Reported Road Casualties in Great Britain: 2011 Annual Report

Hospital admissions data on road casualties in England

This article describes road casualties admitted to hospital contained in Hospital Episode Statistics (HES), comparing it with serious injuries reported to the police in the STATS19 system. Information contained in HES which is unavailable from STATS19 is also explored.

- In 2011 there were around 38.6 thousand recorded emergency admissions to hospitals in England resulting from road traffic accidents, compared to 20.1 thousand serious injuries reported in STATS19. Although police and hospital data are not directly comparable, this illustrates the incompleteness of the police data for non-fatal casualties.
- Comparison of trends shown by police and hospital data is difficult, and there are known factors affecting patterns shown by the hospital data. However, with caution, HES can provide a useful secondary source of trend data, providing further evidence of a fall in casualties in recent years.
- Over two third (68.8%) of road casualties admitted to hospital and linked to the STATS19 data (linked STATS19 and HES data for 2001-2010) have minor or moderate injuries (MAIS 1 or 2). The majority (54.2 per cent) of these road casualties suffered from a facture as a primary injury. The most commonly injured primary body regions include head and leg.
- Using the linked STATS19 and HES data, the proportions of car occupants sustaining minor and moderate injuries (MAIS 1 & 2) were similar across all car age bands (newest and oldest), suggesting age of car isn't such as strong factor in resultant minor or moderate injuries. However, for more serious & critical injuries, figures indicate that the newest vehicles (0-4 years old) had lower proportions compared to older vehicles (15+ years old), suggesting the likelihood of sustaining a serious or critical injury is higher with older vehicles relative to newer vehicles.

Introduction

For many years the police have provided data on road accidents involving casualties reported to them, under the STATS19 system. This source provides almost all the road safety data in the annual reports. In the mid-1990s it became possible to identify road traffic casualties admitted to hospital as inpatients in England from the HES database. HES admissions data provide further useful information on road casualties, and are the focus of this article.

The coverage and trends in road accidents from the police and hospital sources differ in a number of ways, and care should be taken in making comparisons. In previous reports we have explained the differences between the two data sources and issues affecting the quality of HES data. In particular, article 5 of Reported Road Casualties Great Britain: 2008 summarised the strengths and weaknesses of various sources of data on road casualties.

Part 1: Comparing HES and STATS19 data on road casualties

Background

The HES inpatient database is compiled by the Information Centre for Health and Social Care (IC). It contains data on inpatient admissions to hospitals in England[1]. Each record represents an episode of care under a particular consultant, and contains clinical details of the patient's condition, coded to the International Classification of Diseases 10th revision (ICD-10)[2]. This coding allows inpatients whose injuries have been caused by a road traffic accident to be identified.

There are many definitional differences between HES and STATS19; for example, HES covers only patients admitted to a hospital bed whereas STATS19 casualty records relate to those injured in traffic accidents on the public highway that become known to the police. However, it is possible to filter the HES data so that it is broadly comparable with STATS19. Annex A provides some details of the HES data used in this article, and some factors that should be taken into account when interpreting the figures.

The police definition of serious injury covers casualties admitted to hospital, as well as those with specific types of injury (for example fractures or severe cuts). This means that in theory all patients in HES admitted following a road traffic accident should also appear as seriously injured casualties in the police data. However, in practice not all road casualties are reported to the police. In addition, there is evidence that in some cases casualties that meet the definition of a serious injury are only recorded by the police as having slight injuries[3]. The following comparisons are based on STATS19 serious injuries and HES emergency road traffic accident admissions, except where otherwise stated.

Comparing numbers and characteristics of casualties in HES and STATS19: 2011

Table 1 shows the number of seriously injured casualties in STATS19 in England and provisional figures for the number of **non-fatal** emergency road traffic admission episodes recorded in HES in 2011. Note that the figures are not directly comparable – the police definition of serious injury is wider than hospital admissions, and many of those who attend hospital will not become known to the police.

- It has long been acknowledged that not all road casualties become known to the police[3], and these figures illustrate this. The number of road traffic admissions recorded in HES (38.6 thousand in 2011) is nearly twice the total number of serious injuries in STATS19

[1] HES website: http://www.hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=87
[2] ICD website: http://www.who.int/classifications/apps/icd/icd10online/
[3] See for example Road Safety Research Report No. 69: Under-reporting of Road Casualties Phase 1 http://www2.dft.gov.uk/pgr/roadsafety/research/rsrr/theme5/underreportingofroadcasual.pdf

(20.1 thousand).

- The number of pedal cyclist admissions in HES is more than three times the number of seriously injured casualties in STATS19, and for child pedal cyclists the HES figure is more than nine times larger (Table 1). Pedal cyclist casualties involving no other vehicles account for the majority of the discrepancy between STATS19 and HES, with HES recording a much higher proportion of casualties from such accidents (61.5 per cent of all pedal cyclist casualties in HES compared to 8.0 per cent in STATS19). In HES, casualties were assumed to have been involved in a traffic accident unless otherwise stated. Therefore, it may be possible that HES over-estimates the number of cyclists admitted after road traffic accidents. There is a higher propensity for this to affect the cyclist figures than other vehicle types as cyclists are more likely to have been involved in off-road accidents.

- Despite the difference in the number of casualties recorded, the two datasets show broadly similar distributions in terms of the sex and age group of casualties from road traffic accidents. The most notable exception being that a considerably higher proportion of pedal cyclist child casualties in HES compared to STATS19 (Table 1). Chart 1 illustrates the number of casualties recorded in STATS19 and HES by age group, for the main road user groups.

- STATS19 and HES show a similar pattern by month of occurrence of accidents and admissions (Chart 2). Again, the most notable difference is for cyclists. This is unsurprising since cyclists are the least well reported user group in STATS19, and there are substantial variations in types of pedal cycle accidents covered in both data sources.

Overall, these comparisons suggest that both data sources cover a broadly representative (though different) subset of the more seriously injured road casualties in England. HES inpatient data provides no information on slightly injured casualties and only includes fatalities that died in hospitals. STATS19 also provides information on fatalities who did not die in hospitals, those with less severe injuries, and more detailed information on accident circumstances that are not available in HES.

Table 1: Comparison of emergency road traffic hospital admissions (HES) and police recorded seriously injured road casualties (STATS19): England 2011

(RAS web table RAS55001)

Number/*percentage*

	Pedestrians		Pedal cyclists		Motorcyclists		Car occupants		All road users[1]	
	HES[P]	S19	HES[P]	S19	HES[P]	S19	HES[P]	S19	HES[P]	S19
Total	**7,522**	**4,705**	**8,992**	**2,822**	**5,820**	**4,737**	**13,447**	**7,045**	**38,584**	**20,123**
Other vehicle involved	7,455	4,705	2,870	2,596	3,431	3,553	6,061	4,810	20,189	11,769
No other vehicle	0	0	5,529	226	1,723	1,184	4,818	2,235	14,270	8,354
Unknown	67	0	593	0	666	0	2,568	0	4,125	0
% Other veh. (of known)	*100.0*	*100.0*	*34.0*	*92.0*	*67.0*	*75.0*	*56.0*	*68.0*	*59.0*	*58.0*
% No other veh. (of known)	*0.0*	*0.0*	*66.0*	*8.0*	*33.0*	*25.0*	*44.0*	*32.0*	*41.0*	*42.0*
Male	4,573	2,758	7,294	2,318	5,411	4,375	7,364	4,103	26,301	14,106
Female	2,949	1,947	1,698	504	409	362	6,083	2,942	12,283	6,017
% Male	*61.0*	*58.6*	*81.0*	*82.1*	*93.0*	*92.4*	*55.0*	*58.2*	*68.0*	*70.1*
% Female	*39.0*	*41.4*	*19.0*	*17.9*	*7.0*	*7.6*	*45.0*	*41.8*	*32.0*	*29.9*
Age 0-15	2,218	1,349	3,167	349	218	36	670	261	6,372	2,023
Age 16-64	3,818	2,481	5,281	2,288	5,425	4,543	9,637	5,605	25,703	15,494
Age 65+	1,466	798	528	141	172	116	3,078	1,085	6,387	2,341
% Age 0-15	*29.0*	*28.7*	*35.0*	*12.4*	*4.0*	*0.8*	*5.0*	*3.7*	*17.0*	*10.1*
% Age 16-64	*51.0*	*52.7*	*59.0*	*81.1*	*93.0*	*95.9*	*72.0*	*79.6*	*67.0*	*77.0*
% Age 65+	*19.0*	*17.0*	*6.0*	*5.0*	*3.0*	*2.5*	*23.0*	*15.4*	*17.0*	*11.6*

P Provisional data.
1 Includes other road user types and cases where road user type is unknown.

Chart 1: STATS19 seriously injured road casualties and HES emergency road traffic admissions by age and road user type: England 2011

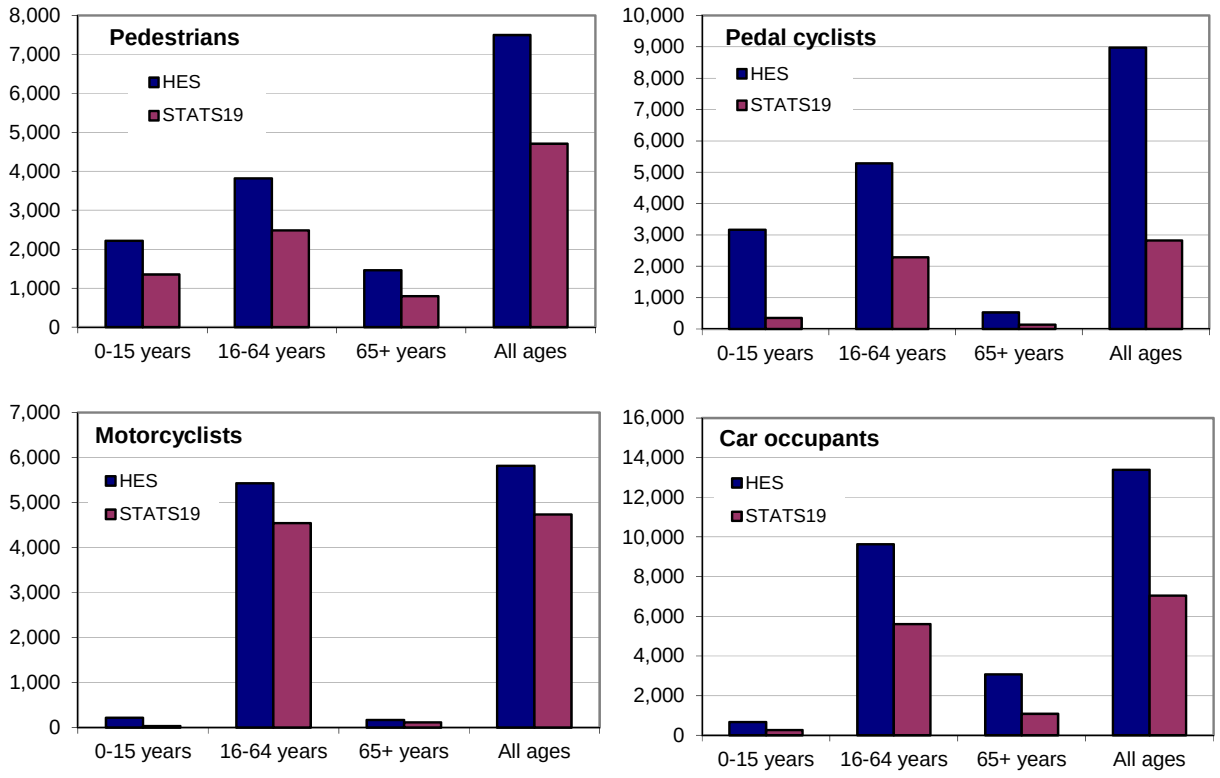
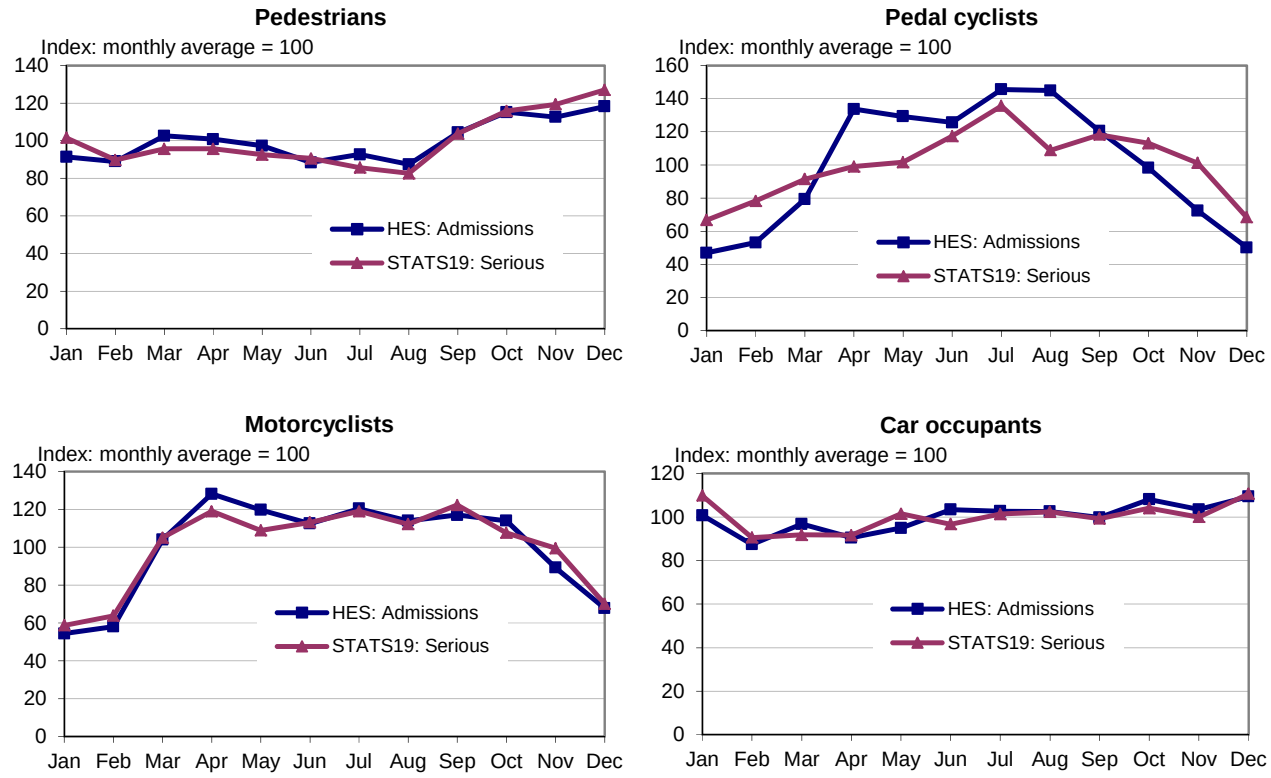


Chart 2: STATS19 seriously injured road casualties and HES emergency road traffic admissions by month and road user type: England 2011



Comparing trends shown by STATS19 and HES: 2001 – 2011

The previous section illustrates the difference in the **number** of casualties recorded in the STATS19 and HES datasets. However some **trends** shown by the two sources are also different. It is likely that the difference is the result of a number of factors, and we have explored a number of these in previous reports. For example, there have been a number of known changes in hospital practices and data systems in recent years. Our 2006 report [4] considered factors affecting the HES data, which imply care is needed when using it for trend analysis.

Chart 3 presents the latest trends in STATS19 recorded seriously injured road casualties and HES emergency road traffic admissions for England. Please note that the two groups are not directly comparable.

- Between 2010 and 2011, the number of emergency road traffic admissions in HES and serious injuries in STATS19 rose around the same percentage (2.0 and 2.4 per cent increase in HES and STATS19 respectively). The HES figure is based on provisional data (see Annex A) so should be treated with caution.

- Overall, STATS19 shows a continuous fall in serious injuries until 2010, while admissions recorded in HES had diverging patterns during certain periods (Chart 3), most notably between 2002 and 2005. Over this period, STATS19 recorded a 19.4 per cent reduction

[4] See article 6 published in Road Casualties Great Britain 2006 for details: http://webarchive.nationalarchives.gov.uk/+/http://www.dft.gov.uk/pgr/statistics/datatablespublications/accidents/casualtiesgbar/roadcasualtiesgreatbritain2006

in seriously injured road casualties while HES recorded a 14.5 per cent increase in admissions. Both sources show reductions between 2005 and 2008 (11.8 per cent and 8.6 per cent falls respectively).

As discussed in previous years' articles, the increase in admissions between 2002 and 2005 appears to be associated with changes in hospital practices, in particular an increase in the proportion of inpatients admitted for short periods. This is likely to relate to increasing numbers being admitted to short-stay wards from Accident and Emergency for observation and assessment. Therefore, the trend shown by HES in Chart 3 probably does not equate to a genuine rise in serious road casualties. Chart 4 shows the trends in emergency road traffic admissions by length of stay[5], based on the initial episode of hospital treatment following admission.

- Chart 4 shows between 2001 and 2010 the number of 0 day emergency admissions increased by more than twice (120.2 per cent increase), compared with a 6.1 per cent fall in one day admissions and a reduction of more than a quarter (29.1 per cent) in the number of patients admitted for two or more days. This compares with a reduction of 37.5 per cent in serious injuries in STATS19 over the same period. However, between 2010 and 2011; both one day and 2+ day admissions have increased by 2.9 and 6.1 per cent respectively.

- The number of emergency road traffic accident admissions for zero days (i.e. not overnight) has increased continuously between 2001 and 2010 (Chart 4). However, there has been a 2.5 per cent fall in such admissions for the first time between 2010 and 2011.

Chart 3: STATS19 seriously injured road casualties and HES emergency road traffic admissions: England 2001-2011

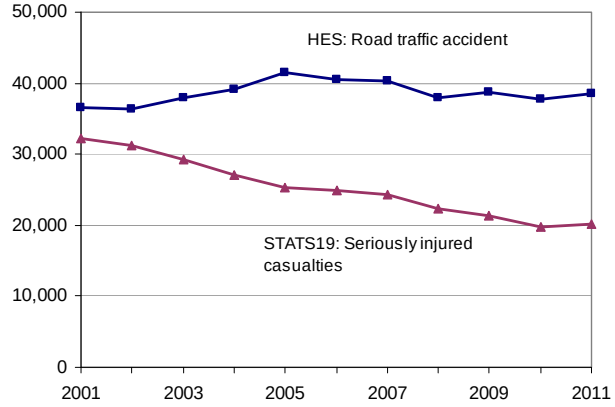
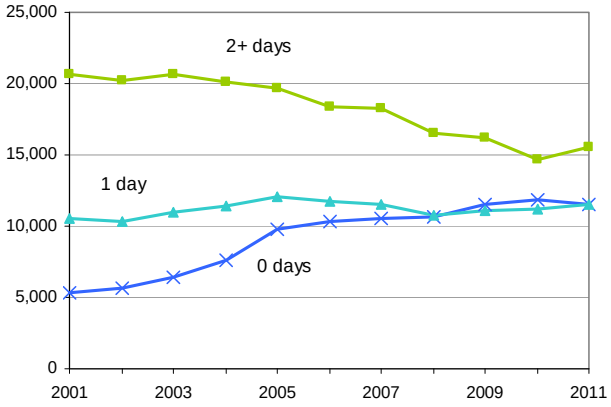


Chart 4: Emergency road traffic hospital admissions by length of episode: HES 2001-2011



The following analyses are focused on hospital road traffic admissions of two or more days. The is because the trends in the most seriously injured casualties are of particular interest in road safety, and these casualties are more likely to require longer hospital stays. In addition, longer admissions may be of greater stability since they should be less affected by changes in hospital practices.

[5] This is based on the length of the admission episode in HES, which in around 10 per cent of cases will understate the actual length of spell in hospital. See Annex A for further details.

In summary, admissions of two or more days should provide a better indication of the underlying trends in the incidence of more serious road casualties than the total number of admissions in HES. Chart 5 shows the trends in fatalities and serious injuries in STATS19, and emergency road traffic admissions for two or more days in HES.

- Until 2005, STATS19 serious injuries fell more quickly than HES emergency road traffic admissions for two or more days, but since then they have followed a similar trend (Chart 5), up until 2010. Admissions fell by 20.3 per cent between 2006 and 2010, while STATS19 serious injuries fell by 20.7 per cent over this period. In 2011, both series (STATS19 serious injuries and HES 2+ day admissions) have increased by 2.1 and 6.1 per cent respectively.

- Admissions lasting two or more days followed a more similar trend to STATS19 fatalities between 2001 and 2007, although the drop in fatalities seen between 2007 and 2010 has not been matched by HES. All three series (HES, STATS19 fatal and serious) show increases between 2010 and 2011.

Chart 5: STATS19 serious injuries and fatalities, and HES emergency road traffic admissions for 2 or more days: England 2001-2011

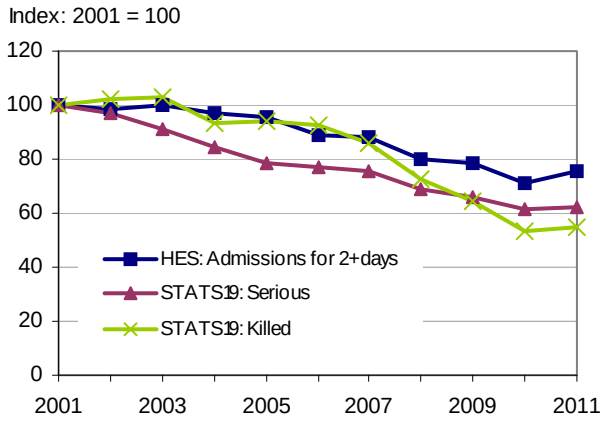
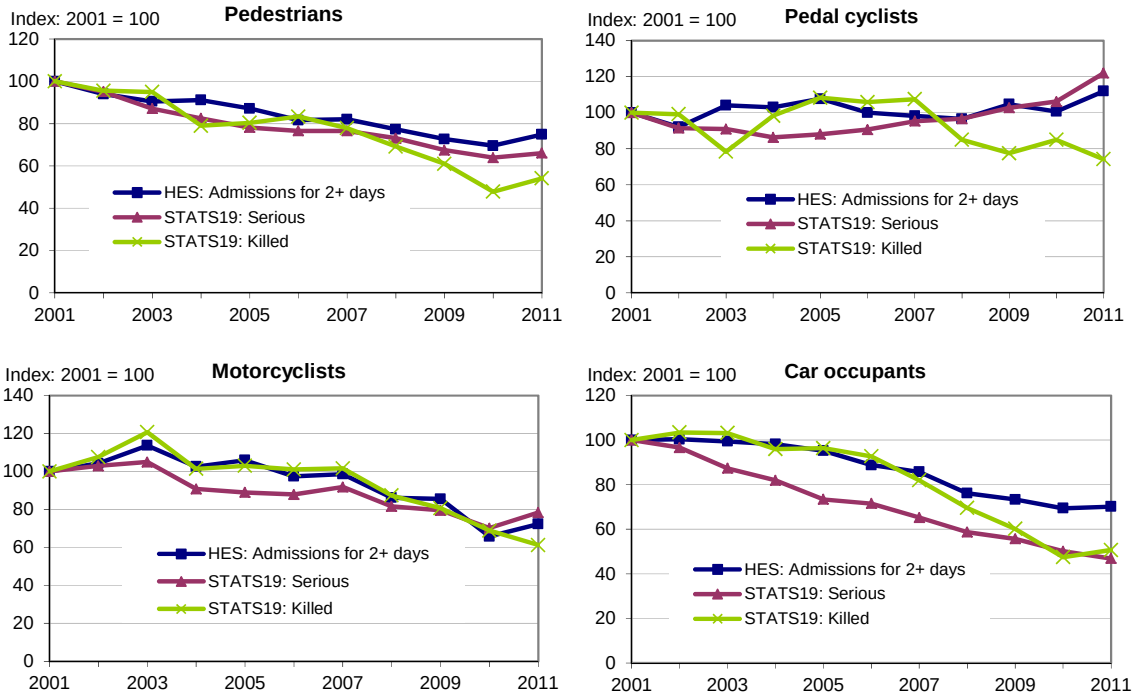


Chart 6 shows the trends in fatalities and serious injuries in STATS19, and emergency road traffic admissions for two or more days in HES for the main road user groups.

- Pedestrian and motorcycle user admissions have very broadly followed similar trends to both serious injuries and fatalities in STATS19. However, the reductions in pedestrian fatalities in 2009 and 2010 were not matched by HES admissions of two or more days. All three series show increases between 2010 and 2011.

- Car occupant admissions followed a trend more similar to fatalities than serious injuries between 2001 and 2007 (although it has been become more similar to serious injuries in recent years). Likewise, in more recent years Pedal cyclist HES admissions have followed a similar trend to serious injuries in STATS19, both of which showing a substantial increase in serious injuries between 2010 and 2011 relative to previous years.

Chart 6: STATS19 serious injuries and fatalities, and HES emergency road traffic admissions for 2 or more days by road user type: England 2001 - 2011



Changes in hospital admissions and recording practices would also affect all other hospital admissions as well as road traffic accident admissions. Chart 7 shows emergency road casualty admissions as a proportion of all emergency injury admissions.

- The proportion of all emergency injury admissions made up by road casualties has fallen steadily over the past ten years, from 6.0 per cent in 2001 to 3.8 per cent in 2011. Among those admitted for two or more days the equivalent proportion fell from 6.8 per cent to 4.2 per cent.

- The above suggests a reduction in the incidence of more seriously injured casualties. However, this could be affected by trends in other causes of injury (such as falls, assaults and exposure to harmful substances).

Chart 7: Emergency road traffic admissions as a proportion of all emergency injury admissions: HES 2001 - 2011

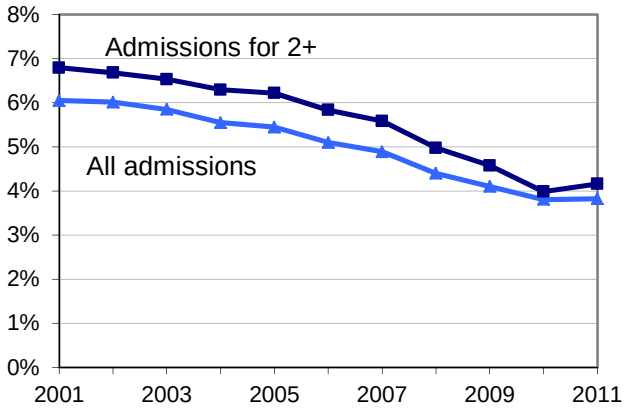


Table 8: HES emergency road traffic admissions and STATS19 seriously injured road casualties: England 2006 - 2011 (RAS web table RAS55008)

Number (thousands)/*percentage*

							Change from:	
	2006	2007	2008	2009	2010	2011[P]	2006	2010
Hospital Episode Statistics: Emergency admissions [1]								
All admissions [2]	4,579.0	4,626.6	4,826.7	5,055.5	5,155.6	5,136.9	*12.2*	*-0.4*
All injury admissions [2, 3]	794.8	825.0	862.8	945.0	989.5	1009.0	*27.0*	*2.0*
All road traffic accident admissions								
All road casualties	40.5	40.3	38.0	38.8	37.7	38.6	*-4.8*	*2.4*
Pedestrians	7.7	7.8	7.4	7.2	7.3	7.5	*-2.1*	*2.7*
Pedal cyclists	6.8	6.9	6.9	7.6	8.1	9.0	*32.0*	*11.1*
Motorcyclists	7.3	7.4	6.7	6.8	5.4	5.8	*-20.8*	*7.4*
Car occupants	14.9	14.5	13.7	13.9	13.9	13.4	*-10.3*	*-3.6*
Male [4]	28.1	28.0	25.9	26.6	25.4	26.2	-6.6	3.1
0-15 years	4.4	4.3	3.8	4.0	4.4	4.5	*1.4*	*2.3*
16-64 years	21.4	21.3	19.6	20.0	18.3	18.8	*-12.0*	*2.7*
65+ years	2.2	2.4	2.4	2.6	2.7	3.0	*33.9*	*11.1*
Female [4]	12.5	12.4	12.1	12.2	12.2	12.2	*-2.2*	*0.0*
0-15 years	2.0	1.9	1.7	1.6	1.8	1.9	*-5.0*	*5.6*
16-64 years	7.7	7.8	7.5	7.5	7.1	6.9	*-10.5*	*-2.8*
65+ years	2.8	2.7	2.9	3.0	3.3	3.4	*22.7*	*3.0*
Road traffic accident admissions for episodes of 2 or more days								
All road casualties	18.4	18.2	16.5	16.2	14.6	15.5	*-15.7*	*6.2*
Pedestrians	3.9	3.9	3.7	3.5	3.3	3.5	*-9.6*	*6.1*
Pedal cyclists	2.6	2.6	2.5	2.8	2.6	2.9	*10.3*	*11.5*
Motorcyclists	4.2	4.2	3.7	3.7	2.8	3.0	*-28.6*	*7.1*
Car occupants	6.1	5.9	5.2	5.0	4.7	4.8	*-20.8*	*2.1*
Male [4]	12.8	12.8	11.4	11.2	9.8	10.5	*-18.2*	*7.1*
0-15 years	1.5	1.4	1.2	1.2	1.2	1.2	*-18.4*	*0.0*
16-64 years	10.2	10.1	9.0	8.7	7.4	7.9	*-22.3*	*6.8*
65+ years	1.2	1.3	1.3	1.3	1.2	1.4	*16.7*	*16.7*
Female [4]	5.5	5.4	5.1	5.0	4.8	5.0	*-9.7*	*4.2*
0-15 years	0.7	0.6	0.5	0.5	0.5	0.5	*-23.1*	*0.0*
16-64 years	3.3	3.3	3.0	2.9	2.6	2.7	*-18.2*	*3.8*
65+ years	1.6	1.6	1.6	1.6	1.7	1.8	*13.2*	*5.9*
STATS19: Seriously injured casualties								
All road casualties	24.9	24.2	22.3	21.3	19.7	20.1	*-19.1*	*2.0*
Pedestrians	5.5	5.5	5.2	4.8	4.6	4.7	*-13.8*	*3.3*
Pedal cyclists	2.1	2.2	2.2	2.4	2.5	2.8	*33.3*	*13.8*
Motorcyclists	5.3	5.6	4.9	4.8	4.2	4.7	*-11.5*	*10.8*
Car occupants	10.8	9.8	8.8	8.4	7.5	7.0	*-34.9*	*-7.2*
Male [4]	17.4	16.9	15.4	14.9	13.5	14.1	*-18.9*	*4.6*
0-15 years	1.7	1.7	1.5	1.5	1.4	1.3	*-24.0*	*-5.1*
16-64 years	14.2	13.8	12.6	12.1	10.9	11.5	*-19.1*	*6.0*
65+ years	1.1	1.1	1.1	1.1	1.0	1.2	*6.2*	*15.4*
Female [4]	7.5	7.4	6.9	6.5	6.2	6.0	*-19.7*	*-3.5*
0-15 years	0.9	0.9	0.8	0.7	0.8	0.7	*-25.5*	*-6.7*
16-64 years	5.2	5.1	4.7	4.4	4.2	4.0	*-22.6*	*-4.1*
65+ years	1.2	1.2	1.2	1.2	1.2	1.2	*-1.6*	*0.8*

P Provisional data. HES data for the 2011/12 financial year is provisional. All STATS19 data is final.
1 Finished inpatient admission episodes excluding in-hospital deaths.
2 Figures may be slightly different to previously published
3 Episodes with an external cause of injury recorded (ICD-10 codes V01 to Y98).
4 Includes cases where age is not recorded.

Table 8 above summarises the HES and STATS19 serious injury data on road casualties between 2006 and 2011. In the patterns shown are **broadly** similar. For example both data sources show pedal and motor cyclists having greater increases than other road users between 2010 and 2011. Furthermore, figures for children (0-15 years old) and older adults (65+ years old) closely match between the two data sources (STATS19 serious injuries and HES Admissions for episodes two days or more in duration).

Part 2: Linking STATS19 and HES data

As outlined in previous reports, the Department for Transport has undertaken work to link data from STATS19 and HES at individual record level. This brings together the details of accident circumstances and vehicles involved contained in STATS19 with the information about injuries sustained found in HES, creating a rich source for research.

Table 9 shows the latest results of the data linkage from 2001 to 2010. Over the period for which data has been linked, around a third of HES records have been linked to STATS19, with a similar proportion of STATS19 serious records linked to HES.

The trends in the number and proportion of STATS19 records linked are affected by an improvement in the quality and completeness of data for the linkage variables, in particular better recording of casualty postcode in STATS19. A report explaining the methodology, including any key assumptions used in the STATS19 and HES data linkage, the quality of the process and results for 1999-2009 can be found: [link to: STATS19-HES Linkage Report.doc]

For further details of the linking methodology or extracts of the linked dataset for research, please contact roadacc.stats@dft.gsi.gov.uk

Table 9: Results of linking STATS19 and HES data: England 2001 – 2010
(RAS web table RAS55009)

Number (thousands)/*percentage*

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001-10
	Linked records	10.3	10.0	9.9	10.0	10.3	10.3	10.8	10.0	10.1	9.3	101.0
STATS19	Total records	32.2	31.3	29.3	27.1	25.2	24.8	24.2	22.2	21.3	19.7	257.3
serious	*% Matched*	*32.0*	*32.0*	*33.9*	*37.1*	*41.0*	*41.5*	*44.7*	*44.9*	*47.2*	*47.0*	*39.0*
	Linked records	6.8	6.5	7.1	7.6	8.2	8.0	8.0	7.5	8.0	7.4	74.9
STATS19	Total records	244.6	234.8	225.6	219.0	212.1	200.8	192.7	179.6	173.4	164.1	2,046.7
slight	*% Matched*	*2.8*	*2.8*	*3.1*	*3.5*	*3.9*	*4.0*	*4.1*	*4.2*	*4.6*	*5.0*	*4.0*
	Linked records	17.1	16.5	17.0	17.6	18.6	18.3	18.8	17.5	18.0	16.7	176.0
STATS19	Total records	276.8	266.0	254.9	246.1	237.3	225.6	217.0	201.8	194.7	183.8	2,303.9
all injuries	*% Matched*	*6.2*	*6.2*	*6.7*	*7.2*	*7.8*	*8.1*	*8.7*	*8.7*	*9.3*	*9.0*	*8.0*
Hospital												
road	Linked records	17.1	16.5	17.0	17.6	18.6	18.3	18.8	17.5	18.0	16.7	176.0
transport	Total records	50.1	49.6	53.0	54.3	57.9	56.8	56.5	56.3	60.0	57.6	552.1
admission	*% Matched*	*34.1*	*33.2*	*32.0*	*32.4*	*32.1*	*32.2*	*33.2*	*31.1*	*30.1*	*29.0*	*32.0*

1 The total number of records relates to files provided by the NHS Information Centre, and includes all road transport accidents, including those recorded as non-traffic accidents. Some cleaning of the data was carried out prior to matching and this means that totals will be different from HES figures published elsewhere.

Maximum Abbreviated Injury Scale

Severity of injury is known to be prone to misclassification in STATS19 due to the difficulties of such assessment by non experts at the scene of the accident. In addition, STATS19 does not distinguish between different injury severities of casualties admitted to hospital.

The Maximum Abbreviated Injury Scale (MAIS) was used to further investigate injury severity using the matched dataset. This is an internationally recognised method of measuring injury severity used in crash investigations. The scale runs from 0 to 6, signifying no injury through to maximum injury. For further details of MAIS please see Annex B.

Body region, injury type and injury severity of road casualties

The body region and injury type of road casualties were derived from the primary diagnosis if the ICD-10 code identified an “injury/poisoning/certain other consequences of external causes” (S and T codes of ICD-10). Most road traffic casualty admissions (97.6 per cent) had a S or T primary diagnosis code.

Chart 10 presents the proportion of casualties in the linked dataset (2001-2010) with selected primary injury types and body regions by injury severity.

- The majority of road casualties in the linked dataset had either minor (MAIS 1 - 27.4 per cent) or moderate (MAIS 2- 41.3 per cent) injuries. Nineteen (19.1) per cent have a serious (MAIS 3 or above) or critical injury according the MAIS. The remaining casualties had unknown or uncoded MAIS.

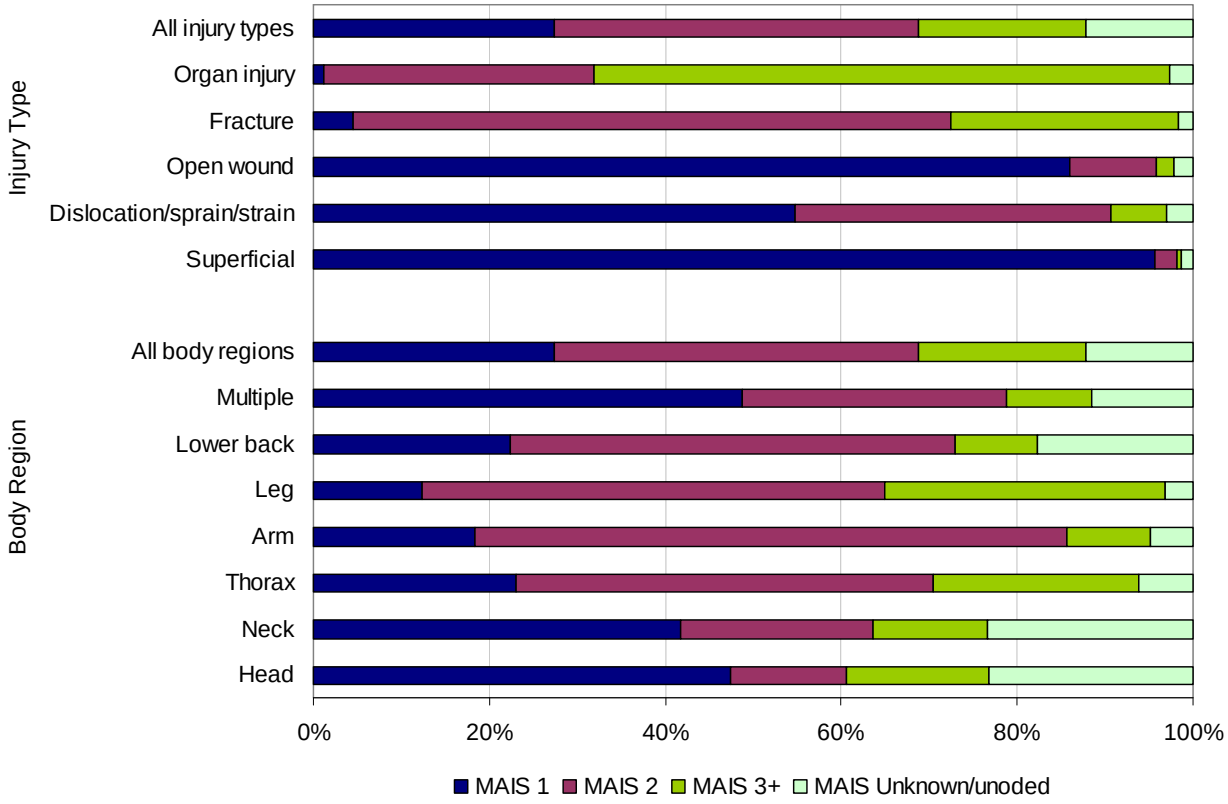
- Based on the primary diagnosis, the majority of road casualties sustained a fracture (51.4 per cent), although the actual percentage may be higher if other diagnoses were also considered. Head and leg were the most common primary body regions injured, representing over 50 per cent of all primary injuries.

- Not unexpectedly, individuals with superficial primary injuries, also had the highest proportion (97.0 per cent) of minor injuries overall (MAIS 1). Casualties admitted to hospital with a primary injury of organ or internal injuries had the highest proportion (65.4 per cent) of MAIS 3 or higher.

- Road casualties with primary injuries to the leg region had the highest proportion (31.7 per cent) of MAIS 3 or higher, followed by primary injuries to the thorax (23.3 per cent). Perhaps unexpectedly, primary injuries to multiple body regions and head injuries had the highest proportions of MAIS 1 (48.7 and 47.4 per cent respectively). This may be potentially due to difficulties in assessing the seriousness of injuries to these body regions at the scene of the accident, leading hospital admissions as a precautionary measure. However, there was insufficient information available in this dataset to confirm this hypothesis.

- The pattern of the overall injury severity based on the primary body region of injury was more unexpected compared to the relationship based on the primary injury type; for example, the high proportion of minor injuries (MAIS 1) among casualties with head injuries. It may be harder for paramedics to quickly assess injury severity to body regions at the scene of the accident. Once admitted to hospital, doctors may able to use the primary injury type to make a rapid assessment of the expected MAIS of the patient.

Chart 10: Proportion of road casualties with selected injury type, and to selected body regions by injury severity in the linked STATS19 and HES data: England 2001 - 2010
(RAS web table RAS55010)



Severity of injury by road user type and age group

For the following analysis, the road user type is derived from STATS19 data, while the age of the casualties is derived from HES data. These different sources were considered to give more accurate information on the road user type and age.

Table 11 presents the proportion of road casualties in the linked dataset, in each MAIS group.

- Motorcycle users have the highest proportion of serious injuries, 24.7 per cent have MAIS of three or more (Table 11). The corresponding figure for all road users is 18.2 per cent.

- Car occupants have the highest proportion of minor injuries (MAIS 1), 30.5 per cent of all injuries sustained. This is higher than the average for all road users (26.2 per cent), although not unexpected given car occupants are less vulnerable in a road accident relative to pedestrians, motor and pedal cyclists.

Table 11: Road casualties by MAIS group for linked STATS19 and HES data: England 2001 - 2010
(RAS web table RAS55011)

Percentage / Number

MAIS code	Pedestrians	Pedal cyclists	Motorcycle users	Car occupants	All road users [1]
1	*25.8*	*29.0*	*15.3*	*30.5*	*26.2*
2	*41.7*	*39.0*	*51.3*	*33.2*	*39.4*
3+	*19.0*	*18.5*	*24.7*	*14.7*	*18.2*
Total number of casualites [2]	45,770	13,992	34,150	77,754	175,844

1 include other road user types including cases where road user type is now known
2 include cases where the AIS is unknown or uncoded.

Chart 12 presents the proportion of road casualties in different severity group by main road user type and age group.

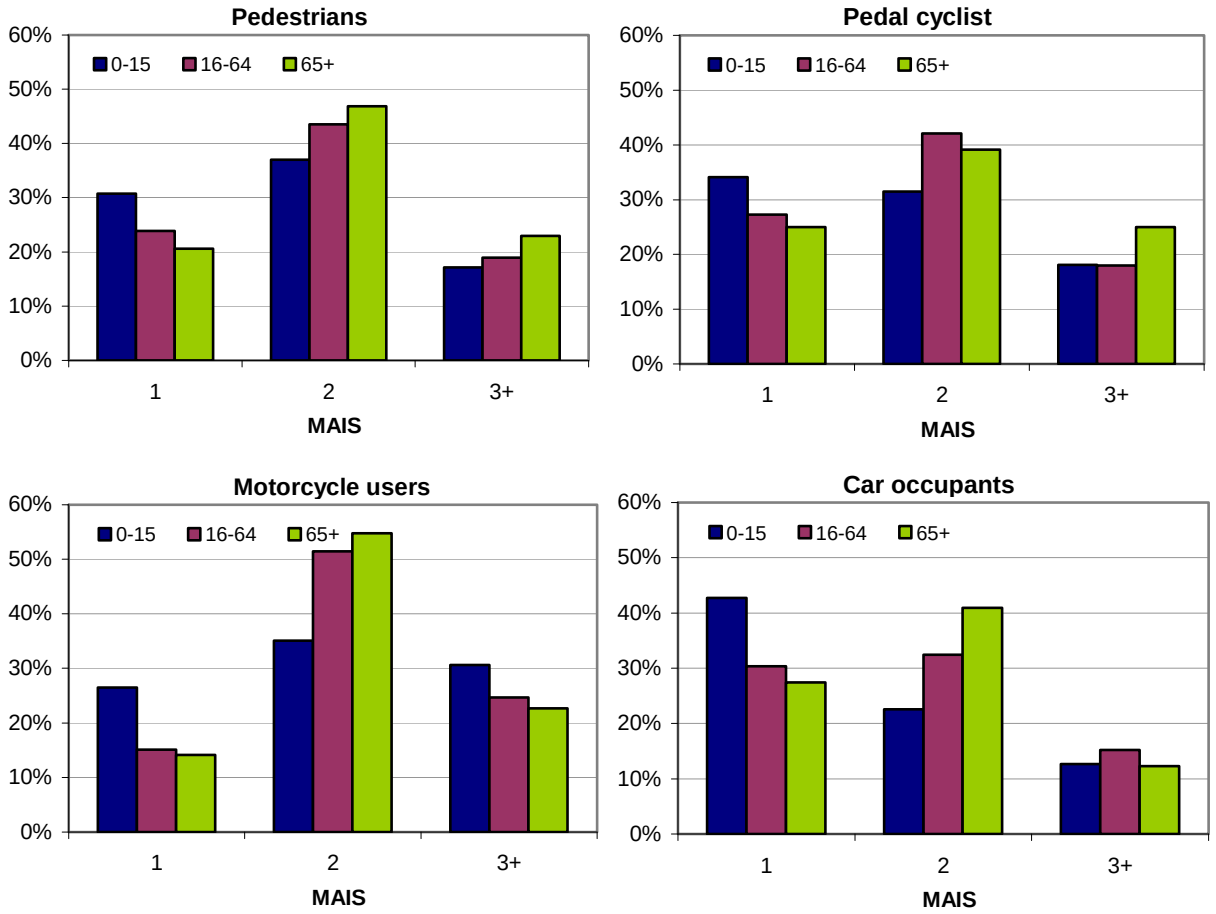
- Of road casualties who were admitted to hospital, children (aged 0-15 years) were more likely to have minor overall injuries (MAIS 1) compared to other ages for all user groups shown (Chart 12). This may be because children are more likely to be admitted to hospital as a precaution.

- Similar to all ages combined, injured children were most likely to have minor injuries (42.7 per cent) as car occupants, and most likely to have a MAIS of three or higher as motorcycle users.

- Generally, injured pedestrians or pedal cyclists over 65 have a higher likelihood of sustaining serious or critical injuries (MAIS 3+) compared to other road user groups. This may be because they are generally more vulnerable to the hazards associated road accidents.

- For motorcycle users, the risk of sustaining a serious injury (MAIS 3 or higher), if involved in a road traffic accident, decreased with increasing age.

Chart 12: Proportion of road casualties in different MAIS group by main road user type and age group, linked STATS19 and HES data: England 2001 - 2010



Age of cars and injury severity

Cars have generally become safer over time due to increased use of modern technology, which may prevent road accidents, but also provide better protection against injuries should an accident occur. Therefore, the severity of injuries of car occupants by age of cars was investigated further. However it is worth noting that the car population (number of licensed vehicles eligible to drive on public roads) is skewed heavily towards newer cars, in which case casualty rates (per 100,000 cars licensed) would need to be considered across each of the age groups (Table 14 and Chart 15).

In the following analysis, the age of car was based on the age at the time of the accident relative to the manufactured year (e.g. if the accident occurred in 2005 and car was manufactured in 1998, then by definition it would be 7 years old at the time of accident). In addition, the analysis was limited to car occupant casualties who were in cars with a known age (85.9 per cent of all car occupant casualties). For further details please see Annex C

Table 13 presents the severity of the injuries sustained by car occupants in cars of different ages that were involved in road accidents and were matched to hospital data.

- The proportion of car occupants sustaining minor injuries varied little by age of car, suggesting all car occupants, regardless of the age of the car, were equally likely to sustain a less severe injury. For more serious and critical injuries (MIAS 3 or higher), the proportions gradually increased as the age of the car involved in the accident increased, suggesting car occupants with older vehicles were more vulnerable to serious injuries relative to car occupants with newer vehicles.

- There may be a possibility that the age of car is a measure of other important factors in injury severity rather than improved technology. For example, older cars may have a higher propensity for frequent mechanical faults or be driven on different types of roads, which may also affect the severity of occupant injuries once involved in road accidents. In addition, the driver demographics (e.g. age, sex or socioeconomic backgrounds) may vary between cars of different ages and these different demographics may affect injury severity through driver behaviour and/or other factors.

Table 13: Age of cars by MAIS group of car occupants in the linked STATS19 and HES data: England 2001 - 2010
(RAS web table RAS55013)

Number/*percentage*

MAIS code	Car [1] ages [2]							
	0-4 years		5-9 years		10-14 years		15 years or older	
	number	per cent	number	per cent	number	per cent	number	per cent
1	6,163	*30.2*	7,415	*30.5*	5,341	*30.3*	1,367	*30.7*
2	6,819	*33.4*	7,949	*32.7*	5,901	*33.4*	1,489	*33.5*
3+	2,652	*13.0*	3,560	*14.6*	2,849	*16.1*	735	*16.5*
Uknown/uncoded	4,752	*23.3*	5,388	*22.2*	3,553	*20.1*	859	*19.3*
Total	20,386	*100.0*	24,312	*100.0*	17,644	*100.0*	4,450	*100.0*

1 Includes cars that were fully or probably matched to the DVLA data with a non-missing manufacture year.

2 The age of car at the time of the accident, based on the manufacture year of vehicle.

- Casualty rate figures, per 100,000 cars, indicate that occupants of older cars (10 years and older) are more likely to sustain an injury if involved in an accident compared to newer vehicles (under 10 years old).

- The 2001-10 average casualty rate figures indicate, that the proportion of occupants sustaining serious or critical injuries (MAIS 3 or higher) relative to slight or moderate injuries (MAIS 1 and 2) increase with older cars implying an increased likelihood of sustaining more serious injuries if driving an older vehicle.

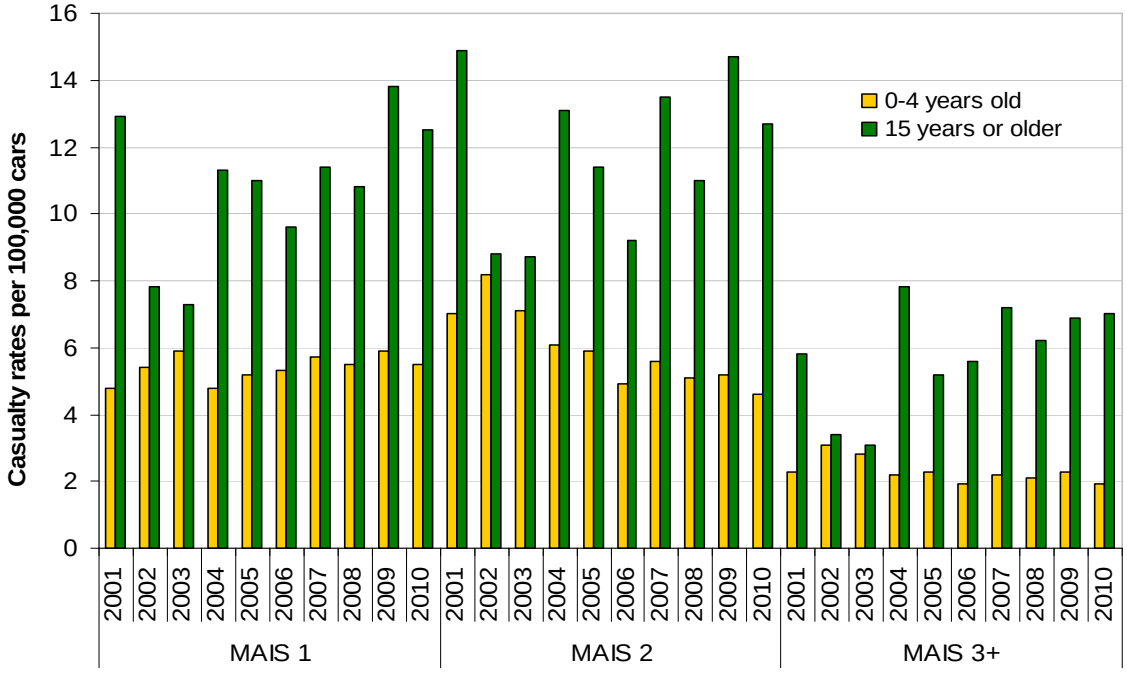
Table 14: Car occupant casualty rates per 100,000 car population, by age of car and MAIS group of injury sustained by car occupants, from the linked STATS19 and HES data: England 2001 & 2010 (RAS web table RAS55014)

Number

		Car [1] ages [2]				
Accident Year	**MAIS code**	**0-4 years old**	**5-9 years old**	**10-14 years old**	**15 years or older**	**All Cars**
2001	1	4.8	6.7	12.6	12.9	**7.3**
2001	2	7.0	9.4	16.6	14.9	**10.1**
2001	3+	2.3	3.1	6.6	5.8	**3.6**
2010	1	5.5	7.6	11.9	12.5	**7.9**
2010	2	4.6	6.8	11.7	12.7	**7.2**
2010	3+	1.9	3.7	5.6	7.0	**3.6**
2001-10 average	**1**	**5.4**	**7.6**	**11.3**	**10.8**	**7.5**
2001-10 average	**2**	**6.0**	**8.1**	**12.5**	**11.8**	**8.1**
2001-10 average	**3+**	**2.3**	**3.6**	**6.0**	**5.8**	**3.6**

1 Includes only cars that were fully or probably matched to the DVLA data with a date of registration
2 The age of car at the time of the accident, based on year of registration of vehicle.

Chart 15: Car occupant casualty rates per 100,000 car population, by MAIS group of injury sustained by occupants of vehicles driving 0-4 years old and 15 years or older cars, from the linked STATS19 and HES data: England 2001 – 2010



Part 3: Admissions for non-road traffic accidents

Information on hospital admissions resulting from non-traffic accidents are also recorded in HES. While these accidents are outside the scope of STATS19, they may still be of interest when considering road safety issues. The number of emergency admissions for falls in the street, cyclists in non-traffic accidents and animal riders/occupants of animal drawn vehicles in England in 2011 is shown in Table 16.

- Pedestrians injured in accidents involving a vehicle on the public highway (including footways) are included in STATS19, but pedestrian falls not involving a vehicle are not collected. In 2011 there were 26.4 thousand emergency admissions to hospital for falls on the street or highway (Table 15). Of these hospital admissions, over half were to individuals aged 65 or older. This particular age group had more female hospital admissions compared to male admissions, in contrast to other age groups.

- Almost 6,400 cyclists were admitted to hospital in 2011 after being injured in a non-traffic accident. Men accounted for 80.0 per cent of these admissions and just over half were aged 16 - 64 (Table 15).

- In HES, it is not possible to identify whether an animal rider or occupant of an animal drawn vehicle admitted to hospital was injured in a road traffic accident. It is likely the majority of these accidents occurred off public highways. Therefore they were excluded from the figures in the rest of this article when comparing HES road traffic accident admissions with STATS19 casualties. There were around 3,800 such admissions in 2011, of which 84 per cent were female. The type of animal was not recorded but it seems likely that a majority of these will be horses.

Table 16: Emergency admissions[1] for falls in the street, cyclists in non-traffic accidents and animal riders or occupants of animal drawn vehicles: HES 2011 (RAS web table RAS55016)

Number/*percentage*

		Falls on the street/highway[2]		Cyclist casualties in non-traffic accidents		Animal riders or occupants of animal drawn vehicles	
Age group	Gender	Number	Per cent	Number	Per cent	Number	Per cent
0-15 years	Male	696	*2.6*	2,221	*34.7*	70	*1.8*
	Female	424	*1.6*	616	*9.6*	796	*20.8*
	Total [3]	1,120	*4.2*	2,837	*44.3*	866	*22.7*
16-64 years	Male	6,373	*24.1*	2,636	*41.2*	470	*12.3*
	Female	3,899	*14.7*	567	*8.9*	2,358	*61.7*
	Total [3]	10,272	*38.9*	3,203	*50.1*	2,828	*74.0*
65+ years	Male	5,691	*21.5*	254	*4.0*	55	*1.4*
	Female	9,353	*35.4*	105	*1.6*	73	*1.9*
	Total [3]	15,044	*56.9*	359	*5.6*	128	*3.4*
All ages[4]	Male	12,760	*48.3*	5,111	*79.9*	595	*15.6*
	Female	13,676	*51.7*	1,288	*20.1*	3,227	*84.4*
	Total [3]	26,436	*100.0*	6,399	*100.0*	3,822	*100.0*

1 The figures in this table include casualties who died in hospital as well as those discharged alive.
2 These figures may be under-recorded since the location was unknown in 29.6 per cent of falls.
3 includes cases where gender was not recorded
4 Includes cases where age was not recorded.

Annex A: HES data used in this article

All HES figures in this article relate to hospital *inpatients*. Inpatients are defined as patients who are admitted to hospital and occupy a bed, including both admissions where an overnight stay is planned and day cases. Those who attend A&E only are not included.

The main unit of recording in HES is the *finished consultant episode* (a period of admitted patient care under one consultant within one healthcare provider). This is not always the same as a single stay (spell) in hospital, because a patient may be transferred from one consultant to another during their stay. In these cases, there will be two or more episode records for the spell of treatment.

A *finished admission episode* is the first period of in-patient care within a spell in hospital. Finished admissions episodes are usually counted against the year in which the episode finishes, but in this analysis we have used date of admission to count them against the year in which they started. Please note that admissions do not represent the number of inpatients, as a person may have more than one admission within one year, although this is likely to have a minimal effect on the overall patterns for road casualty admissions.

This article looks at trends up to 2011. 2011/12 financial year data are provisional and may have been collected before complete data could be provided by the NHS. Counts produced from them are likely to be lower than those generated for the same period in the final dataset, although any shortfalls will be most pronounced in the final two months of the period (February and March 2012) which are not included in this article. There may also be a variety of errors due to coding inconsistencies that have not yet been investigated and corrected.

In Part 1 and Part 3 of this article, the HES figures represent counts of finished admission episodes that were emergency (rather than elective) admissions. Also, episodes relating to individuals dying in hospital have not been included in the analysis in Part 1, in order to give the closest possible comparison with the STATS19 seriously injured category. Figures are based on the calendar year in which a casualty was admitted.

In terms of road casualties, the coding of injury is likely to be more accurate in HES than in STATS19, but coding of location is likely to be less accurate meaning some off-road incidents may be recorded as traffic accidents, or, to a lesser extent, vice versa.

Acknowledgement

We are grateful to the Health and Social Care Information Centre for allowing us to access the HES system. Copyright © 2012, re-used with the permission of The Health and Social Care Information Centre. All rights reserved.

Annex B: Limitations of MAIS used in the linked dataset

Severity of injury is known to be prone to misclassification in STATS19 due to the difficulties of such assessment by non experts at the scene of the accident. In addition, the serious injury definition in STATS19 includes all admissions to hospitals, which may include injuries on a scale of seriousness. The linked dataset was used to further explore severity of injuries.

An enhanced file was created to supplement the data from STATS19 and HES linked dataset. This includes the Maximum Abbreviated Injury Scale value (MAIS), and the length of stay in hospital which may be used to assess the severity of injuries sustained.

The Abbreviated Injury Scale (AIS)[6] is an internationally recognised method of measuring injury severity, used in crash investigations. AIS takes account of threat to life as well as permanent impairment. The body is divided into six regions, and an AIS assigned to each region. The scale runs from 0 to 6, which signifies no injury through to maximum injury (Table 15). The maximum of the AIS scores assigned is the Maximum Abbreviated Injury Scale (MAIS) score used to summarise the overall injury.

For the linked STATS19 and HES data, AIS scores using the 1998 revision, were estimated from ICD-10 coding of injury diagnoses using the mapping developed at the University of Navarra for the Apollo project[7] .

Table 15: Abbreviated Injury Scale (AIS)

AIS code	Injury severity
AIS 0	No injury
AIS 1	Minor injury
AIS 2	Moderate injury
AIS 3	Serious injury
AIS 4	Severe injury
AIS 5	Critical injury
AIS 6	Maximum injury

Limitations of the AIS include its lack of ability to predict mortality or outcomes, and it is not a true scale (for example the difference between AIS 1 and AIS 2 is not the same as between AIS 4 and AIS 5). In addition, not all S and T codes of ICD-10 are assigned an AIS score using the mapping method developed for the Apollo project.

Limitations within the linked dataset include the lack of S or T code diagnosis for a small percentage of road traffic hospital admissions. Further, for largely practical reasons, the assignment of MAIS was based on the first six diagnoses out of the 20 codes recorded in HES. However, only around one per cent of total records have more than six diagnoses codes.

It is likely the combined effect of the above factors may underestimate the injury severity in the linked dataset.

While there are some limitations to the derived MAIS, this measure of injury severity is considered to be less affected by hospital admissions practices than the length of hospital stay. Therefore the article focuses on the MAIS as measure of severity in the linked dataset.

[6] http://www.aaam1.org/ais/

[7] European Center for Injury Prevention, University of Navarra, Algorithm to transform ICD-10 codes into AIS 90 (98 update)

Annex C: Car occupant casualties included in the age of cars analysis

Of the 77,754 car occupant casualties included in the linked dataset, 66,792 (85.9%) were casualties in cars which were matched to the Driver and Vehicle Licensing Agency's (DVLA) vehicle registration dataset and had a non missing car manufacture year. The age of cars was based on the car age at the time of the accident, and the year of car manufacture was used for this calculation.

The following analysis focuses on these 66,792 car occupant casualties only. It is possible that the patterns of injury may be different for causalities in cars with missing data, which are not included in this analysis.

Annex D: Strengths and weaknesses of the data

The Hospital Episode Statistics (HES) data for the calendar year 2010 has now been finalised, however HES data for the financial year 2011 is currently provisional. This will remain provisional until more complete and validated information is available is September 2013.

For the HES and STATS19 linked data, of the 2,303 thousand records in STATS 19 only 176 thousand records (8.0 per cent) were successfully matched using common partial identifiers for casualties which include;

- Age
- Gender of casualty
- Location of Accident being within the proximity of the Strategic Health Authority
- Casualty residential post code
- Date of admission to the Hospital's A&E department (which is matched with the date of the accident with some level of tolerance added for late admissions)
- Road User Group (e.g. pedal cyclist, car occupant, motor cyclist) at the time of the accident

However, it is important to know the limitations of both data available, and the conclusions that can therefore be drawn from them. As discussed in the HES Inpatient Data Quality note, there are constant changes in NHS responsibilities between years making it potentially difficult to compare trends between years. Other known issues for the HES data include duplicate records for a very small number of known health care providers and PCTs and issues with admissions length (e.g. If a patient was admitted to hospital at 12.30am and then subsequently discharged on the same day at 11:30pm, the admissions length would be recorded as "0 Days", even though the admission had been 23 hours in length. However if another patient was admitted to hospital at 11.30pm and then discharged at 1.30am the following day, the admissions length would be recorded as "1 Day", even though the admission was only 2 hours in length.)

Likewise, with STATS19 there are known problems with underreporting of road casualties (e.g. only those involved in an accident which were reported to the police authority would be included) and coding errors associated with residential post code of casualty, age and severity of injury (particularly with children, 0-15 years old, and older aged persons, 65 years and over). However, our best current estimate derived from the National Travel Survey (NTS) data is that the total of number of road casualties in Great Britain annually, including those not reported to the police, is within the range 660 thousand to 800 thousand with a central estimate of 730 thousand. This is based on data for the seven year period 2004 to 2010. A discussion of how this estimate has been derived, and its limitations, together with information on complementary sources of data on road accidents and casualties, are contained in Article 5 (pages 83-92) of Reported Road Casualties Great Britain: 2010 Annual report, which can be found at: http://www.dft.gov.uk/statistics/releases/road-accidents-and-safety-annual-report-2010/

A revised estimate will be produced next year when NTS 2011 data are available.

Background notes

Detailed statistics (tables and charts) on "Hospital admissions data on road casualties" can be found on Reported Road Casualties in Great Britain – 2011 annual report web page at: http://www.dft.gov.uk/statistics?post_type=table&series=road-accidents-and-safety-series

Table numbers RAS55001 – RAS55016

1. Further information about the Reported Road Casualties Great Britain Annual Report can be found at: http://www.dft.gov.uk/statistics/series/

2. Notes & Definitions used in STATS19 can be found at: http://www.dft.gov.uk/statistics/series/road-accidents-and-safety/

3. Further information about the Hospital Admissions Statistics can be found at: http://www.hesonline.nhs.uk

4. The complete methodology document on linking Police and Hospital data on Road Accidents in England can be found at: http://www.dft.gov.uk/statistics/series/road-accidents-and-safety/