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# Road casualties analysis

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## ABSTRACT

This article examines the circumstances of road casualties over the period 2012–2021 in Greater Manchester in North West England. In particular, the demographics of road casualties, the nature of the road activity involved, and the nature of the roads where the casualties occurred are examined. Over the period studied there was an overall decrease in road casualties, similar to that of Great Britain overall, and there were 1.55 times as many male as female road casualties. The largest decrease in road casualties by age group was amongst those aged less than 18. The majority of road casualties occurred on urban roads with a speed limit of 21–30mph. There was a strong relationship between age group and the rate of road casualties for pedestrians, driver/riders, and passengers.

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**KEYWORDS** Road; casualty; analysis

## 1. Introduction

In Great Britain in 2021 there were an estimated 128,209 road casualties, which represented a decrease of 34.49% from 2012 to 2021 (NS, 2023). In Great Britain road casualties are reported by the relevant police force. In this article we examine road casualties in Greater Manchester in the North West of England. Greater Manchester covers an area of 1,276 km<sup>2</sup> and in the 2021 UK Census, had a population of 2,867,800 (ONS, 2023). Transport for Greater Manchester is the local government body that is responsible for delivering Greater Manchester's transport strategy and commitments set by the Greater Manchester Combined Authority (TfGM, 2023). The road network in Greater Manchester comprises over 10,000 km

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(6,000 miles) of roads, of which approximately 10% are classified as rural roads (GMHSIF, 2018). In the UK urban roads are defined as those within an urban area of 10,000 population or more and rural roads are those outside an urban area (RL, 2023). In Great Britain in 2019 33% of all road casualties occurred on rural roads, despite such roads carrying 44% of all road traffic (RSS, 2019).

In England the central government sets the regulatory framework for roads, vehicles and road users, and the national road safety strategy. Central government funding and resources are provided to local government and other agencies to improve road safety, in terms of research into the nature, causes, and strategies to reduce road casualties. Local government is the main delivery agent of road safety, and has a statutory duty under section 39 of the 1988 Road Traffic Act to take actions to reduce and prevent road accidents (ROSPA, 2019). The UK Parliamentary Advisory Council for Transport Safety (PACTS, 2023) states that road safety is a shared responsibility between road users, road managers, and vehicle manufacturers for taking appropriate actions to ensure that road traffic collisions do not result in serious or fatal injuries. In 2019 the UK Government announced 74 actions to improve road safety including: improved road safety education for children, young people, and older people, especially learner drivers, and improved vehicle safety in conjunction with vehicle manufacturers. (RSS, 2019). During the period studied Greater Manchester Council had introduced a number of road safety initiatives including improved cycle and walking routes, and road safety training and courses specifically for drivers, motorcyclists, cyclists and pedestrians (TGM, 2023).

The research reported in this article concerns the patterns and distributions of the circumstances of road casualties. The originality of the research concerns the detailed analysis of the circumstances of road casualties in the English county of Greater Manchester over a ten year period 2012–2021 in terms of road casualty demographics, road activities and road types. The purpose of the research was to inform road safety initiatives in Greater Manchester and the UK.

## 2. Literature review

### 2.1. Road casualties

Road traffic collisions result in the deaths of approximately 1.3 million people around the world annually and cause between 20 and 50 million non-fatal injuries. More than half of all road traffic deaths and injuries involve vulnerable road users, such as pedestrians, cyclists and motorcyclists and their passengers (WHO, 2018). Christie (2018) commented that transport poses a significant public health risk. Road casualties are disproportionately experienced by some social groups more than others. Children, for example, are at a greater risk of pedestrian injury than any other age group (O'Toole & Christie, 2018). In the UK the main causes of

serious road injuries and deaths are speeding, drink/drug driving, not wearing a seat belt and using a mobile phone while driving (GMP, 2023). The road deaths per million population in England in 2021 was 23 which was lower than the other countries in the United Kingdom (Wales 27, Scotland, 26, Northern Ireland 26), and also lower than most other European countries (e.g. France 43, Italy 49, Germany 41) and considerably lower than the United States of America (129) (NS, 2023).

## 2.2. Road casualty costs

Road traffic injuries can have a major impact on victims' physical and psychological well-being and functioning (Weijermars et al., 2016). The value of preventing all reported and unreported road collisions in Great Britain in 2021 was estimated to be £30 billion. The cost of a fatal road casualty in Great Britain in 2021 was £2,114,526, the cost of a serious road casualty was £237,614, and the cost of a slight casualty was £18,318 (UKGOV, 2023). In the UK, the NHS injury costs recovery (ICR) scheme recovers the cost of NHS treatment where personal injury compensation is paid following a road casualty. The UK Compensation Recovery Unit (CRU, 2023) recovers funds mainly from insurance companies and then pays them to the NHS hospital or ambulance trust that provided treatment for the individual injured in a road traffic collision (NHSCRU, 2021). In 2020/2021 in Great Britain the NHS received £193,744,905 from the Compensation Recovery Unit.

## 2.3. Road casualty prevention

Effective and comprehensive road safety strategies can reduce the number of people killed or injured in road traffic collisions, despite increasing levels of traffic (ROSPA, 2023). In the UK the Parliamentary Advisory Council for Transport Safety (PACTS, 2023) advocates investing in effective, targeted action in the transport system to protect against death and serious injury, and aligning public health, occupational health and safety, environmental and social justice objectives for road safety. In practical terms this concerns safer vehicles, safer roads and roadsides, and safer speeds, and education on safer road use. In England, methods of road casualty prevention include the introduction of 20mph speed limits in residential areas (Jepson et al., 2022; Li & Graham, 2016), the introduction of road speed bumps (Daddah et al., 2022), the introduction of cycle lanes (Blank-Gomel, 2017), and road safety classes (GMRSP, 2023). A study by Klanjčić et al. (2022) involving 24 cities in 5 European countries concluded that cities with the highest rates of walking and cycling paths are the safest for the most vulnerable road users. A higher presence of low-speed limit roads appeared to only significantly reduce the number of injuries of car occupants.

Overall, although research has been undertaken into specific aspects of road casualties, there has been limited research into the patterns and distributions of road casualty circumstances. The originality of the research presented in this article is the detailed analysis of the circumstances of road casualties in an English county over a ten-year period in terms of casualty demographics, road usage, and type of road.

### 3. Research method

The research method adopted was exploratory data analysis of road casualty data for Greater Manchester in England between 2012 and 2021 from the UK Department for Transport. The analysis of road casualty data was undertaken by examining the recorded circumstances of road casualties during 2012–2021 in Greater Manchester in England using frequency analysis, percentages, ratios and correlations. The research involved analysing overall patterns of road casualties, and analysis of the distribution of road casualties by demographics, the nature of the road activity involved, and the nature of the roads where the road casualties occurred.

The research questions posed by the research were:

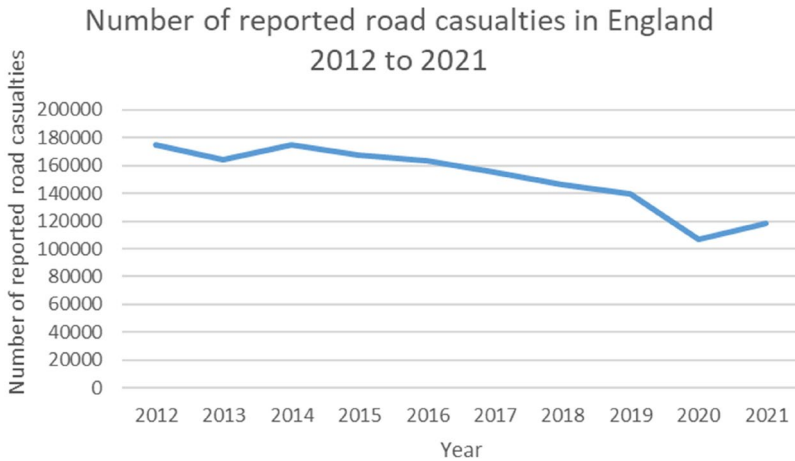
- Who is most at risk of road casualty in terms of age and gender?
- Who is most at risk of road casualty in terms of road activity (pedestrian/driver/passenger)?
- Where do road casualties occur in terms of road type and speed limit?

These are important research questions, since road casualties have both a social and economic cost. The cost of a fatal road casualty in 2021 in Great Britain was over £2m, the cost of a serious road casualty was almost £0.25m, and the cost of a slight casualty was over £18,000 (UKGOV, 2023). The purpose of the research was to examine the distribution of road casualties in order to inform road safety initiatives.

The data was collected from the UK Department of Transport for the relevant period for the Greater Manchester area which comprises of the ten local authorities of Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford and Wigan. The data analysis was undertaken using frequency analysis using frequency charts, percentage increases and decreases over the study period and ratios of casualties by different categories. The data analysis was performed using the MS Excel spreadsheet software.

### 4. Road casualty analysis results

The pattern of road casualties in England over the period studied 2012–2021 is shown in [Figure 1](#).



**Figure 1.** Number of reported road casualties (including deaths) in England 2012–2021.



**Figure 2.** Number of reported road casualties (including deaths) in Greater Manchester 2012–2021.

**Figure 1** shows the number of reported road casualties in England by year from 2012 to 2021 (including deaths). The percentage decrease in the number of reported road casualties over the period was 31.99%.

**Figure 2** shows the number of reported road casualties in Greater Manchester by year from 2012 to 2021 (including deaths). The percentage decrease in the number of reported road casualties over the period was 35.66% compared to a 31.99% decrease over the same period for England as a whole. There was overall a declining trend in the numbers of reported road casualties per year over the time period, with the lower number for

2020 possibly due to the effects of lockdowns when fewer road journeys were likely to be made.

#### 4.1. Road casualty demographics

Figure 3 shows the reported male and female road casualties in England by year from 2012 to 2021. There was a 28.12% decrease in male casualties, and a 38.89% decrease in female casualties over the period studied. Overall, the ratio of male to female road casualties was 1.5–1 over the period studied. Overall, over the period studied, there were 904,387 male road casualties with a rate of male road casualties per 100,000 of 3267, and there were 604,851 female road casualties with a rate of female road casualties per 100,000 of 2095.

Figure 4 shows the reported male and female road casualties in Greater Manchester by year from 2012 to 2021. There was a 33.52% decrease in male casualties, and a 39.30% decrease in female casualties over the period studied. Overall, the ratio of male to female road casualties was 1.55–1 over the period studied. Overall, over the period studied, there were 29,094 male road casualties with a rate of male road casualties per 100,000 of 2059, and there were 18,794 female road casualties with a rate of female road casualties per 100,000 of 1291 based upon 2021 population estimates from the Office for National Statistics (Nomis, 2023). Typically males are more likely to engage in risky driving behaviours such as speeding which may account for the differences (Laapotti et al., 2003).

Figure 5 shows the reported road casualties per 100,000 of age group in Greater Manchester by year between 2012 and 2021. Over the period studied, those aged less than 18 had the largest percentage decrease in

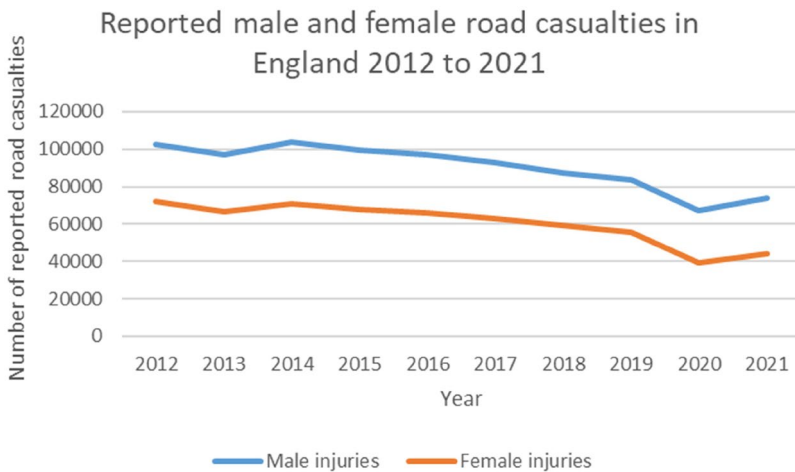
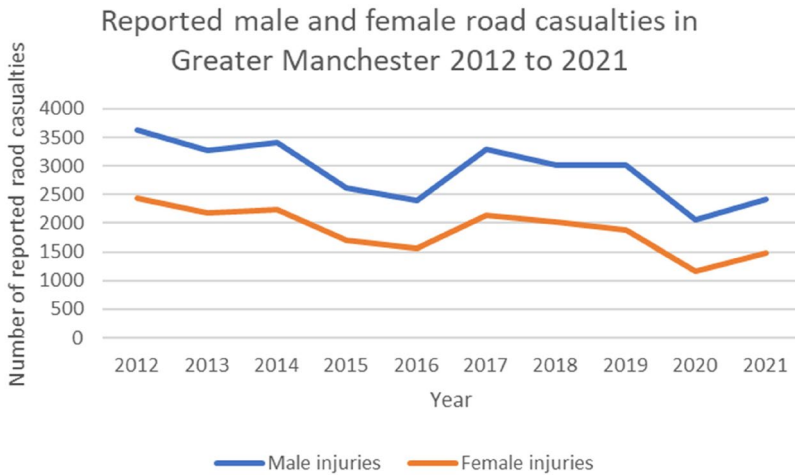
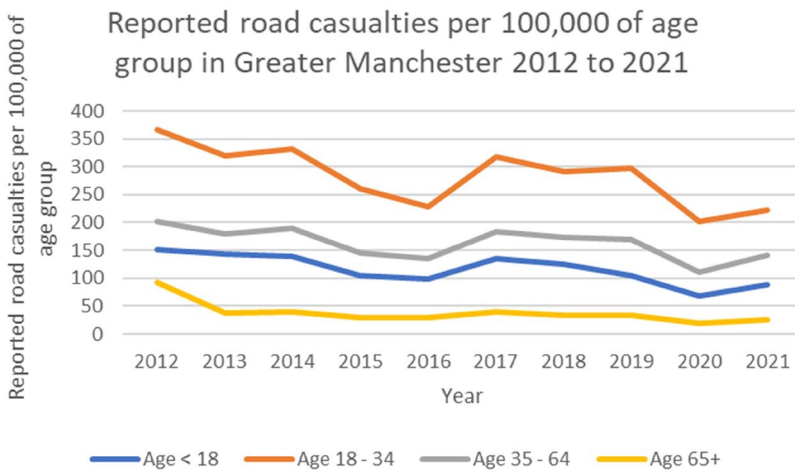


Figure 3. Reported male and female road casualties (including deaths) in England by year from 2012 to 2021.



**Figure 4.** Reported male and female road casualties (including deaths) in Greater Manchester by year from 2012 to 2021.

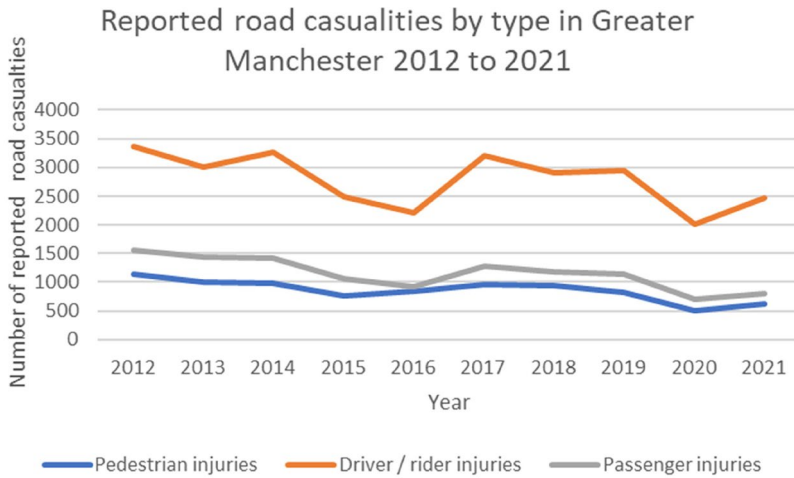


**Figure 5.** Reported road casualties (including deaths) per 100,000 of age group in Greater Manchester by year between 2012 and 2021.

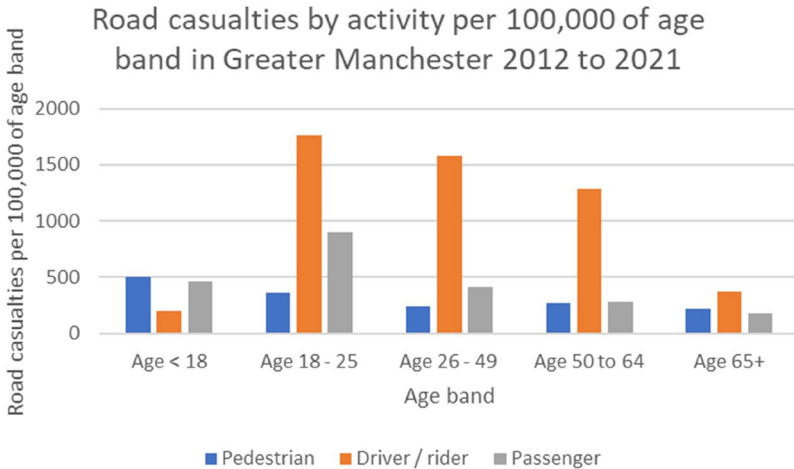
road casualties (42.50% decrease), followed by those aged 18–34 (38.92% decrease). Those aged 35–64 showed a 29.51% decrease, and those aged 65+ showed a 37.20% decrease. Overall, those aged 18–34 were the highest risk group in terms of road casualties.

#### 4.2. Road casualty road activities

Figure 6 shows the reported road casualties by type over the period studied. There was a 47.90% decrease in passenger road casualties, a



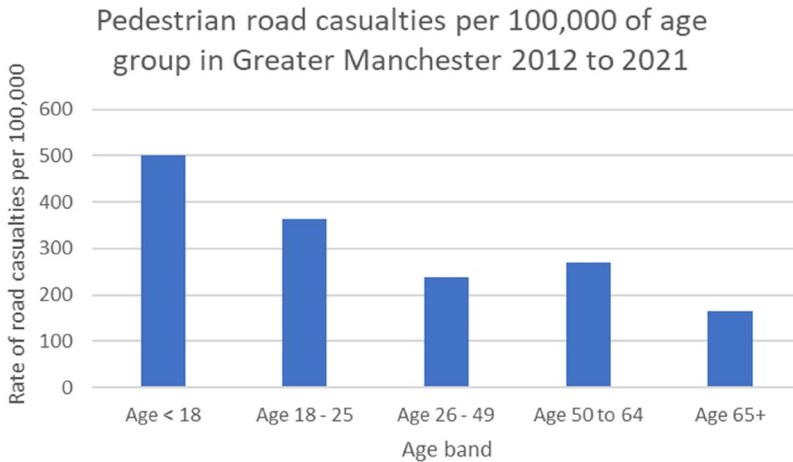
**Figure 6.** Reported road casualties (including deaths) by type in Greater Manchester by year between 2012 and 2021.



**Figure 7.** Road casualties (including deaths) by activity per 100,000 of age band in Greater Manchester 2012–2021.

44.81% decrease in pedestrian road casualties, and a 26.94% decrease in driver/rider road casualties over the period studied. It would appear that being a passenger is much safer than being a driver, possibly this difference arises because most journeys may be driver only journeys.

Figure 7 shows how the relative numbers of road casualties of the different types varied by age band, with those aged less than 18 more likely to be injured as a pedestrian, and driver/rider road casualties being



**Figure 8.** Pedestrian road casualties (including deaths) per 100,000 of age group in Greater Manchester 2012–2021.

much more likely than the other types of road casualty for those aged 18–64.

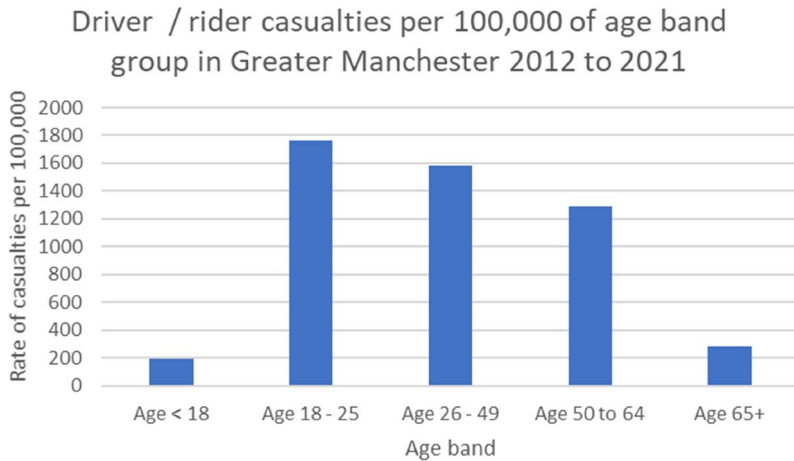
Figure 8 shows the pedestrian road casualties per 100,000 of age group in Greater Manchester between 2012 and 2021. Overall, the rate of pedestrian road casualties decreased with age group. The Pearson Product Moment Correlation Coefficient between age group and the rate of pedestrian road casualties per 100,000 of age band was 0.93 with a significance level of 0.02. A significance level indicates the probability that the result (in this case the value of the correlation coefficient) is due to chance.

Figure 9 shows the rate of driver/rider casualties per 100,000 of age group in Greater Manchester between 2012 and 2021. Overall, apart from those aged less than 18, the rate of driver/rider road casualties decreased with age group. The Pearson Product Moment Correlation Coefficient between age group and the rate of driver/rider road casualties per 100,000 of age band for those aged over 18 was 0.93 with a significance level of 0.074

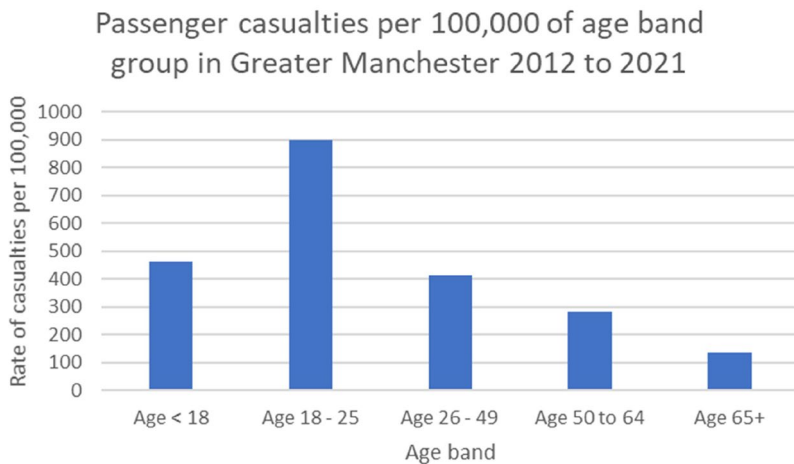
Figure 10 shows the rate of passenger casualties per 100,000 of age group in Greater Manchester between 2012 and 2021. Overall, apart from those aged less than 18, the rate of passenger road casualties decreased with age group. The Pearson Product Moment Correlation Coefficient between age group and the rate of passenger road casualties per 100,000 of age band for those aged over 18 was 0.94 with a significance level of 0.056.

### 4.3. Road casualty road types and speed limits

Figure 11 shows the reported urban and rural road casualties in Greater Manchester by year from 2012 to 2021. There was a 36.82% decrease in



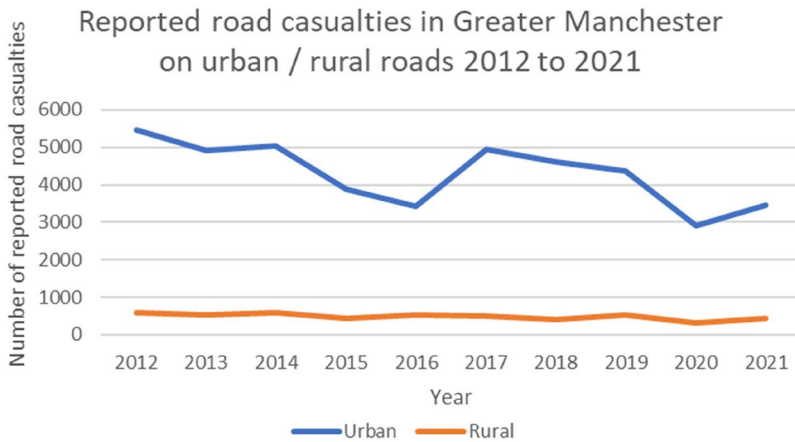
**Figure 9.** Driver/rider road casualties (including deaths) per 100,000 of age group in Greater Manchester 2012–2021.



**Figure 10.** Passenger road casualties (including deaths) per 100,000 of age group in Greater Manchester 2012–2021.

urban road casualties, and a 25.34% decrease in rural casualties over the period studied. Overall, the ratio of urban to rural road casualties was 8.78–1 over the period studied. However, Greater Manchester is a mainly urban area, with roughly only 10% of roads being classified as rural roads, whereas in 2021, the majority of road length in Great Britain was rural, with 75% of A roads, 80% of B roads, and 57% of the combined C and U roads classified as rural (RLGB, 2022).

Figure 12 shows reported road casualties by road speed limit by year in Greater Manchester 2012–2021. Over the period studied the majority



**Figure 11.** Urban and rural road casualties (including deaths) in Greater Manchester 2012–2021.

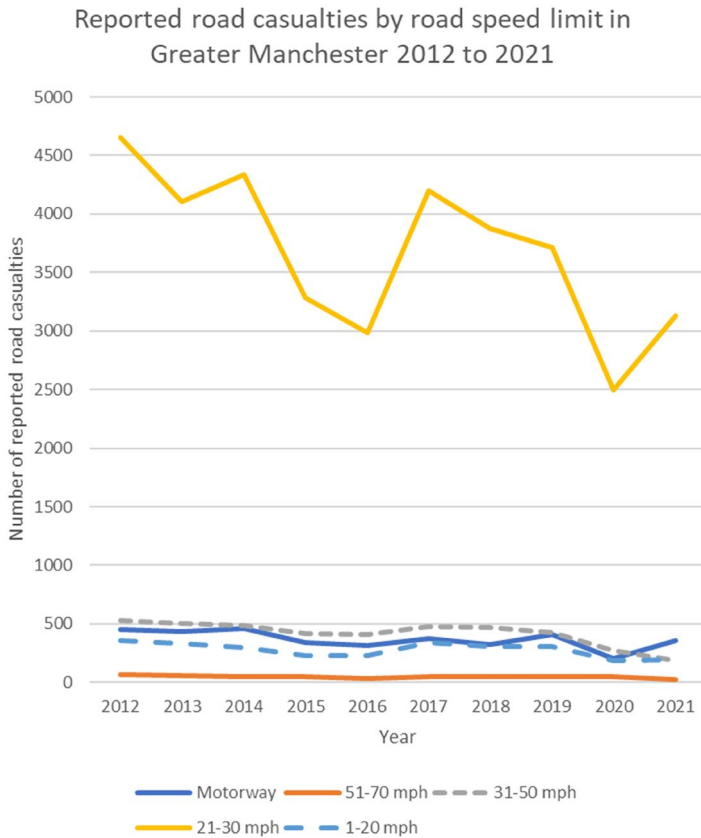
of road casualties (76.78%) occurred on roads with a speed limit of 21–30mph. There was a 64.15% decrease in road casualties on roads with a speed limit between 31 and 50 mph, a 62.12% decrease in road casualties on 51–70mph roads, a 44.63% decrease in road casualties on 1–20mph roads, a 32.78% decrease in road casualties on 21–30mph roads, and a 21.05% decrease in road casualties on motorways. Within the Greater Manchester area 30mph roads form the majority of road lengths.

## 5. Limitations

The data used for the analysis was reported road casualties from the UK Department for Transport. The UK Department for Transport states that whilst very few road fatalities are not reported to the police it has long been known that a considerable proportion of non-fatal road casualties are not reported to the police (and thus are not included in UK Department for Transport data records), as hospital, survey and compensation claims data all indicate a higher number of road casualties than police accident data would suggest (UKDFT, 2023). In the UK there is no obligation for individuals to report all personal injury road collisions to the police (NS, 2023).

## 6. Conclusion

Overall, over the study period 2012–2021 road safety in terms of the number of road casualties per year had improved in Greater Manchester across all age bands, genders, road user types, and types of road. There was a strong relationship between age group and the rate of road casualties per 100,000 for pedestrians, driver/riders, and passengers over the



**Figure 12.** Road casualties by road speed limit (including deaths) in Greater Manchester 2012–2021.

period studied, with the rate of such casualties decreasing with age for those aged over 18.

The originality of the research presented in this article is the detailed analysis of the circumstances of road casualties in Greater Manchester over a ten year period 2012–2021. Over the period studied road casualties were steadily decreasing, with the largest decrease by age group being amongst the elderly (those aged 65+). In terms of the pattern of road casualties by road user type, the largest decreases were amongst passengers, then pedestrians, then driver/riders. The ratio of road casualties on urban compared to rural roads was roughly 9–1 in Greater Manchester, which contrasts with the figures for Great Britain as a whole where 33% of all road casualties occurred on rural roads. However, Greater Manchester contains only roughly 10% of rural roads, whereas in Great Britain as a whole the majority of roads are rural.

In terms of the practical application of the research for road casualty prevention, it appeared that males were roughly 1.5 times more likely to

be injured than females in road traffic collision incidents, and that overall, the rate of road casualties decreased with age, with younger road users being more at risk. It is hoped that the results of this research may be useful to public sector agencies in the UK and elsewhere in terms of informing road safety initiatives.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Notes on contributors

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## References

- Blank-Gomel, R. (2017). Cycling injuries and the re-modernisation of mundane risks: From injury prevention to a population health and environmental problem. *Health, Risk & Society*, 19(3–4), 168–188. <https://doi.org/10.1080/13698575.2017.1338339>
- Christie, N. (2018). Why we need to view road safety through a public health lens? *Transport Reviews*, 38(2), 139–141. <https://doi.org/10.1080/01441647.2018.1411226>
- CRU. (2023). Compensation Recovery Unit, UK Government, <https://www.gov.uk/government/collections/cru>
- Daddah, D., Hounkpe Dos Santos, B., & Glèlè Ahanhanzo, Y. (2022). Contribution of a geographic information system to the prevention of crashes among vulnerable road users in the city of Cotonou: Exploratory study. *Risk Management and Healthcare Policy*, 15, 1271–1282. <https://doi.org/10.2147/RMHP.S362167>
- GMHSIF. (2018). Greater Manchester highway safety inspection framework, Manchester City Council. <https://democracy.manchester.gov.uk/documents/s2288/Appendix-2-GM-Framework-for-Highway-Safety-Inspections.pdf>
- GMP. (2023). Road safety, Greater Manchester Police. <https://www.gmp.police.uk/advice/advice-and-information/rs/road-safety/>

- GMRSP. (2023). Safer roads, transport for Greater Manchester. <https://tfgm.com/safer-roads>
- Jepson, R., Baker, G., Cleland, C., Cope, A., Craig, N., Foster, C., Hunter, R., Kee, F., Kelly, M. P., Kelly, P., Milton, K., Nightingale, G., Turner, K., Williams, A. J., & Woodcock, J. (2022). Developing and implementing 20-mph speed limits in Edinburgh and Belfast: Mixed-methods study. *Public Health Research, 10*(9), 1–164. <https://doi.org/10.3310/XAZI9445>
- Klanjčić, M., Gauvin, L., Tizzoni, M., & Szell, M. (2022). Identifying urban features for vulnerable road user safety in Europe. *EPJ Data Science, 11*(1), 1–15. <https://doi.org/10.1140/epjds/s13688-022-00339-5>
- Laapotti, S., Keskinen, E., & Rajalin, S. (2003). Comparison of young male and female drivers' attitude and self-reported traffic behaviour in Finland in 1978 and 2001. *Journal of Safety Research, 34*(5), 579–587. <https://doi.org/10.1016/j.jsr.2003.05.007>
- Li, H., & Graham, D. (2016). Quantifying the causal effects of 20mph zones on road casualties in London via doubly robust estimation. *Accident; Analysis and Prevention, 93*, 65–74. <https://doi.org/10.1016/j.aap.2016.04.007>
- NHSCRU. (2021). NHS injury costs recovery scheme: April 2020 to March 2021, UK Government. <https://www.gov.uk/government/publications/nhs-injury-cost-recovery-scheme-april-2020-to-march-2021>
- Nomis. (2023). Population estimates. UK Office for National Statistics, <https://www.nomisweb.co.uk>
- NS. (2023). Reported road casualties Great Britain, annual report: 2021, UK National Statistics. <https://www.gov.uk/government/statistics/reported-road-casualties-great-britain-annual-report-2021>
- ONS. (2023). Population and household estimates, England and Wales: Census 2021, UK Office for National Statistics. <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationandhouseholdestimatesenglandandwalescensus2021>
- O'Toole, S., & Christie, N. (2018). Deprivation and road traffic injury comparisons for 4–10 and 11–15 year-olds. *Journal of Transport & Health, 11*, 221–229. <https://doi.org/10.1016/j.jth.2018.08.003>
- PACTS. (2023). UK parliamentary advisory council for transport safety. <https://www.pacts.org.uk/safe-system/>
- RL. (2023). Road lengths, UK Government. <https://www.gov.uk/government/collections/road-lengths>
- RLGB. (2022). Road length in Great Britain: 2021, UK Department for Transport. <https://www.gov.uk/government/statistics/road-lengths-in-great-britain-2021/road-lengths-in-great-britain-2021>
- ROSPA. (2019). Road safety, Royal Society for the Prevention of Accidents, UK. <https://www.rospa.com/media/documents/road-safety/factsheets/road-safety-guide-for-councillors.pdf>
- ROSPA. (2023). Road safety: Advice and information, Royal Society for the Prevention of Accidents, UK. <https://www.rospa.com/road-safety>
- RSS. (2019). Road safety statement 2019: A lifetime of road safety, UK Government. <https://www.gov.uk/government/publications/road-safety-statement-2019-a-lifetime-of-road-safety>
- TfGM. (2023). Transport for Greater Manchester. <https://tfgm.com/about-tfgm>
- TGM. (2023). Safer roads, transport for Greater Manchester. <https://tfgm.com/safer-roads>

- UKDFT. (2023). Road accidents and safety statistics, UK Department for Transport. <https://www.gov.uk/government/collections/road-accidents-and-safety-statistics>
- UKGOV. (2023). Average value of prevention per reported casualty and per reported road collision: Great Britain, Reported road collisions, vehicles and casualties tables for Great Britain. <https://www.gov.uk/government/statistical-data-sets/reported-road-accidents-vehicles-and-casualties-tables-for-great-britain#other-road-safety-data-ras40>
- Weijermars, W., Bos, N., & Stipdonk, H. (2016). Health burden of serious road injuries in the Netherlands. *Traffic Injury Prevention, 17*(8), 863–869. <https://doi.org/10.1080/15389588.2016.1157591>
- WHO. (2018). Road traffic injuries, World Health Organization. <https://www.who.int/health-topics/road-safety>