Goodman, Anna, Phil Edwards, and Anthony A. Laverty. 2025. "Do Sports Utility Vehicles (SUVs) Cause More Severe Injuries to Pedestrians and Cyclists than Passenger Cars, in the Case of a Crash? Findings from Great Britain, 2004-2023." *Findings*, July. https://doi.org/10.32866/001c.141647.

SAFETY FINDINGS

Do Sports Utility Vehicles (SUVs) Cause More Severe Injuries to Pedestrians and Cyclists than Passenger Cars, in the Case of a Crash? Findings from Great Britain, 2004-2023

Anna Goodman, PhD[1], Phil Edwards, PhD[1], Anthony A. Laverty, PhD[2]

[1] Department of Population Health, London School of Hygiene & Tropical Medicine, [2] School of Public Health, Imperial College London

Keywords: Road traffic crash, road danger, vehicle type, pedestrian, cyclist, sports utility vehicles

https://doi.org/10.32866/001c.141647

Findings

We used police-reported road crash data from Great Britain, 2004-2023, to examine whether being hit by a sports utility vehicle (SUV) is more dangerous for pedestrians and cyclists than being hit by a passenger car. In adjusted analyses, being hit by an SUV increased the odds of fatality by a modest amount in adults (odds ratio 1.14 (95% confidence interval 1.02, 1.28)). In children the odds of fatality increased considerably (odds ratio 1.77 (1.33, 2.35) in children aged 0-18 years), with particularly large effects in young children (odds ratio 3.09 (1.92, 4.97) in children aged 0-9 years). Vehicle weight and height showed strong, dose-response associations with injury severity, but vehicle length showed little association.

1. QUESTIONS

Sports utility vehicles, or SUVs, have become increasingly popular in recent years: as of 2023, SUVs made up 48% of new car sales globally, up from 15% in 2010 (IEA 2024). These larger vehicles consume more resources to manufacture, take up more space when parked, and on average produce more pollution when driven. A growing number of cities across the world are therefore seeking to discourage the proliferation of larger vehicles, through measures such as parking surcharges (Goodman et al. 2025).

One potential rationale for seeking to discourage SUVs relates to road danger. A recent systematic review found that, in the case of a crash, being hit by an SUV was associated with more severe injuries to pedestrians and cyclists than being hit by a passenger car (Robinson et al. 2025). Most of this evidence came from the USA, however, where vehicle design standards are weaker than in Europe with regards to pedestrian safety. In the present study we examine for the first time whether being hit by an SUV, as opposed to a passenger car, is associated with more severe injuries for pedestrians and cyclists in Great Britain.

2. METHODS

We used police-reported Stats19 road traffic crash data for Great Britain for 2004-2023. Alongside the open access police data, we requested the data fields of vehicle make, model and registration year, which we used to look up the vehicle's body style, kerb weight, height and length. This look-up used

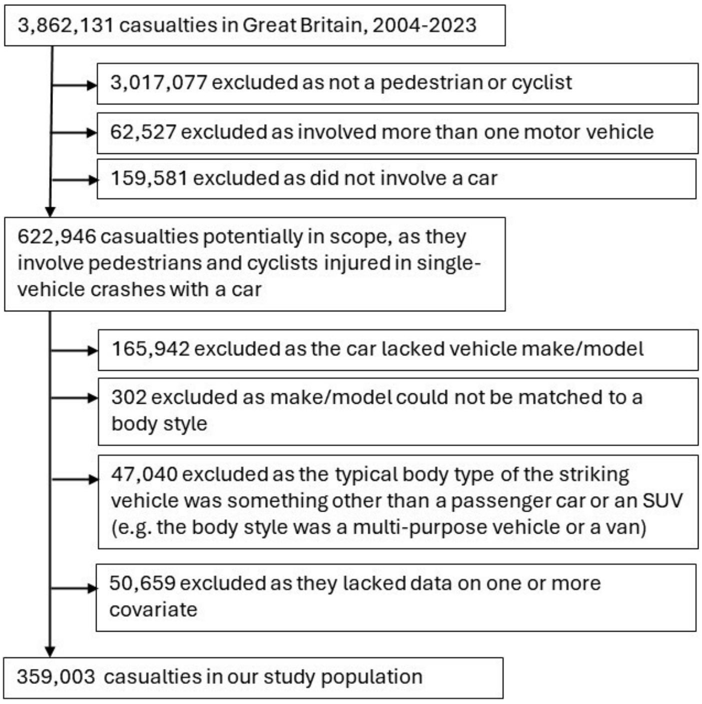

Figure 1. Flow chart showing casualties included in the analysis

manufacturer-reported body style and dimension data compiled by Vehicle Data Global Ltd (https://vehicledataglobal.com).[1] Where vehicle dimensions varied within a given make/model/year, Vehicle Data Global Ltd provided us with the current average value (e.g. the mean kerb weight) amongst all vehicles registered in the UK in February 2025.[2]

We restricted our analysis to pedestrian and cyclist casualties in crashes that involved a single car and no other motor vehicles. As shown in Figure 1, we excluded casualties where a valid make and model of the car was not recorded in Stats19, where the body style of the striking vehicle was something other than a passenger car or an SUV, or where data was missing on one or more covariates. This left a study population of 359,003 casualties, who are described in Table 1.

We used two binary outcomes: fatal vs non-fatal injury; and killed and seriously injured (KSI) vs slight injury. Our primary exposure of interest was whether the striking vehicle was a passenger car or an SUV. Additional analyses used the weight, height or length of the striking vehicle as an

1 Vehicle Data Global Ltd also compiles manufacturer-reported information on vehicle width. We did not use this data in the present study, however, as we identified that the Vehicle Data Global Ltd width data was not of a consistent type. Instead, Vehicle Data Global Ltd typically recorded the width including wing-mirrors but sometimes recorded the width excluding wing-mirrors.

2 The Stats19 dataset includes weight data on some vehicles, obtained via a look-up of their numberplate to the information held on the vehicle's log book. The proportion of missing data is, however, very high: 63% missing for unladen weight in our sample, and 82% missing for gross weight. In addition, the weight data held in Stats19 included some clear errors (e.g. unladen weights ranging from 100kg to 44,000kg). We therefore instead examine the impacts of weight using the kerb weight data returned by Vehicle Data Global Ltd, which is only missing for 2% of vehicles. We established that these two datasets were highly correlated (r=0.92 for gross weight, the metric available in both datasets).

Table 1. Distribution of casualty, driver and crash characteristics in the study population

Variable type	Variable	Response levels	Number of casualties	% of casualties
Outcome	Injury severity	Slight	275,978	77%
		Serious	78,433	22%
		Fatal	4,592	1%
Exposures	Car body style†	Passenger car	323,529	90%
		SUV	35,474	10%
	Kerb weight‡	<1550kg	311,940	88%
		1550-2049kg	35,100	10%
		≥2050kg	6,216	2%
	Height	<1575mm	296,849	90%
		1575-1749mm	25,248	8%
		≥1750mm	7,375	2%
	Length	<4600mm	277,632	84%
		4600-4899mm	46,147	14%
		≥4900mm	6,113	2%
Casualty characteristics	Travel mode	Pedestrian	148,256	41%
		Cyclist	210,747	59%
	Age band of casualty	0-9 years	38,324	11%
		10-18 years	88,987	25%
		19-35 years	91,556	26%
		36-55 years	82,400	23%
		56-75 years	40,946	11%
		76+ years	16,790	5%
	Sex of casualty	Male	240,519	67%
		Female	118,484	33%
Striking vehicle characteristics	Age band of car driver	≤20 years	26,388	7%
		21-25 years	41,505	12%
		36-35 years	78,616	22%
		36-55 years	130,625	36%
		56-75 years	65,494	18%
		76+ years	16,375	5%
	Sex of car driver	Male	218,466	61%
		Female	140,537	39%
	Age of vehicle	0-4 years	111,486	31%
		5-9 years	128,256	36%
		10-14 years	92,801	26%
		15-19 years	23,695	7%
		20+ years	2,765	1%
Crash location and conditions	Region/ country	North East	15,104	4%
		North West	48,668	14%
		Yorkshire and The Humber	36,973	10%

Variable type	Variable	Response levels	Number of casualties	% of casualties
		East Midlands	23,061	6%
		West Midlands	31,552	9%
		East of England	30,427	8%
		London	54,288	15%
		South East	51,045	14%
		South West	29,885	8%
		Scotland	25,737	7%
		Wales	12,263	3%
	Rural/urban status	Rural road	53,632	15%
		Urban road	305,371	85%
	Road class$	Motorway or A	125,594	35%
		B	44,403	12%
		C	28,705	8%
		Unclassified	160,301	45%
	Road speed limit	20mph or below	23,062	6%
		30mph	299,214	83%
		40mph	19,168	5%
		50mph or above	17,559	5%
	Light conditions and infrastructure	Daylight	270,597	75%
		Darkness, street lights lit	76,830	21%
		Darkness, street lights unlit, absent, or status unknown	11,576	3%
	Road surface	Dry	270,273	75%
		Wet or damp	84,729	24%
		Snow, frost or other	4,001	1%
	Year	2004-2008	104,669	29%
		2009-2013	94,255	26%
		2014-2018	89,264	25%
		2019-2023	70,815	20%

†We classified as passenger cars vehicles with the following manufacturer-reported body styles: convertible, coupe, estate, hatchback, saloon. We classified as SUVs vehicles with the following manufacturer-reported body styles: SUV, SUV convertible, SUV coupe, SUV estate, SUV hatchback, SUV saloon. We excluded other body styles, e.g. vans, multi-purpose vehicles and taxis. ‡These distributions have been chosen to approximate an 80% / 17% / 3% split among striking vehicles as of 2023. $'A roads' in the UK are major roads that are designed and intended to accommodate substantial traffic volumes. 'B roads' are generally somewhat smaller and are intended to distribute traffic from A roads to minor roads. 'C' roads and 'Unclassified' roads are different types of minor roads, and are designed and intended for local traffic.

alternative exposure of interest. We did this to inform policy decisions around which metric to use to define 'large cars' (Goodman et al. 2025). We examined these alternative exposures in separate models, i.e. including either SUV status or height or weight or length, but never more than one of these.

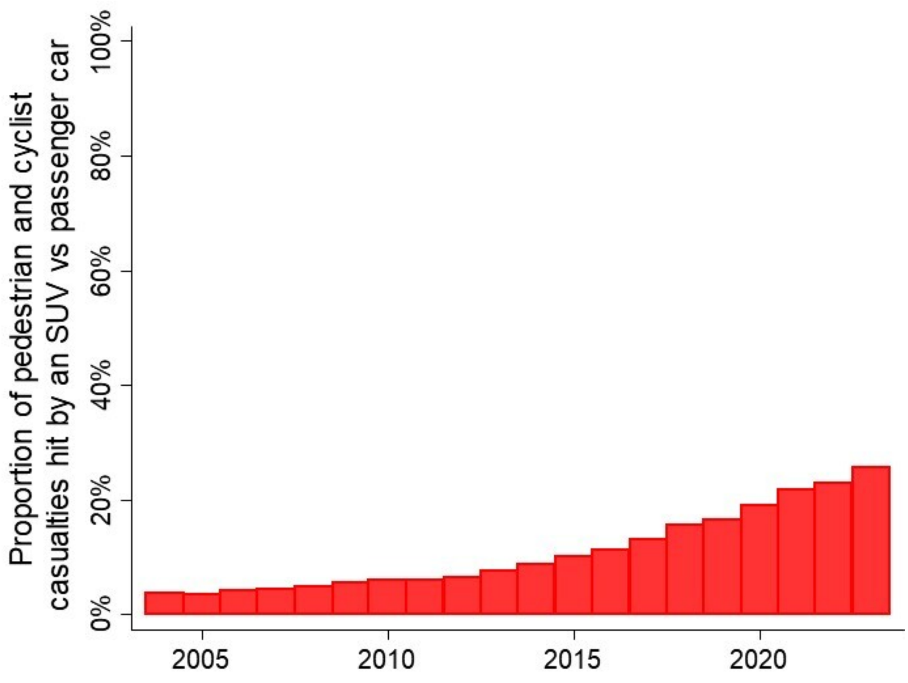

Figure 2. Proportion of striking cars that are SUVs (versus passenger cars), for pedestrian and cyclist casualties injured in single-vehicle car crashes

Over this period, SUVs increased substantially as a share of the car fleet in Great Britain. The increase shown in this graph therefore does not imply that SUV collision rates increased per vehicle. However, to the extent that SUVs are more dangerous than passenger cars in the case of a crash, the fact that SUV collisions have become more common will increase their impact at the population level.

We tested *a priori* for interactions between SUV status and a) casualty age (0-9 years, 10-18 years, 19+ years);[3] b) casualty travel mode (pedestrian versus cyclist); c) urban versus rural status; d) year (as a continuous variable).

We first present minimally-adjusted models that adjust only for casualty travel mode, region of Great Britain and calendar year. We then present fully adjusted models that adjust for all the covariates shown in Table 1. All analyses used Stata/SE 18.5.

3. FINDINGS

From 2004-2023 in Great Britain, the proportion of pedestrian and cyclist car crash casualties that involved an SUV increased from 4% to 26% (Figure 2). Across that period, there was likewise an increase in the mean kerb weight (+20%), height (+6%) and length (+3%) of the cars involved in these collisions.

There was strong evidence for an interaction between SUV status and casualty age category ($p<0.001$ for interaction in adjusted models in relation to both KSI/slight and fatal/non-fatal outcomes). We therefore present all

3 We stratified into these three non-overlapping age groups when testing for interactions. In our main analysis, however, we present the overlapping age groups of 0-9 years and 0-18 years, to facilitate comparisons with a recent systematic review.

Table 2. The association between injury severity to pedestrians and cyclists and being hit by an SUV versus a passenger car: results from Great Britain, 2004-2023

Outcome	Casualty age	No. casualties	Odds ratio (95% CI) for being hit by an SUV vs passenger car		Equivalent pooled odds ratio (95% CI) from recent systematic review [No. studies]‡	Population Attributable Fraction, as of 2023 $
			Minimally-adjusted	Fully-adjusted		
Fatal vs non-fatal	Adults, 19+ years	231,692	1.07 (0.96, 1.18)	1.14 (1.02, 1.28)*	1.44 (1.33, 1.56)*** [N=15]	4%
	Children, 0-18 years	127,311	1.45 (1.10, 1.90)**	1.77 (1.33, 2.35)***	1.82 (1.57, 2.11)*** [N=6]	17%
	Children, 0-9 years	38,324	2.56 (1.63, 4.02)***	3.09 (1.92, 4.97)***	2.30 (2.09, 2.53)*** [N=2]	35%
KSI vs slight	Adults, 19+ years: pedestrians¥	118,978	0.91 (0.87, 0.95)***	0.97 (0.93, 1.02)	1.28 (1.13, 1.44)*** [N=13]	[not calculated]
	Adults, 19+ years: cyclists¥	112,714	1.14 (1.08, 1.19)***	1.11 (1.06, 1.16)***	1.19 (1.07, 1.33)*** [N=7]	3%
	Children, 0-18 years	127,311	1.12 (1.06, 1.17)***	1.18 (1.12, 1.24)***	1.28 (1.19, 1.37)*** [N=4]	4%
	Children, 0-9 years	38,324	1.29 (1.18, 1.40)***	1.35 (1.23, 1.47)***	1.48 (1.34, 1.63)*** [N=2]	8%

†p≤0.10, *p≤0.05, **p≤0.01, ***p≤0.001. CI = confidence interval, KSI = killed and seriously injured. Minimally-adjusted analyses adjust for travel mode, region of Great Britain and the year of the crash (in two-year bands). The fully-adjusted analyses adjust for all the 'casualty characteristics', 'striking vehicle characteristics', and 'crash location and conditions' variables shown in Table 1, as categorical variables (but using two-year not five-year age bands). See the Supplementary Material for tables presenting the raw numbers of casualties, and for a version of this table that presents results for urban areas only. ‡ Note that the studies in this systematic review were mostly from the USA (16/24 studies) and most relied on unadjusted odds ratios (20/24 studies). ¥p<0.001 for interaction between the impact on pedestrians and cyclists, in relation to KSIs among adults. $ Population attributable fractions calculated using the formula "(P * (OR - 1)) / (1 + P * (OR - 1))", where OR is the fully-adjusted odds ratio, and P is 26% which was the prevalence of SUVs among car crashes in 2023. We only calculated these fractions where the odds ratio in question was statistically significant.

our analyses stratified by age, choosing the overlapping age strata 0-9 years; 0-18 years; and 19+ years, to facilitate comparisons with a recent systematic review (Robinson et al. 2025). There was also an interaction between casualty travel mode and SUV status in relation to KSI injuries (p<0.001 overall; p<0.001 in adults; but p=0.94 in children), and we therefore additionally stratify our adult KSI results by mode. There was no evidence of an interaction with urban/rural status or year (p>0.05).

As shown in Table 2, the effect estimates for the impact of being hit by an SUV versus a passenger car increased upon adjustment for the variables in Table 1. This increase in the effect estimates was primarily driven by adjustment for vehicle's age and driver's age. On average, SUVs have a more recent date of manufacture than passenger cars, and SUVs are also currently more likely to be driven by middle-aged drivers rather than very young or very old drivers. Both factors are associated with reduced injury risk, meaning they act as 'negative confounders' in the minimally-adjusted analyses.

After adjusting for covariates, there was evidence of a modest increase in the odds of fatality for adult pedestrians and cyclists, if hit by an SUV versus a passenger car (odds ratio 1.14, p=0.02). There was also evidence of a modest increase in the odds of a KSI injury for adult cyclists (odds ratio 1.11, $p<0.001$), but no evidence of an effect for adult pedestrians (odds ratio 0.97, $p=0.25$). These effect sizes were all smaller than those obtained in a recent systematic review, which drew mainly on data from the USA (Robinson et al. 2025).

For child pedestrians and cyclists, being hit by an SUV versus a passenger car was associated with a larger increase in the odds of fatality and KSI in adjusted analyses (odds ratio 1.77, $p<0.001$, for fatality; odds ratio 1.18, $p<0.001$, for KSI). These effects were particularly large in young children (odds ratio 3.09, $p<0.001$, for fatality; odds ratio 1.35, $p<0.001$, for KSI), and were similar to those documented in the two comparable studies from the USA in the recent systematic review.

As of 2023, these effect sizes translated into population attributable fractions ranging from 3% to 35% (Table 2). These fractions capture the proportion of car crash fatalities/injuries that one would be expected to be averted in Great Britain if all SUVs were replaced with passenger cars.

Finally, we examined injury severity in relation to the dimensions of weight, height and length (Table 3). We found a strong, dose-response associations with weight and height, but at most a weak association with length.

We conclude that in Great Britain, being hit by an SUV as opposed to a passenger car increases injury severity among pedestrians and cyclists, with the strongest effect in children. This effect is well-captured by the dimensions of weight and height, but not by length.

ACKNOWLEDGEMENTS

This study received ethical approval from the London School of Hygiene and Tropical Medicine (ref 31606). We are grateful to Tony Percival and colleagues at Vehicle Data Global Ltd for performing look-ups of body styles and dimensions based on vehicle make, model and registration year. The researcher time on this work was unfunded, but we are grateful to Clean Cities and to the Rees Jeffreys Road fund for contributing towards the cost of data matching by Vehicle Data Global Ltd, and to Ruth Carlson in helping to arrange the Rees Jeffreys Road contribution.

Submitted: April 08, 2025 AEST. Accepted: July 01, 2025 AEST. Published: July 07, 2025 AEST.

Table 3. The association between injury severity to pedestrians and cyclists and the dimensions of the striking car: results from Great Britain, 2004-2023

Outcome	Casualty age	Fully-adjusted odds ratio (95% CI) for the effect of striking vehicle kerb weight‡				Fully-adjusted odds ratio (95% CI) for the effect of striking vehicle height				Fully-adjusted odds ratio (95% CI) for the effect of striking vehicle length			
		N	<1550 kg	1550-2049kg	≥2050kg	N	<1575 mm	1575-1749mm	≥1750mm	N	<4600 mm	4600-4899mm	≥4900mm
Fatal vs non-fatal	Adults, 19+ years	228,360	1	1.17 (1.05, 1.30)**	1.38 (1.11, 1.71)**	215,095	1	1.07 (0.93, 1.22)	1.38 (1.13, 1.68)***	215,332	1	1.10 (1.00, 1.21)†	1.12 (0.88, 1.43)
	Children, 0-18 years	124,896	1	1.64 (1.25, 2.16)***	1.34 (0.69, 2.61)	114,377	1	1.57 (1.11, 2.22)*	1.65 (0.95, 2.85)†	114,560	1	1.18 (0.91, 1.54)	0.86 (0.38, 1.98)
	Children, 0-9 years	37,584	1	2.21 (1.33, 3.69)**	3.75 (1.49, 9.45)**	34,300	1	2.23 (1.24, 4.01)**	3.20 (1.37, 7.44)**	34,363	1	1.35 (0.81, 2.25)	1.85 (0.56, 6.08)
KSI vs slight	Adults, 19+ years: pedestrians†	116,741	1	1.05 (1.00, 1.09)*	1.02 (0.92, 1.12)	108,942	1	0.96 (0.91, 1.01)	0.99 (0.90, 1.08)	109,073	1	1.00 (0.97, 1.05)	1.01 (0.92, 1.12)
	Adults, 19+ years: cyclists†	111,619	1	1.07 (1.02, 1.12)**	1.11 (1.00, 1.23)*	106,153	1	1.06 (1.00, 1.12)†	1.27 (1.15, 1.39)***	106,259	1	0.99 (0.94, 1.03)	1.00 (0.90, 1.11)
	Children, 0-18 years	124,896	1	1.12 (1.06, 1.18)***	1.26 (1.12, 1.41)***	114,377	1	1.15 (1.09, 1.22)***	1.28 (1.15, 1.41)***	114,560	1	1.03 (0.99, 1.08)	1.02 (0.90, 1.16)
	Children, 0-9 years	37,584	1	1.24 (1.13, 1.36)***	1.40 (1.13, 1.73)**	34,300	1	1.27 (1.14, 1.40)***	1.46 (1.23, 1.74)***	34,363	1	1.11 (1.03, 1.21)**	1.01 (0.80, 1.28)

†p≤0.10, *p≤0.05, **p≤0.01, ***p≤0.001. All analyses in this table adjust for the 'casualty characteristics', 'striking vehicle characteristics', and 'crash location and conditions' variables shown in Table 1, as categorical variables (but using two-year not five-year age bands). ‡This table presents results for kerb weight categories. See the Supplementary Material for a version of this table that presents results for an 'adjusted weight' variable, that uses different weight thresholds for electric and plug-in hybrid vehicles.

REFERENCES

Goodman, A., J. Nix, J. Tyndall, and A. A. Laverty. 2025. "SUV Toolkit for Cities: Overview of Options for Defining and Addressing 'Oversized Vehicles.'" https://www.transportforqualityoflife.com/reports/suv-toolkit-for-cities-options-for-defining-and-addressing-oversized-vehicles/.

IEA. 2024. "SUVs Are Setting New Sales Records Each Year – and so Are Their Emissions." https://www.iea.org/commentaries/suvs-are-setting-new-sales-records-each-year-and-so-are-their-emissions.

Robinson, E., P. Edwards, A. A. Laverty, and A. Goodman. 2025. "Do Sports Utility Vehicles (SUVs) and Light Truck Vehicles (LTVs) Cause More Severe Injuries to Pedestrians and Cyclists than Passenger Cars, in the Case of a Crash? A Systematic Review and Meta-Analysis." *Injury Prevention*. https://doi.org/10.1136/ip-2024-045613.

SUPPLEMENTARY MATERIALS

Supplement

Download: https://findingspress.org/article/141647-do-sports-utility-vehicles-suvs-cause-more-severe-injuries-to-pedestrians-and-cyclists-than-passenger-cars-in-the-case-of-a-crash-findings-from-gr/attachment/291438.pdf