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Risk of road traffic injury in Norway 1970–2022

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Highlights

- Changes in the risk of road traffic injury in Norway from 1970 to 2022 are described.
- Possible explanations of the changes are discussed.
- The reporting of injuries in official statistics has declined over time.
- A real decline in risk is found after adjusting for incomplete reporting.

Abstract

This paper describes changes in the risk of road traffic injury in Norway during the period from 1970 to 2022. During this period, the risk of fatal and personal injury declined by more than 70 % for most groups of road users. There are five main potential explanations of a decline in the risk of injury: (1) a reduced probability of accidents that have the potential for causing injury; (2) an improved protection against injury given that an accident has occurred; (3) improved medical care increasing the survival rate, given an injury (this would reduce the number of fatalities, but not the number of injuries); (4) a tendency for the reporting of injuries in official accident statistics to decline over time; (5) uncertain or erroneous estimates of the exposure to the risk of injury. The decline in the risk of road traffic injuries in Norway after 1970 can probably be attributed to a combination of reduced reporting of injuries in official statistics, improved protection against injury in accidents, and (for fatal injuries) improved medical care. Insurance data, available from 1992, do not indicate a reduction in the risk of accidents leading to insurance claims. Incomplete and possibly erroneous data for mopeds and motorcycles make it impossible to identify sources of changes in injury risk over time for these modes of transport.

Previous

Next

Keywords

Traffic injury; Risk; Changes over time; Incomplete reporting; Injury protection

1. Introduction

The number of road traffic fatalities has declined considerably from a peak around 1970 in many highly motorised countries (International Transport Forum, 2023). In Norway, the highest number of traffic fatalities, 560, was recorded in 1970. By 2021 the number had declined to 80. It increased to 116 in 2022 and to 118 (preliminary figure) in 2023.

The decline in the number of traffic fatalities has occurred during a period when traffic volume increased considerably. In Norway, vehicle kilometres of travel increased by a factor of more than four from 1970 to 2020 (Vaaje and Fosser, 1976, Flotve and Farstad, 2022). Person kilometres of travel increased by a factor of more than three from 1970 to 2020. The rate of fatal injury per kilometre of travel therefore declined by 50–95% from 1970 to 2020, depending on the mode of travel.

The number of injured road users in Norway has also declined, in particular in the most recent 15 years. Before that the number of injured road users remained very stable for a long time, varying roughly between 10,000 and 12,000 per year (Bjørnskau et al., 2024). However, the rate of traffic injury per kilometre of travel declined despite the nearly unchanged number of injured road users, as both vehicle kilometres and person kilometres have grown almost without interruption since 1945.

There are five potential explanations of a decline over time in the rate of traffic injury per unit of travel: (1) The probability of an accident with a potential for causing injury has declined; (2) The protection from sustaining injury in accidents has improved; (3) Improved medical care has increased survival rates for given injuries (this applies to fatal injury only); (4) The reporting of injuries in official road accident statistics has declined; (5) Estimates of the exposure to risk, i.e. vehicle or person kilometres of travel are uncertain or erroneous. Hauer (2006) has called attention to the "frequency-severity indeterminacy". This denotes the impossibility of knowing whether a difference between two accident rates is caused by a true difference in accident rate per kilometre of travel or a difference in accident severity which generates an artefactual difference in accident rates because the reporting of injuries depends strongly on their severity (see e.g. Elvik and Mysen, 1999). The frequency-severity indeterminacy is relevant for the interpretation of any estimate of accident rate based on injury data that are likely to be incompletely reported. If possible, estimates of injury rates should be adjusted for incomplete reporting.

The objectives of this paper are: (1) to describe changes in the risk of road traffic injury in Norway from 1970 to 2022 and (2) to identify which of the five possible explanations of changes in risk that have contributed most to the changes found in Norway after 1970. The study adds knowledge by: (1) studying the changes in risk of traffic injury for a longer period than other studies; (2) trying to identify the extent to which changes over time in the reporting of injuries can account for the changes in risk.

2. Data and method

The study is based on previous studies of the risk of road traffic injury in Norway. Data and results from several studies have been used. The terms injury risk and injury rate are used interchangeably in the paper. They refer to the number of injuries per unit of travel, i. e. per person kilometre of travel. Table 1 gives an overview of the studies that have been used to reconstruct changes in the risk of road traffic injury in Norway from 1970 to 2022.

Table 1. Overview of studies used to estimate the risk of road traffic injury in Norway 1970–2022.

Study	Data for	Transport modes included
Vaaje and Fosser, 1976	1969–72	Passenger car, bus, van, truck, moped, motorcycle
Vaaje, 1982	1979	Passenger car, bus, van, truck, moped, small motorcycle, large motorcycle, bicycle, pedestrian
Bjørnskau, 1988	1984–85	Passenger car, moped, small motorcycle, large motorcycle, bicycle, pedestrian
Bjørnskau, 1993	1991–92	Passenger car, moped, small motorcycle, large motorcycle, bicycle, pedestrian
Bjørnskau, 2000	1997–98	Passenger car, moped, small motorcycle, large motorcycle, bicycle, pedestrian
Bjørnskau, 2008	2005	Passenger car, moped, small motorcycle, large motorcycle, bicycle, pedestrian
Bjørnskau, 2015	2013–14	Passenger car, moped, small motorcycle, large motorcycle, bicycle, pedestrian
Bjørnskau et al., 2024	2021–22	Passenger car, moped, small motorcycle, large motorcycle, bicycle, pedestrian
Flotve and Farstad, 2022	1985–2021	Bus, van, truck (data on vehicle- and passenger kilometres)
Statistics Norway	1985–2021	Bus, van, truck (data on injured occupants of these vehicle types)

Study	Data for	Transport modes included
Finance Norway	1992–2023	Motor vehicles (insurance claims)

The first study was published in 1976 (Vaaje and Posser 1976) and was based on data for 1969–1972. It did not include pedestrians and cyclists. It contained estimates both of fatality risk and injury risk. Based on a study published in 2004 (Rideng and Strand 2004), estimates of kilometres travelled by vans have been adjusted in studies published before 1998. In the study by Vaaje and Fosser (1976), vehicle kilometres performed by vans was adjusted from 600 to 920 million vehicle kilometres. In the study by Vaaje (1982) vehicle kilometres performed by vans was adjusted from 738 to 1350 million vehicle kilometres. These adjustments were made by assuming that annual distance driven by vans was the same before 2004 as it was found to be in that year. This assumption cannot be verified, but for passenger cars, annual driving distance has remained very stable over time.

The next study (Vaaje, 1982) was published in 1982. It included pedestrians and cyclists in addition to all types of motor vehicles. The study by Vaaje (1982) estimated kilometres cycled on the basis of a periodic survey called the cycling survey. However, a later study (Bjørnskau, 1993) found that the cycling survey (Borger and Frøysadal 1993) produces considerably higher estimates of the amount of cycling than the travel behaviour survey. Since the travel behaviour survey is the source of data for all estimates of risk from 1985 onwards, the estimate of cycling distance in Vaaje (1982) was adjusted from 1350 million kilometres to 910 million kilometres.

All subsequent studies have been based on national travel behaviour surveys, and all have been made by Bjørnskau, 1988, Bjørnskau, 1993, Bjørnskau, 2000, Bjørnskau, 2003, Bjørnskau, 2008, Bjørnskau, 2011, Bjørnskau, 2015, Bjørnskau, 2020, Bjørnskau et al., 2024. Studies reporting results for 1985, 1992, 1998, 2005, 2014 and 2022 have been used. In the studies performed by Bjørnskau, risk is stated either for motor vehicle occupants – which includes passenger cars, vans, buses and trucks – or for passenger car occupants. In this study, separate estimates of risk have been developed for passenger cars, vans, buses and trucks. Data on killed or injured occupants have been taken from official accident statistics (Statistisk sentralbyrå, statistikkbanken, årlig) (Statistics Norway, database of statistics, annual) *https://www.ssb.no/statbank/list/vtu*↗. Data on vehicle kilometres or person kilometres of travel are published annually in a report describing the amount of transport in Norway (Flotve and Farstad, 2022). Occupancy in vans and trucks has been assumed to be constant over time and the occupancy rates stated by Vaaje (1982) have been used (1.2 for vans and 1.3 for trucks).

Injury risk is stated as the number of fatalities per billion person kilometres of travel or as the number of injured road users per million kilometres of travel. For motor vehicles, no distinction is made between drivers and passengers.

3. Results

3.1. Estimates based on official accident statistics

Table 2 shows the rates of traffic fatalities per billion person kilometres of travel in Norway for selected years between 1970 and 2022. The first study (Vaaje and Fosser, 1976) did not list small and large motorcycles separately. To see the long-term trend, estimates for subsequent years list both small motorcycles, large motorcycles and all motorcycles. Pedestrians and cyclists were not included in the first study.

Table 2. Traffic fatalities per billion person kilometres of travel in Norway 1970–2022.

	Fatalities per billion person kilometres of travel							
Group of road user	**1970**	**1979**	**1985**	**1992**	**1998**	**2005**	**2014**	**2022**
Passenger car	9.8	6.8	5.6	4.1	4.0	2.4	1.3	0.7
Bus	0.6	1.0	0.2	0.9	0.5	0.2	1.5	0.3
Van	10.6	4.7	4.3	5.4	2.0	0.7	0.5	0.7
Truck	9.4	6.0	3.0	5.7	3.9	6.2	3.2	1.6
Large motorcycle		266.0	191.4	69.1	68.4	39.5	22.0	16.6
Small motorcycle		106.2	98.4	31.9	15.0	93.8	48.1	20.7
Motorcycle (all)	147.4	179.6	165.1	63.6	63.5	44.5	23.9	17.0
Moped	59.8	42.1	47.9	25.6	27.2	8.4	4.0	1.0
Bicycle		32.2	36.3	30.2	33.9	10.1	11.1	5.0
Pedestrian		81.4	28.0	48.9	32.2	18.8	8.7	4.4

The risk of fatal injury has declined over time for all groups of road users. The smallest percentage decline is seen for bus occupants. However, the annual number of fatalities in buses is very low (between 0 and 10 during 1990–2022), as indicated by the irregular pattern in estimates of fatality rate. For motorcycles, fatality rate did not start to decline until 1992. The somewhat irregular decline seen for pedestrians is probably due to a combination of few fatalities per year and uncertain estimates of travel exposure (kilometres walked). Thus, million kilometres walked were estimated as: 1200 (1979), 1467 (1985), 1104 (1992), 1212 (1998), 1594 (2005), 1955 (2014), and 2161 (2022). The estimates for 1992 and 1998 seem rather low compared to the others in this series. For cyclists, the decline in fatality rate started after 1998.

Table 3 shows rates of injury in police reported accidents per million person kilometres of travel in Norway for selected years from 1970 to 2022. There has been a decline in injury risk for all groups of road users from 1970 (or 1979) to 2022. The decline is uninterrupted for passenger cars. Buses and trucks show a more irregular pattern, probably because the annual number of injured bus and truck occupants is comparatively low. There was no clear decline in injury rate for motorcyclists until 1992. For moped riders, injury rate did not decline between 1970 and 2005. For cyclists, injury rate was almost unchanged from 1979 to 1998.

Table 3. Injured road users per million person kilometres of travel in Norway 1970–2022.

	Injured road users per million person kilometres of travel							
Group of road user	**1970**	**1979**	**1985**	**1992**	**1998**	**2005**	**2014**	**2022**
Passenger car	0.306	0.219	0.184	0.168	0.159	0.135	0.061	0.039
Bus	0.039	0.034	0.035	0.056	0.055	0.031	0.021	0.013
Van	0.338	0.190	0.147	0.236	0.078	0.050	0.024	0.031
Truck	0.155	0.145	0.084	0.104	0.116	0.114	0.051	0.033
Large MC		5.336	3.974	1.651	1.392	0.782	0.521	0.410
Small MC		4.980	4.452	1.739	1.374	2.406	1.946	2.178
Motorcycle	4.026	5.144	4.109	1.664	1.390	0.931	0.629	0.570
Moped	1.198	1.302	2.085	1.539	1.222	1.272	0.509	0.305
Bicycle		1.123	1.434	1.224	1.236	0.816	0.537	0.306
Pedestrian		1.150	0.635	0.792	0.681	0.468	0.260	0.134

For all groups of road users, the decline in injury rate has been greater after 1998 than it was before 1998. For passenger car occupants, for example, injury rate was reduced by about 50% from 1970 to 1998 (0.306 to 0.159), but by 75% from 1998 to 2022.

3.2. Changes over time in the reporting of injuries

The reporting of traffic fatalities is believed to be complete in Norway. However, the reporting of injuries is incomplete, as several studies have shown. Table 4 lists four of these studies and their main findings.

Table 4. Changes over time in the reporting of traffic injury in official statistics in Norway.

	Percent of injuries reported in official statistics					
Study	**Bø 1970**	**Lereim, 1984**	**Hagen, 1993**	**Lund, 2019**	**Mean annual change (%) 1968–1991**	**Mean annual change (%) 1991–2017**
Data from	1968	1979–80	1991	2017		
Motor vehicle occupants	81	76	53	35	−1.82	−1.58
Moped or MC (#)	65	77	35	22	−2.66	−1.77
Pedestrian	77	88	41	18	−2.71	−3.12
Cyclist	19	14	7	3	−4.25	−3.54
Total	74	53	33	17	−3.41	−2.56
N (total cases)	2364	1143	36,119	31,000		

(#) Reporting of injuries for moped and MC for Bø 1970 was estimated based on the studies of Nordentoft and Dalby, 1972, Bull and Roberts, 1973 and Tolagen (1977).

The study by Bø (1970) was the first made in Norway in order to assess the reporting of injuries in official accident statistics. The study found an overall reporting rate of 74%. The study did not include an estimate of reporting rate for moped and motorcycle riders. However, other studies made at about the same time (Nordentoft and Dalby, 1972, Bull and Roberts, 1973, Tolagen, 1977) found, on average, that the reporting rate for moped and motorcycle riders was about 80% of that for car occupants. Based on this, a reporting rate of 65% has been assumed.

The subsequent studies by Lereim, 1984, Hagen, 1993 and Lund (2019) found a declining reporting of injuries, as shown in Table 4. By 2017, the overall reporting rate had declined to 17%. The estimates of reporting rate were not made the same way in all studies. The studies by Bø (1970) and Lereim (1984) collected data from medical facilities and compared them to police data. The study by Hagen (1993) relied on an estimate of the total number of injuries based on data recorded by four hospitals located in different parts of Norway. These hospitals were assumed to serve about 10% of the population. Finally, Lund (2019) estimated the number of injured road users by putting together data recorded in various medical records, such as the national trauma registry (covering severe injuries treated at hospitals) or records of the number of patients seeking treatment from their regular doctor.

Despite these differences, there can hardly be any doubt that reporting has declined over time. If the two most recent studies are treated as comparable, they indicate that the actual number of injured road users has also declined (from about 36,000 in 1991 to about 31,000 in 2017).

The two columns to the right in Table 4 show the mean annual percentage decline in injury reporting from 1968 to 1991 and from 1991 to 2017. Based on these percentages, estimates have been made of the level of reporting for all years from 1968 to 2022 (extrapolating from 2017 to 2022). It is of course not known whether reporting has declined by a constant percentage each year, or whether the decline has been more irregular. However, the estimates can be used to illustrate what the risk of injury in traffic could have been if reporting had been complete. These estimates are shown in Table 5. Their accuracy is unknown. Nevertheless, they at least give some indication as to whether the observed decline in injury risk in road traffic in Norway is real or just the result of declining reporting.

Table 5. Injured road users per million person kilometres of travel corrected for incomplete reporting.

Injured road users per million person kilometres of travel corrected for incomplete reporting								
Group of road user	**1970**	**1979**	**1985**	**1992**	**1998**	**2005**	**2014**	**2022**
Passenger car	0.392	0.454	0.311	0.323	0.336	0.319	0.166	0.120
Bus	0.050	0.071	0.059	0.107	0.117	0.073	0.058	0.041
Van	0.433	0.393	0.249	0.451	0.165	0.119	0.066	0.095
Truck	0.198	0.299	0.142	0.199	0.244	0.269	0.138	0.102
Large MC		11.040	9.664	4.805	4.507	2.870	2.246	2.037
Small MC		10.303	10.825	5.061	4.450	8.831	8.387	10.831
Motorcycle	6.536	10.642	9.992	4.843	4.501	3.417	2.710	2.835
Moped	1.945	2.693	5.070	4.478	3.957	4.669	2.195	1.517
Bicycle		9.531	15.793	18.115	22.593	19.083	17.241	13.045
Pedestrian		2.019	1.315	1.994	2.074	1.780	1.317	0.870

3.3. Estimates of injury risk corrected for incomplete reporting

Table 5 shows estimates of injury risk in road traffic in Norway corrected for incomplete reporting. If, for example, reporting was 33.3%, the adjusted estimate of risk was developed by multiplying the crude estimate by 1/0.333.

For car occupants, the adjusted estimates show that risk did not decline until after 2005. For bus occupants, no clear decline in risk is seen at all. For moped riders, there is a very irregular pattern, showing at best a small decline in injury risk at the end of the period. The risk to cyclists increased until 1998 and then declined but remained higher in 2022 than it was in 1979. Pedestrian risk showed a clear decline only after 2005.

These estimates of risk are clearly all highly uncertain. They do, however, show that even when adjusting for incomplete reporting, injury risk was lower in 2022 for all groups of road users, possibly except for cyclists, than it was in 1970 or 1979. The fact that there has been a decline in

injury risk from 1970 or 1979 to 2022 must be regarded as real and is not only the result of reduced reporting of injuries in official statistics. However, the true size of the decline is uncertain.

3.4. Decline in probability or severity?

A decline in injury risk, as shown in Table 5, can either be a decline in the rate of accidents per kilometre of travel, or a decline in the severity of accidents, meaning that fewer accidents of a given severity result in personal injury, for example because cars protect occupants better from injury than they did before.

To determine which of these sources of decline in risk is dominant is not easy, because there does not exist a data source which is known to record all accidents and state their severity in objective terms, such as impact speed. However, if accidents have become less severe, so to speak, one would expect the case fatality rate to decline. Case fatality rate is the percentage of all injured road users (adjusted for incomplete reporting) who sustain a fatal injury. Table 6 shows case fatality rates for traffic injury in Norway from 1970 to 2022.

Table 6. Case fatality rates adjusted for incomplete reporting of injuries (percent fatalities).

Case fatality rates (percent of injured road users who were killed – adjusted for incomplete reporting)								
Group of road user	**1970**	**1979**	**1985**	**1992**	**1998**	**2005**	**2014**	**2022**
Passenger car	2.50	1.50	1.79	1.27	1.20	0.75	0.77	0.57
Bus	1.25	1.40	0.35	0.80	0.47	0.29	2.67	0.76
Van	2.44	1.19	1.72	1.20	1.22	0.57	0.70	0.77
Truck	4.72	2.02	2.12	2.85	1.62	2.32	2.31	1.53
Large MC		2.41	1.98	1.44	1.52	1.38	0.98	0.81
Small MC		1.03	0.91	0.63	0.34	1.06	0.57	0.19
Motorcycle	2.26	1.69	1.65	1.31	1.41	1.30	0.88	0.60
Moped	3.07	1.56	0.95	0.57	0.69	0.18	0.18	0.07
Bicycle		0.34	0.23	0.17	0.15	0.05	0.06	0.04
Pedestrian		4.03	2.13	2.45	1.55	1.06	0.66	0.51

Case fatality rates have declined for all groups of road users. One can easily think of reasons for this with respect to car occupants. Even for moped riders and motorcyclists, developments such as increased use of helmets, better quality of helmets or increased use of protective clothes could reduce the probability of a fatal injury.

However, case fatality rates have declined markedly even for cyclists and pedestrians. These groups of road users have not become better protected from injury over time in the same sense as car occupants. Cyclists may increasingly be wearing helmets, but pedestrians remain unprotected, and the human body cannot survive a given impact today that it could not survive in 1970. One potential explanation is improved medical care. A paper by Noland (2003) supports this. He found that the number of traffic fatalities was negatively related to the number of physicians per inhabitant. Applying the coefficient of −0.2458 in Noland's paper, the increase in the number of physicians per inhabitant in Norway from 1970 to 1996 is estimated to have reduced the number of fatalities by about 15% from 1970 to 1996.

Another potential explanation is that cars are less aggressive to pedestrians now than in the past. There is evidence (Elvik and Høye, 2020) that cars scoring well for pedestrian protection in the European New Car Assessment Programme (EuroNCAP) have increased their market share in recent years. A speed limit of 30 km/h is also slowly becoming more common in urban areas (Bjørnskau and Amundsen, 2015). Despite these trends, the decline in case fatality rate among pedestrians is surprisingly large.

3.5. Changes in the risk of any accident

There is no record of all accidents that occur in road traffic in Norway, irrespective of their severity. The most complete record of road accidents in Norway is probably insurance statistics. These statistics are affected by incomplete reporting. Collision insurance is not mandatory in Norway, and many owners of old cars do not have it. Minor damages may not be reported to insurance companies as the owner may lose bonus when filing a claim. Assuming that these sources of incomplete data do not change over time, what do insurance data show about changes over time in the probability of a road accident in Norway?

The first study of insurance statistics was reported by Garberg and Vaaje (1979) using data for 1976. From 1992, annual statistics have been published by Finance Norway, a trade organisation for insurance companies. Table 7 shows estimated rates of insurance claims per million vehicle kilometres for 1976 and selected years after 1992. Data on vehicle kilometres were taken from Flotve and Farstad (2022).

Table 7. Insurance claims per million vehicle kilometres of travel.

	Insurance claims per million vehicle kilometres of travel					
Vehicle type	**1976**	**1992**	**1998**	**2005**	**2014**	**2022**
Car or van	13.11	7.35	8.11	6.99	8.52	10.35
Truck	12.30	10.14	11.16	9.05	7.93	10.07
Bus	13.93	5.23	10.29	11.70	17.30	14.79
Moped	3.13	5.06	5.31	7.74	7.13	6.93
Small MC	14.10	4.07	6.96	6.65	5.11	9.66
Large MC	6.72	5.18	7.66	3.09	2.07	5.39
Total	12.77	7.42	8.23	7.07	8.43	10.24

While the claims rate was somewhat higher in 1976 than in later years, there has not been any decline in claims per million vehicle kilometres after 1992. If anything, an increasing trend, albeit irregular, can be discerned. It cannot be ruled out that reporting has increased. Repairing cars has become very expensive in Norway, making it more attractive to file claims to insurance companies. At any rate, there is no evidence suggesting that accident rate has declined after 1992.

Table 8 shows case injury rates for insurance claims, defined as the percentage of claims involving personal injury, corrected for incomplete reporting of injuries. The injury data are based on official statistics, corrected for incomplete reporting, i.e. the same injury data as in Table 5. The estimates make good sense for cars. A declining percent of claims involve personal injury. Cars protect occupants better from injury than before.

The estimates for mopeds and motorcycles make less sense. For mopeds, a declining share of claims involve personal injury. For motorcycles, the percentage of personal injury is more than 100 in some years, suggesting that in those years there were more cases of personal injury than of property damage only. This is not entirely unthinkable. A motorcyclist can be thrown off the cycle and be injured, while the cycle itself is not damaged. However, the estimates jump up and down from year to year in a very irregular manner, suggesting that estimates of vehicle kilometres are unreliable. This point is discussed further in the next section.

4. Discussion

There is a saying that in road safety research you always run out of data before you run out of questions. This paper illustrates this very well, even if it had very simple and unambitious objectives. It turns out that even describing changes over time in the risk of road traffic injury is difficult, mainly because of incomplete reporting of injuries in official accident statistics, but to some extent also because exposure to risk is poorly known. Fatalities are believed to be completely reported. The risk of fatal traffic injury has declined for all groups of road users in Norway from 1970 or 1979 to 2022. Why it has declined is less clear. However, to the extent that changes over time in the severity of accidents can be estimated, it seems that the main source of the decline in fatality risk is that the chance of sustaining a fatal injury, given that an accident has occurred, has declined. This is not surprising as far as car occupants are concerned, as it is well known that modern cars protect occupants better from injury than cars did around 1970 (Høye, 2019). However, even pedestrians and cyclists seem to be much less likely to sustain fatal injuries in accidents now than in 1979. Increasing use of helmets may to some extent protect cyclists, but pedestrians are as unprotected as they have always been.

In a study of long-term changes in the contribution of risk factors to the number of accidents, Elvik (2016) reported data indicating that drinking-and-driving in Norway has declined after 1970. The data included just a few years, and these were not evenly spaced in time. Nevertheless, the trend was clear. A decline in drinking-and-driving may contribute to a larger percentage decline in fatalities than in injuries, since impairment by alcohol increases the risk of fatal injury more than the risk of any injury (Høye and Hesjevoll, 2023).

The declining case fatality rate for pedestrians may be attributable to improved medical care, cars that are less aggressive to pedestrians and an increased use of 30 km/h speed limits in urban areas. Still, the decline in case fatality rate is so large that it seems unlikely that these factors can explain all of it. It could of course also be the case that the adjusting for incomplete reporting is too large; that studies estimating the true number of injuries exaggerate and estimate too high numbers. The data needed to sort out these interpretations do not exist.

Many road safety measures that have been implemented after 1970 have a larger effect on fatalities than on injuries. This applies, for example, to motorways and 2+1 roads with a median barrier (Elvik et al., 2017).

The results for mopeds and motorcycles are erratic. In particular, the results presented in Table 8 regarding the share of insurance claims involving personal injury make no sense. In addition to incomplete reporting of injuries, unreliable estimates of exposure are a problem for mopeds and motorcycles. Table 9 shows estimated annual driving in kilometres as estimated by different studies.

Table 8. Case injury rates for insurance claims (percent of claims involving personal injury).

Case injury rates (percent of insurance claims involving personal injury)					
Vehicle type	**1992**	**1998**	**2005**	**2014**	**2022**
Car or van	4.5	3.9	4.2	1.8	1.1
Truck	2.0	2.2	3.0	1.7	1.0
Bus	2.1	1.1	0.6	0.3	0.3
Moped	88.4	74.6	60.3	30.8	21.9
Small MC	124.3	64.0	132.7	164.2	112.2
Large MC	92.7	58.9	93.0	108.7	37.8

Table 9. Annual driving distance in kilometres for mopeds and motorcycles according to different studies.

	Mean annual driving distance in kilometres		
Study	**Mopeds**	**Small motorcycle**	**Large motorcycle**
Ørbeck, 1975	4500	5500	6000
Lie, 1983	2900	6000	7900
Ingebrigtsen, 1990	3355	7489	5818
Bjørnskau, 2009		2985	4920
Sagberg and Amundsen, 2015	3242	7774	

It is seen that the results of the studies vary considerably. Each time a new study has been published, older estimates of driving distance have been updated by linear interpolation between the most recent study and the second most recent study. As can be seen from Table 9, this has resulted in highly varying estimates of driving distance, in particular for small motorcycles. The results for mopeds and motorcycles are so uncertain that any interpretation of them is speculative. The only thing that seems clear, is that fatality risk has been reduced.

The most recent report on the risk of traffic injury in Norway (Bjørnskau et al., 2024) contains a detailed discussion of the declining quality of the data used to estimate risk. It notes that the reporting of injuries in official statistics is declining, and that the response rate in the travel behaviour survey has been declining for a long time. Hence, estimates both of the number of injuries and of travel exposure are becoming more uncertain. This trend is unlikely to change as long as official accident statistics and survey data on travel behaviour are used as the primary sources of data. A low response rate in surveys can be counteracted by a larger sample, but incomplete reporting of injuries remains a problem.

Norwegian hospitals are required to record data on traffic injury. However, these records are so far incomplete and do not include a geocoding of injuries. In ongoing projects at the Institute of Transport Economics, the feasibility of geocoding injuries by letting those who were injured do it themselves is tested. Most injury victims are slightly injured and are capable of identifying the place where they were injured. For those who are too seriously injured to provide information on the place of injury when arriving at hospital, these data can be collected later or provided by, for example, ambulance staff. If such a system can be made to work, data collected by hospitals may replace police reports as the primary source of data on traffic injury. There will still be incomplete reporting, at least of very minor injuries, but it is likely that the reporting will be more complete than in the data currently collected by the police.

5. Conclusions

The main conclusions of the study presented in this paper can be summarised as follows:

1. The risk of fatal injury has declined for all groups of road users in Norway from 1970 or 1979 to 2022.

2. The risk of any personal injury, adjusted for incomplete reporting in official statistics, has declined for all groups of road users in Norway, especially after 1998. Before that, there was no clear decline.

3. The decline in the risk both of fatal injury and any personal injury is likely to be mostly attributable to improved protection from injury when an accident occurs.

4. The quality of data, both on traffic injury and exposure to risk, has declined over time. It is not unrealistic that data collected by hospitals may replace data collected by the police on traffic injury.

CRediT authorship contribution statement

Rune Elvik: Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Recommended articles

Data availability

Data will be made available on request.

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