives from Allergy UK
191 and the Anaphylaxis Campaign to inform the presentation of the data included
192 in this report.

194 RESULTS

195 Hospital admissions due to “allergy” increased steadily across all ages since
196 1998 (supplementary fig 1), from 8.0 to 20.8 admissions per 100,000 population
197 in 2018, an increase of 160%. The estimated rate ratio (multiplicative increase
198 of the rate per year over the study period) was 1.039 (95% CI, 1.038 to 1.040;
199 $p<0.0001$). However, only 50.7% of these admissions were coded as being due
200 to (all-cause) anaphylaxis; the remainder also included day cases (for example,
201 for allergy testing such as food challenges). Limiting the analysis to anaphylaxis
202 (T78.0, T78.2, T88.6), hospital admissions increased by 174%, from 4.2 to 11.5
203 per 100,000 p.a., equivalent to a rate ratio of 1.047 (95% CI 1.046 to 1.048,
204 $p<0.0001$). Consistent with our previous data, there was no obvious impact
205 noted following the introduction of maximum waiting time targets in Emergency
206 Departments introduced by the UK government in 2004.

207
208 Analysing these data by age group (0-14 years, 15-59 years, 60+ years), a
209 similar trend was noted although there was evidence of a plateau in adult
210 “allergy” admissions but not for anaphylaxis since 2014 (Figure 1A).
211 Anaphylaxis hospitalisations where the trigger was unknown or due to a non-
212 food trigger are shown in Figure 1B. Across all age groups, age-specific rates
213 for hospitalisations increased, with rate ratios of 1.065 (95% CI 1.060 to 1.069)
214 for 0-14 years, 1.041 (95% CI 1.039 to 1.042) for 15-59 years, and 1.050 (1.048
215 to 1.053) for 60+ years.

217 *Hospitalisations due to food-induced anaphylaxis*

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218 Food-induced anaphylaxis represented 29.4% of reported “allergy” admissions,
219 and significantly increased over the study period from 1.23 to 4.02 admissions
220 per 100,000 population per annum (estimate rate ratio 1.057 (95% CI 1.055 to
221 1.059); $p<0.001$) (supplementary fig 1). The greatest increase in admissions
222 due to food-anaphylaxis was noted for young people under age 15 years: from
223 2.6 to 9.2 admissions per 100,000 population p.a. (an increase of 260%),
224 equivalent to a year-on-year increase of 6.6% (rate ratio 1.066 (95% CI 1.063
225 to 1.070), $p<0.0001$). This compares an increase of 178% (rate ratio 1.059
226 (95% CI 1.056 to 1.062), $p<0.0001$) for age 15-59 years, 93% increase (rate
227 ratio 1.021 (95% CI 1.02 to 1.03), $p<0.0001$) for age 60+ years over the same
228 time period (Figure 1C).

229

230 In 2011, guidance from the National Institute for Health and Care Excellence
231 (NICE) was published which recommended that children under age 16 years
232 should be admitted to hospital under the care of a paediatric medical team
233 following emergency treatment for suspected anaphylaxis.⁵ We therefore
234 calculated rate ratios for the increase in hospitalisations due to food
235 anaphylaxis in children for the time periods 1998-2010 (prior to guideline),
236 2011-2018 and 2014-2018. The rate ratios were 1.057 (95% CI 1.049 to 1.065),
237 1.091 (95% CI 1.079 to 1.103) and 1.086 (95% CI 1.064 to 1.109) respectively.
238 This implies that there was a significant increase in hospital admissions after
239 2011, but also that the rate of increase has continued to persist from 2014
240 onwards. Therefore, the increase over the last 5 years cannot be attributed to
241 the impact of NICE guidance.

Association between gender and anaphylaxis hospitalisation rates

A clear female predominance was seen for non-food triggers of anaphylaxis admissions throughout the study period (Figure 2A), whereas this was not apparent for food anaphylaxis (Figure 2B). On further analysis, looking at gender differences by age, there was a clear male predominance in food anaphylaxis admissions prior to puberty (M:F ratio 1.6:1), which then reversed from age 15 years onwards (Figure 2E), consistent with previous data.⁶ The gender ratio for anaphylaxis admissions due to an “unspecified” trigger in younger children (Figure 2D) implies that many of these prepubertal cases may have been due to a food trigger but coded incorrectly.

Time-trends for anaphylaxis admissions in the UK by devolved nation

Analysing hospital admissions by devolved nation, we observed a significantly lower rate of admissions per 100,000 in Wales compared to the other devolved nations for all-cause anaphylaxis (supplementary fig 2). Due to data protection issues, we were unable to assess the impact of Welsh residents seeking medical attention in English hospitals, which might explain this finding. With respect to food-induced anaphylaxis, admissions were higher in England and Scotland than in Northern Ireland and Wales, although this difference was not significant. The annual increase in admissions showed evidence of plateauing in Wales and Northern Ireland, as reflected by the estimated rate ratio for the year-on-year increase in admissions when considering the period 2014-2018 (Table 1). However, the confidence intervals for these data are wider due to the lower number of cases of anaphylaxis in Wales (3.7%) and Northern Ireland (3.2%).

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269 ***Fatal food-induced anaphylaxis***

270 Between 1998 and 2018, we identified 152 fatalities where there was a high
271 level of suspicion that the fatal event was due to food-induced anaphylaxis; in
272 120 cases, the cause of death at coronial inquiry was for food-induced
273 anaphylaxis, while in the remaining 32 cases, there was sufficient information
274 from the inquest and/or other sources that the fatal event had been associated
275 with exposure to a food allergen to which the individual was allergic. The annual
276 fatality rate due to food-induced anaphylaxis was 0.009 fatalities per 100,000
277 population in 1998 and 0.008 fatalities per 100,000 population in 2018 (Figure
278 3A). The case fatality rate (number of fatalities expressed as a proportion of
279 hospital admissions for food-anaphylaxis) decreased from 0.70% in 1998 to
280 0.19% (confirmed cases) or 0.30% (suspected cases) in 2018 (Figure 3B). The
281 estimated rate ratio was 0.931 (95% CI 0.904 to 0.959; $p<0.0001$) for confirmed
282 cases and 0.970 (95% CI 0.945 to 0.996; $p=0.024$) for suspected fatal food
283 anaphylaxis. The age distribution for fatal cases demonstrated a peak in the
284 teenage years (Figure 3C); however, this age was also associated with a peak
285 in hospital admissions. Assessing the case fatality rate by age group, the
286 highest fatality rate was seen in teenage years but remained elevated
287 throughout adulthood (Figure 3D). While those under 5 years were most likely
288 to be admitted to hospital with anaphylaxis, the rate of fatalities in this age group
289 was very low.

290

291 The triggers for these events are shown in Figure 4. In over one quarter of
292 cases, the precise food could not be identified. At least 86 (46%) fatalities were

293 triggered by peanut/tree nut. However, cow's milk was responsible for 26% of
294 fatalities in children and 5% of adults, despite allergy to cow's milk allergy being
295 uncommon in older children and adults. Since 1992, there has been a
296 downwards trend in the proportion of deaths due to peanut / tree nuts but an
297 increase in those due to cow's milk exposure (Figure 4C).

298

299 ***Prescription of adrenaline autoinjector devices***

300 Time-trends in the prescription of adrenaline autoinjector devices to UK
301 residents, overall and by devolved nation, is shown in Figure 5. Overall,
302 prescriptions increased by 336% from 1998 to 2018. The estimated rate ratio
303 was 1.113 (95% CI 1.112 to 1.113) over the study period, which represents a
304 year-on-year increase of 11% per annum.

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DISCUSSION

In this analysis of hospitalisations and fatalities due to food anaphylaxis over a 20 year period, we demonstrated that while hospitalisations have continued to increase across all age groups, fatalities due to food anaphylaxis have not. Furthermore, over the same time period, the case fatality rate has more than halved, from 0.7% in 1998 to 0.3% in 2018. These data extend previous findings reported for England and Wales to encompass the UK population,⁴ and are consistent with epidemiological trends in hospitalisations for anaphylaxis from USA and Australia.²

Improvements in the recognition and management of anaphylaxis may explain, at least in the part, the decrease in case fatality rate despite increasing anaphylaxis hospitalisations. There is no evidence to suggest that the clinical criteria used to diagnose anaphylaxis has changed in the UK over the study period. It is likely that the introduction of national guidance from the NICE in 2011 resulted in a small increase in hospitalisations due to anaphylaxis, but the year-on-year increase has persisted since. Whether is due to a true increase in the prevalence of anaphylaxis (rather than a reduction in the threshold to admit patients presenting with anaphylaxis) is unclear, as the evidence for an increase in prevalence of food allergy in the UK (and elsewhere) over the same time period is lacking.⁷

These data represent the largest published series of food-anaphylaxis fatalities in the literature, and clearly demonstrate that while preschool-aged children have the highest rate of hospitalisation due to anaphylaxis, the case fatality rate

in this age group is very low. Teenagers are considered to be at highest risk for fatal reactions,^{4,8} but our data imply that while this is true, the case fatality rate remains elevated well into mid-adulthood. This challenges the traditional view that teenagers are more at risk of fatal outcomes due to risk-taking behaviours,⁸ and supports our hypothesis that there may be a specific, age-dependent vulnerability to severe outcomes from food-induced allergic reactions in early-mid adulthood.⁴

By including published data relating to fatal food anaphylaxis in this analysis, we observed that over the past 25 years, there has been a decrease in the proportion of fatal reactions due to peanut/tree nuts (which we attribute to removal from many confectionery brands and general avoidance by food businesses), but a concerning increase in those due to cow's milk, such that cow's milk is now the most common cause of fatal food anaphylaxis in children in the UK. The increase in milk as a cause of severe anaphylaxis has also been noted in North America and Israel.⁹⁻¹¹ Furthermore, in the UK, cow's milk allergy is relatively uncommon in adults but was still responsible for 5% of fatal food reactions. There is increasing awareness amongst food business operators and the general public over food allergy related to peanut and tree nuts, but not to cow's milk.^{12,13} Cow's milk is ubiquitous in the Western diet, and has a relatively high protein content so very low levels of exposure may be sufficient to cause reactions. Allergen control is further complicated by the possibility of homogenous (where the allergen is equally dispersed throughout the food product) rather than particulate contamination in food preparation.¹⁴ The majority of children with cow's milk protein allergy outgrow their allergy in early

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childhood,¹⁵ but those with persisting milk allergy tend to have other
concomitant atopic diseases including asthma.¹² Furthermore, the lower
proportion of food-anaphylaxis reported to milk in older children in the European
Anaphylaxis Registry raises a concern that those reactions which do occur
triggered by milk exposure in older children may be of a greater severity.¹⁵

Strengths and limitations

The use of a national dataset in the context of the UK health system provides
a unique opportunity to draw robust conclusions as to changes in hospital
admissions and outcomes due to food anaphylaxis, compared to other
countries where data collection may be less systematic and not applied to the
entire population. However, our data do have some limitations as previously
discussed elsewhere,^{2,4,16} including miscoding (both for the eliciting trigger but
also misdiagnosis, with non-anaphylaxis reactions being miscoded as
anaphylaxis). By using the same methods throughout the study period, we were
able to monitor time trends irrespective of the risk of miscoding which is unlikely
to have been affected by time. Unfortunately, we were unable to include cases
of anaphylaxis seen in Emergency departments that did not require
hospitalisation, as these datasets are incomplete and very prone to miscoding.⁴

Our data highlight some of the potential pitfalls in analysing health datasets in
terms of anaphylaxis admissions. Hospital admissions for anaphylaxis are often
used as a surrogate measure for the occurrence of anaphylaxis, but this is a
false assumption. González-Pérez reported that under half of anaphylaxis
presentations in a UK analysis presented to Emergency Departments.¹⁷ There

is little evidence that the incidence of food allergy or anaphylaxis has increased over the past decade in the UK;⁷ our observation that prescriptions of adrenaline autoinjectors have increased at a year-on-year rate of 11% (despite anaphylaxis hospitalisations increasing at around half that rate over the same period) does not imply an increase in prevalence of individuals at risk of anaphylaxis. At least in the UK, “allergy” admissions include elective day-case procedures such as oral food challenges. As a result, only approximately 30% of hospital admissions for “allergy” are due to food anaphylaxis. Due to the limitations of ICD-10, food-related anaphylaxis reactions will often be coded as anaphylactic “shock”, despite the fact that “shock” is a rare occurrence in food anaphylaxis.^{2,4,16} Thus, no conclusions can be drawn as to the severity of anaphylaxis when analysing hospital admissions, unless other considerations are taken into account (such as admission to intensive care or fatal outcomes). The introduction of ICD-11 will hopefully address many of the current limitations of ICD-10,¹⁸ although a proposal to include a classification of anaphylaxis by clinical severity was rejected.¹⁹

397

398 **Conclusions and policy implications**

399 We have demonstrated a fall in case fatality due to food anaphylaxis between
400 1998 and 2018 in the UK, despite a three-fold increase in hospital admissions
401 due to food anaphylaxis over the same time. Cow’s milk is increasingly seen as
402 the culprit allergen for fatal food reactions, and is now the commonest cause of
403 fatal anaphylaxis in children. More education is needed to highlight the specific
404 risks posed by cow’s milk to allergic individuals, to increase awareness
405 amongst food businesses.¹⁵ Finally, further work is needed to assess the

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evidence for an age-related vulnerability to severe anaphylaxis in young adults,
to improve our ability to risk-stratify food-allergic patients and reduce the risk of
fatal outcomes.

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Contributors: All authors contributed to study design. PJT and RJB acquired
the data, and PJT and DI conducted initial analyses. All authors were involved
in data interpretation, drafting of the manuscript and critical review. PJT is the
guarantor of the study. The corresponding author attests that all listed authors
meet authorship criteria and that no others meeting the criteria have been
omitted.

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Competing interests

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www.icmje.org/coi_disclosure.pdf and declare: grants from UK Medical

Research Council and UK Food Standards Agency for the submitted work. PJT reports grants from JM Charitable Foundation, NIHR/Imperial Biomedical Research Centre and End Allergies Together, outside the submitted work; personal fees from UK Food Standards Agency, DBV Technologies, Aimmune Therapeutics, Allergenis and ILSI Europe outside the submitted work. RJB reports personal fees from ALK-Abello, Protta Therapeutics, DBV Technologies outside the submitted work; consultancy payment for designing a clinical trial for the Dairy Goat Cooperative and from Cochrane; and has given expert testimony in cases relating to food anaphylaxis and infant formula health claims. The other authors do not report any conflicts of interest.

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Data sharing: Requests for data can be made to the corresponding author.

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The corresponding author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported. No important aspects of the study have been omitted, and all discrepancies from the study as planned have been explained.

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Dissemination to patient and public communities: We have disseminated the findings of this study via the British Society for Allergy & Clinical Immunology, and to the working group for Anaphylaxis within the Resuscitation Council UK. In addition, we plan to further disseminate through presentations at medical conferences, press releases, social media, and on institutional web sites upon publication.

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Table 1: Estimated rate ratios (and 95% CI) for time-trends in hospital admissions for all-cause and food-induced anaphylaxis, between 1998-2018, 2009-2018 and 2014-2018, by devolved nation.

	All-cause anaphylaxis	Food-induced anaphylaxis
1998-2018		
• UK	1.047 (1.046-1.048)	1.057 (1.055-1.059)
• England	1.052 (1.051-1.053)	1.061 (1.058-1.063)
• Scotland	1.030 (1.027-1.034)	1.046 (1.040-1.053)
• Wales	1.009 (1.004-1.015)	1.015 (1.005-1.024)
• N. Ireland	1.018 (1.012-1.024)	1.039 (1.027-1.052)
2009-2018		
• UK	1.036 (1.033-1.039)	1.063 (1.058-1.068)
• England	1.039 (1.036-1.042)	1.063 (1.057-1.069)
• Scotland	1.011 (1.002-1.021)	1.072 (1.054-1.090)
• Wales	1.014 (0.998-1.030)	1.049 (1.020-1.078)
• N. Ireland	1.033 (1.017-1.050)	1.045 (1.011-1.080)
2014-2018		
• UK	1.042 (1.034-1.050)	1.062 (1.048-1.076)
• England	1.047 (1.039-1.056)	1.069 (1.054-1.085)
• Scotland	1.034 (1.007-1.062)	1.038 (0.992-1.085)
• Wales	0.965 (0.924-1.008)	0.981 (0.911-1.056)
• N. Ireland	0.988 (0.945-1.032)	0.991 (0.907-1.082)

Figure Legends

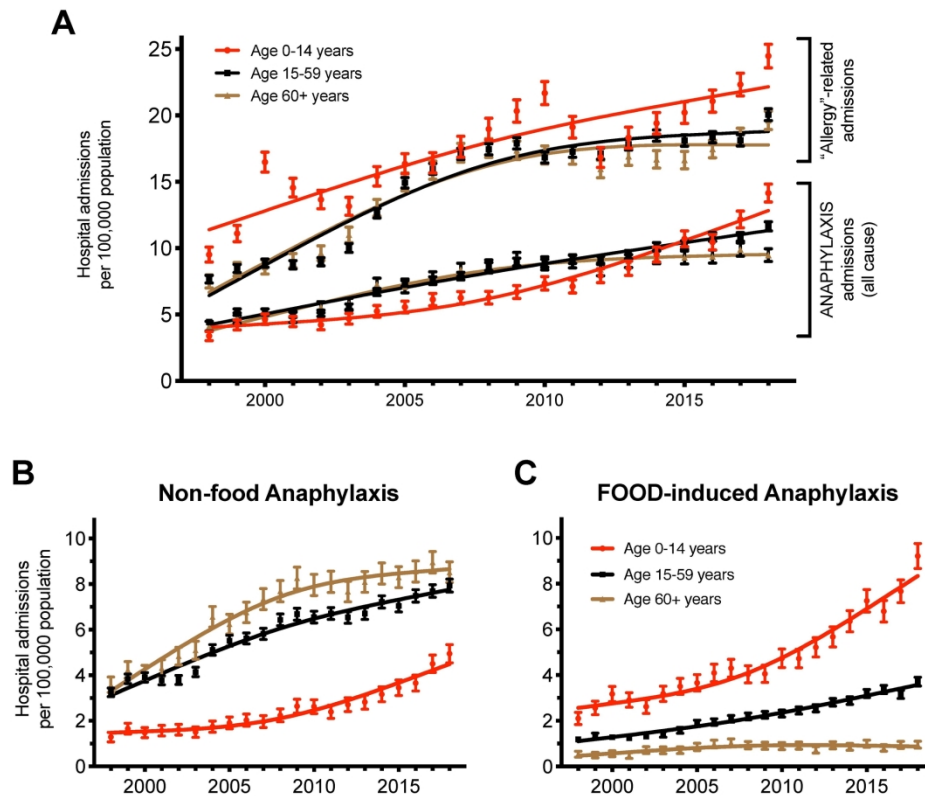
Figure 1: Time-trends in hospital admissions per 100,000 population since 1998, by age strata, for **A** “allergy” and all-cause anaphylaxis; **B**, non-food anaphylaxis; **C**, food-related anaphylaxis. Vertical bars represent SEMs.

Figure 2: Impact of gender on hospital admissions for anaphylaxis, for food and non-food-induced anaphylaxis. Vertical bars represent SEMs. A national 4 hour target for Accident & Emergency visits was introduced in 2004; NICE guidance recommending overnight admission for paediatric anaphylaxis was introduced in 2011.

Figure 3: Fatalities due to food-induced anaphylaxis in UK, 1998-2018. **A**, deaths per 100,000 population. **B**, case fatality rate (with line fitted using linear regression). **C**, hospital admissions and deaths by age group. **D**, case fatality rate by age group. Vertical bars represent SEMs.

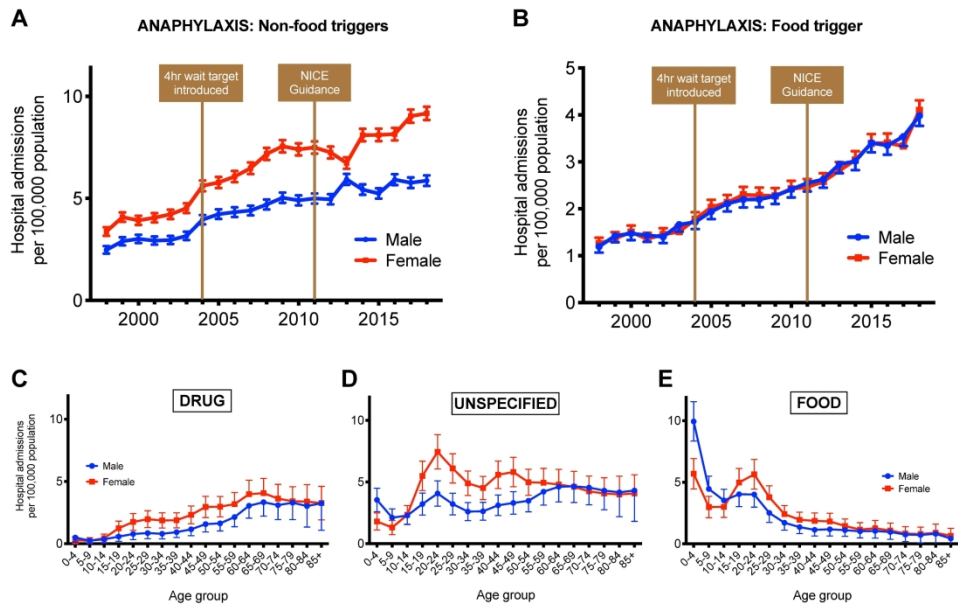
Figure 4: Cause of fatal food-induced anaphylaxis cases by trigger in children (**A**) and adults (**B**) and by 5-year groups (**C**).

Figure 5: Prescription of adrenaline autoinjectors to UK residents from 1998 to 2018, overall and by devolved nation. Data refers to number of prescriptions issued (as opposed to number of devices issued).



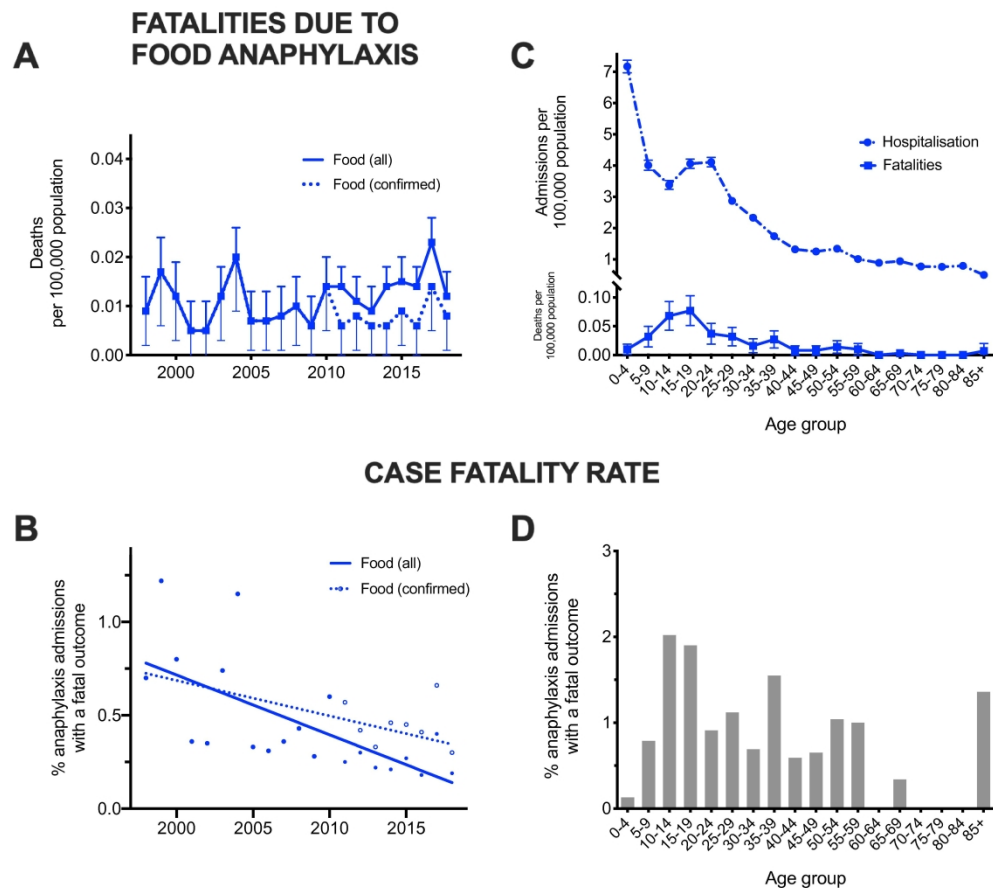
Time-trends in hospital admissions per 100,000 population since 1998, by age strata, for A "allergy" and all-cause anaphylaxis; B, non-food anaphylaxis; C, food-related anaphylaxis. Vertical bars represent SEMs

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Impact of gender on hospital admissions for anaphylaxis, for food and non-food-induced anaphylaxis. Vertical bars represent SEMs. A national 4 hour target for Accident & Emergency visits was introduced in 2004; NICE guidance recommending overnight admission for paediatric anaphylaxis was introduced in 2011.

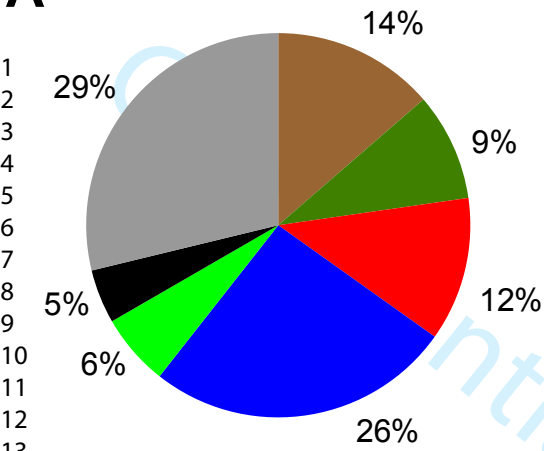
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Fatalities due to food-induced anaphylaxis in UK, 1998-2018. A, deaths per 100,000 population. B, case fatality rate (with line fitted using linear regression). C, hospital admissions and deaths by age group. D, case fatality rate by age group. Vertical bars represent SEMs.

197x178mm (600 x 600 DPI)

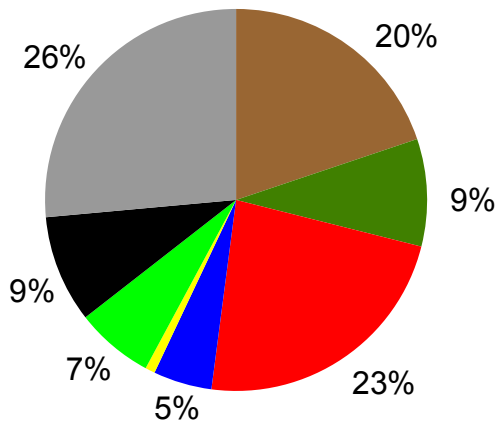
A



Children (under 16 years)

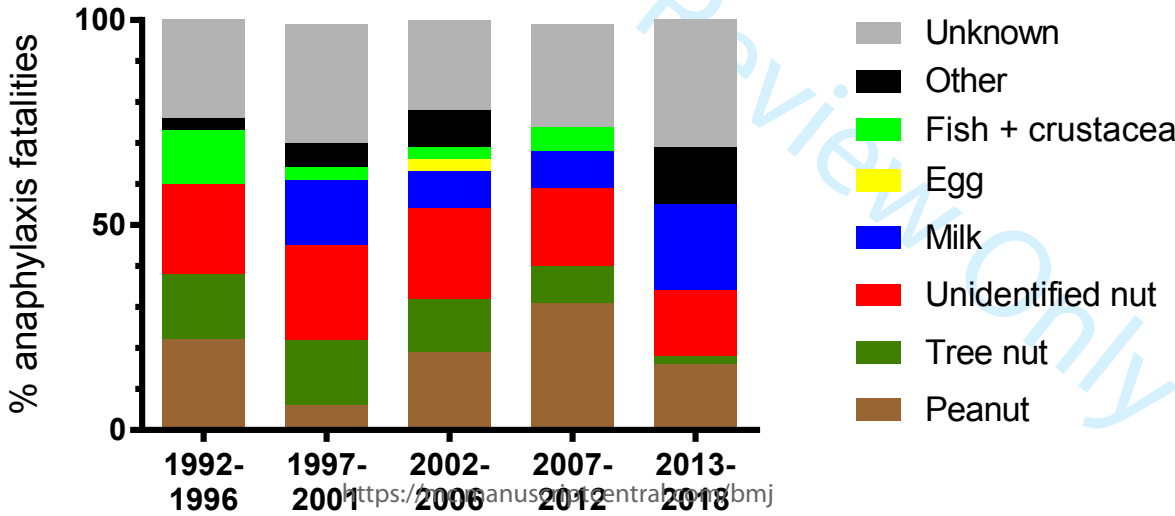
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B



Adults

C



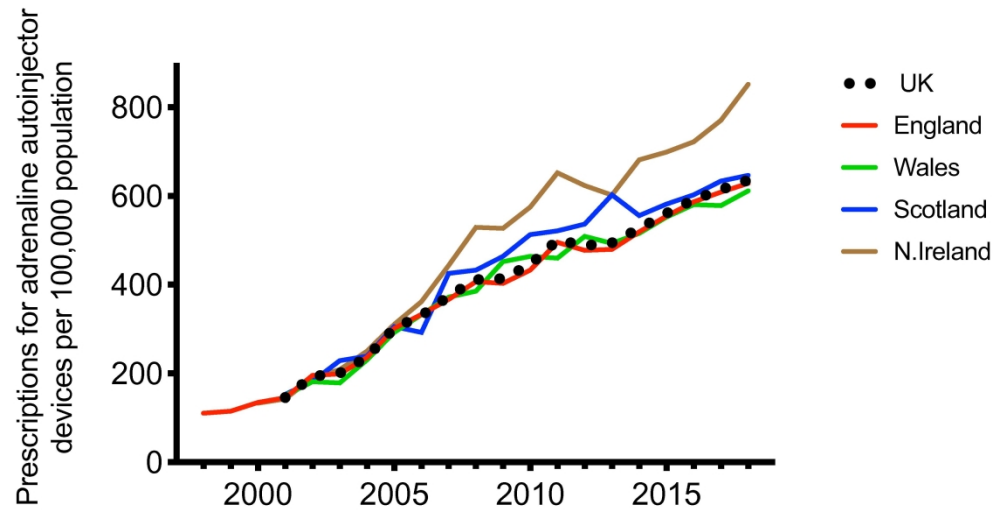


Figure 5: Prescription of adrenaline autoinjectors to UK residents from 1998 to 2018, overall and by devolved nation. Data refers to number of prescriptions issued (as opposed to number of devices issued).

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Food Anaphylaxis in the UK: an analysis of national data, 1998-2018

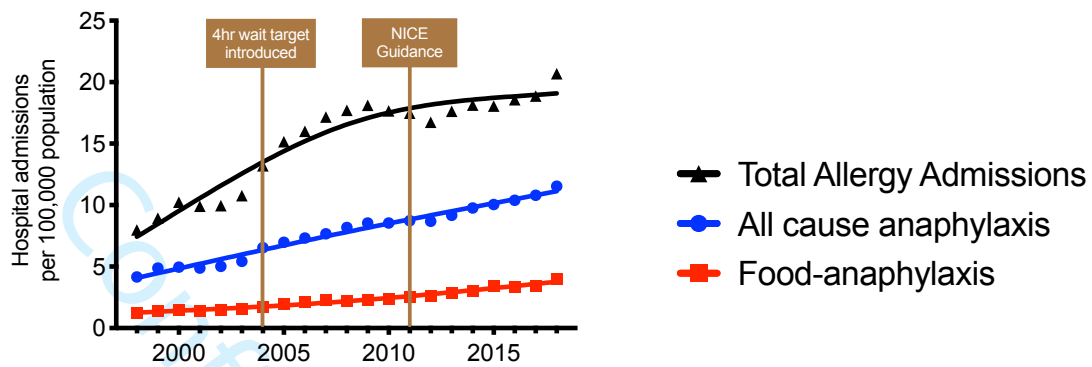
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Paul J. Turner

SUPPLEMENTARY FIGURES

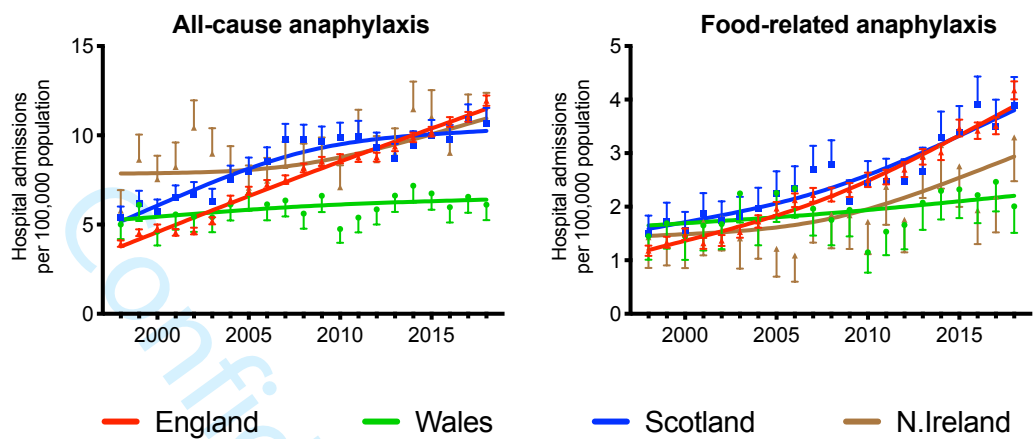
Table of Contents

Supplementary Figure 1 2

Supplementary Figure 2 3



Suppl. Figure 1: Hospital admissions for “allergy”, all-cause anaphylaxis and food-induced anaphylaxis in the United Kingdom from 1998-2018.



Suppl. Figure 2: Time trends in anaphylaxis admissions by devolved nation. Vertical bars represent SEMs.