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The burden and trends of road injuries in Afghanistan (1990–2021): A joinpoint analysis of data from the global burden of diseases, 2021 study

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A B S T R A C T

Objective: Road injuries pose a major public health challenge, particularly in low-income, conflict-affected regions like Afghanistan. Despite issues like poor infrastructure and weak traffic regulations, no national study has assessed the road injury burden. This study examines Afghanistan's road injury burden from 1990 to 2021.

Method: This epidemiological study utilized the global burden of diseases (GBD) 2021 data. Key metrics included age-standardized mortality rate (ASMR), age-standardized disability-adjusted life-years rate (ASDR), years of life lost (YLL), and years lived with disability (YLD) per 100,000 population. Trends were analyzed using joinpoint analysis to determine annual and average annual percent changes (APC and AAPC). Estimates were presented with a 95 % uncertainty Interval, and statistical significance was assessed via permutation tests ($p < 0.05$).

Results: Between 1990 and 2021, Afghanistan's road injury burden declined across all indicators (ASMR: -1.2 %, ASDR, YLL, YLD). Males (1.2 %) and children (AAPC: −3.1 %) saw the steepest declines, while the elderly (−0.7 %) had the slowest. Motor vehicle injuries dropped most (1.3 %), followed by pedestrian (1.0 %) and motorcyclist (0.9 %) injuries.

Period-specific trends showed fluctuations: ASMR, ASDR, and YLL rose (1990–1997), then declined, except YLD, which increased post-2018 (+0.5 %). From 2017 to 2021, YLD rose across all age groups (except 0–14 years). Post-2014, motorcycle-related ASMR increased (+0.3 % APC), while from 2017 to 2021, ASDR and YLD increased across all injury types (+0.4 % to +1.3 % APC).

Conclusion: Despite progress, rising DALYs and YLDs, especially from 2017 onward, highlight a growing disability road injury burden, necessitating targeted interventions to address long-term disability and mitigate its public health impact.

1. Introduction

Road injuries are a significant global public health concern, accounting for approximately 1.3 million preventable deaths and 50 million injuries annually (Ning et al., 2016). Transport injuries, which include road injuries and other transport injuries, significantly impact global disability-adjusted life-years (DALYs) and mortality, accounting for more than 2.5 % of all deaths worldwide (Wan et al., 2023). In response to this concern, the United Nations General Assembly adopted resolution 74/299 in 2021, committing to a 50 % reduction in road traffic deaths and injuries by 2030 (Hua et al., 2023).

Despite these global efforts, over 90 % of road traffic deaths occur in low- and middle-income countries, which often face unique challenges in addressing road safety (Herman et al., 2012). Afghanistan, with a population of approximately 38 million, is a low-income country in the Eastern Mediterranean region where road injuries rank among the leading causes of mortality. Vulnerable groups, including pedestrians, cyclists, children, and public transport users, bear the brunt of these injuries, compounded by insufficient road infrastructure, unsafe vehicles, weak enforcement of traffic laws, and limited access to emergency medical services (Bazargan-Hejazi et al., 2018; Massahikhaleghi et al., 2018a; Noh et al., 2022a).

Afghanistan's young and economically active population is disproportionately affected by road injuries, as more than 34.8 % of its population falls within the 10–24 age group, the highest proportion of youth among 22 countries in the eastern Mediterranean region (Massahikhaleghi et al., 2018a). Road injuries thus place a substantial burden on the country's future productivity and development. Additionally, Afghanistan's prolonged history of over four decades of conflict, natural disasters, poverty, and food insecurity has further exacerbated vulnerabilities. The political and security crises, particularly following the collapse of the republic government in 2021, led to a sharp increase in the number of refugees and internally displaced persons, severely straining public health systems and creating additional

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challenges in addressing road safety. (Massahikhaleghi et al., 2018a; Noh et al., 2022a).

Violence and road injuries have profound impacts on vulnerable populations, especially in crisis-affected regions. Afghanistan, home to one of the world's largest refugee populations, exemplifies this reality. Continuous political unrest and conflict have not only weakened the country's healthcare infrastructure but also undermined data collection and monitoring systems, leading to substantial gaps in understanding the scope and trends of road injuries in the country (Noh et al., 2022a). The Global Burden of Disease (GBD) study offers a robust framework to address such challenges, integrating diverse data sources and employing standardized methodologies (Mettananda and Mettananda, 2024). This approach enables the estimation of health metrics, such as mortality rates and DALYs, even in data-scarce settings such as Afghanistan. Despite the numerous challenges mentioned, the burden of road injuries in Afghanistan has not been systematically studied at the national level and remains largely unknown (Massahikhaleghi et al., 2018a; Noh et al., 2022a).

This study represents the first systematic effort to analyze trends and demographic characteristics of road injuries and their road user types in Afghanistan via GBD 2021 data from 1990 to 2021. By examining temporal trends and identifying high-risk groups, this research aims to provide actionable insights for policymakers. The findings are expected to inform targeted interventions, improve resource allocation, and enhance road safety initiatives in Afghanistan.

2. Methodology

2.1. Study design

This epidemiological study utilized annual data from the GBD 2021 database to assess the burden of road injuries in Afghanistan from 1990 to 2021. The analysis focused on the burden and temporal trends of road injuries and their subtypes, as classified by the GBD framework, including pedestrian, cyclist, motorcyclist, motor vehicle, and other road injuries. These trends were examined using four key measures—age standardized mortality rate (ASMR), age-standardized DALY rate (ASDR), years of life lost (YLL), and years lived with disability (YLD) across four GBD-defined age groups (0–14, 15–49, 50–69, 70+) and both sexes over the past three decades.

2.2. Data sources

This analysis was based on data obtained from the GBD results tool via the Global Health Data Exchange (https://ghdx.healthdata.org/). The GBD 2021 provides a comprehensive assessment of 371 diseases and injuries, along with 88 risk factors, across 204 countries and territories from 1990 to 2021. Using DisMod-MR, a Bayesian meta-regression tool, GBD systematically integrates demographic and epidemiological data to ensure consistency between morbidity and mortality estimates. A detailed description of data sources and methodologies is available in the GBD reports. (Mettananda and Mettananda, 2024; Collaborators G, 2020).

GBD data are derived from various sources, including censuses, household surveys, civil registration systems, disease registries, health service utilization records, and satellite imaging. This study reports point estimates with 95 % uncertainty intervals, calculated from 1000 model iterations, with the 2.5th and 97.5th percentiles of the posterior distribution defining the uncertainty interval bounds. Trends in the burden of road injuries are expressed as percentage changes between 1990 and 2021. Road injuries were classified according to the International Classification of Diseases-10 codes as follows:

Road injury: V01–V04.99, V06–V80.929, V82–V82.9, V87.2–V87.3, pedestrian: V01–V04.99, V06–V09.9, cyclist: V10–V19.9, motorcyclist: V20–V29.9, motor vehicle: V30–V79.9, V87.2–V87.3 and other road injuries: V80–V80.929, V82–V82.9.

This study follows the recommendations of the Guidelines for Accurate and Transparent Health Estimate Reporting (Stevens et al., 2016). The age-standardized population model specific to Afghanistan, as provided by GBD 2021 and the World Health Organization (WHO) 2000–2025 standard population and the direct method, enabled consistent comparisons of trends and burdens over time (Collaborators, A.E.A.G, 2024; Ahmad et al., 2001).

2.3. Ethical considerations

This study utilized publicly available databases and did not involve human participants, requiring neither ethical approval nor a clinical trial registration number.

2.4. Joinpoint regression model and statistical analysis

The joinpoint regression model assessed temporal trends in road injury burden. This model calculates annual percent change (APC) for specific intervals and average annual percent change (AAPC) for overall trends. Positive APC values indicate increasing trends, whereas negative values signify decreases. APCs were derived from a log-linear model: $APC = [e(\beta) \times 100\ \%$, where β represents the segment slope (Noh et al., 2022a; Fu et al., 2023; Dragomirescu et al., 2019).

AAPC was computed as a weighted average of interval-specific APCs. Permutation testing was used to determine statistical significance. During the analysis, $APC > 0$ indicated a rising trend in road injury burden, whereas an $APC < 0$ signified a decline. The results provide a detailed view of temporal patterns and their significance (Chen et al., 2024).

All trend analyses were conducted using Microsoft Excel (Version

Table 1
Age-standardized mortality rate, disability-adjusted life years rate, years of life lost, and years lived with disability per 100,000 population for road injuries in Afghanistan (1990–2021), with average annual percentage change and 95 % confidence intervals, stratified by sex.

		95 % UI / 100,000	95 % UI / 100,000	AAPC (95 % CI)
ASMR	Both	45.8 (35.7–57.6)	31.3(24.3–39.7)	−1.2(−1.4, −1.0)
	Male	73.7 (56.2–93.7)	49.8(36.9–64.2	-1.2(−1.4, −1.0)
	Female	21.2 (15.9–26.5)	13.2(10.2–17.1)	−1.5(−1.7, −1.3)
ASDR	Both	2460.8 (1979.2–3029.2)	1635.2 (1307.1–2043.8)	−1.3(−1.5, −1.0)
	Male	3908.8 (3081.9–4920.5)	2575.1 (2002.7–3301.7)	−1.3(−1.5, −1.1)
	Female	1246.7 (969.9–1542.1)	693.2 (556.3–897.1)	−1.8(−2.0, −1.5)
YLL	Both	2238.8 (1756.2–2816.2)	1487.4 (1170.1–1897.1)	−1.2(−1.5, −1.0)
	Male	3606.03 (2774.9–4591.4)	2361.0 (1808.3–3069.0)	−1.3(−1.5, −1.1)
	Female	1095.0 (809.9–1377.9)	607.2 (478.7–789.7)	−1.8(−2.2, −1.5)
YLD	Both	222.0 (163.0–288.9)	147.7 (108.5–192.7)	−1.3(−1.4, −1.2)
	Male	302.8 (220.2–395.6)	214.0 (155.7–278.8)	−1.1(−1.2, −1.0)
	Female	151.6 (111.9–196.4	85.9 (63.3–112.3)	−1.8(−2.0, −1.6)

Abbreviations: Average annual percentage change (AAPC), Road injury (RI), Uncertainty interval (UI), Confidence Interval (CI), Age-standardized mortality rate (ASMR), Age-standardized DALY rate (ASDR), Year of life lost (YLL), years lived with disability (YLD).

Table 2
Trends in age-standardized mortality rate, disability-adjusted life years rate, years of life lost, and years lived with disability per 100,000 population for road injuries in Afghanistan (1990–2021), with average annual percentage change and 95 % confidence intervals, stratified by age group.

Measure	Age group	1990	2021	1990–2021
		95 % UI (per 100,000)	95 % UI (per 100,000)	AAPC (95 % CI)
ASMR	0–14	22.6 (15.2–31.4)	8.1 (6.0–10.3)	−3.1(−3.9, −2.4)
	15–49	42.2 (31.0–55.5)	32.7 (24.4–43.7)	−0.8(−0.9, −0.6)
	50–69	82.1 (59.9–107.9)	48.2 (35.7–64.3)	−1.7(−1.9, −1.4)
	70+	84.0 (64.2–108.1)	59.5 (44.4–72.7)	−1.0(−1.2, −0.9)
ASDR	0–14	1979.2 (1342.4–2724.0)	700.8 (528.7–887.6)	−3.2(−3.9, −2.4)
	15–49	2694.9 (2036.9–3503.2)	2073.2 (1575.7–2695.3)	−0.8(−1.0, −0.6)
	50–69	3024.6 (2329.6–3879.7)	1936.3 (1486.0–2538.5)	−1.4(−1.5, −1.2)
	70+	1834.6 (1464.0–2294.1)	1276.2 (1008.9–1521.5)	−1.1(−1.2, −1.0)
YLL	0–14	1922.8 (1290.0–2666.2)	678.1 (505.1–862.7)	−3.2(−4.0, −2.4)
	15–49	2486.0 (1823.6–3271.5)	1935.8 (1443.2–2584.9)	−0.8(−1.0, −0.6)
	50–69	2606.1 (1900.9–3457.5)	1648.2 (1202.2–2206.7)	−1.4(−1.6, −1.3)
	70+	1447.0 (1086.1–1903.8)	987.8 (737.5–1213.0)	−1.2(−1.3, −1.0)
YLD	0–14	56.4 (40.6–74.4)	22.6 (16.4–30.5)	−2.9(−3.1, −2.6)
	15–49	208.9 (152.1–272.3)	137.3 (99.4–179.8)	−1.3(−1.5, −1.1)
	50–69	418.4 (307.8–544.8)	288.0 (210.9–376.7)	−1.2(−1.3, −1.1)
	70+	387.5 (279.5–516.8)	288.4 (209.2–382.8)	−0.9(−1.0, −0.8)

2021) and joinpoint regression software (version 5.2.0.0, Information Management Services, Calverton, Maryland, United States of America), which segments trends into distinct linear intervals, enabling interval-specific assessments.

3. Results

3.1. Overview of results

The results of this study are presented in two main sections. The first section provides an analysis of the overall trends in road injury burden based on AAPC from 1990 to 2021, considering age groups, gender, and road injury types for four key age-standardized indicators: mortality, DALY, YLL, and YLD. The second section explores these indicators' trends over shorter time intervals using APC, also considering age groups, gender, and road injury types.

3.2. Overall trends in road injury burden: AAPC analysis

From 1990 to 2021, the burden of road injuries showed a consistent decline across all indicators (ASMR, ASDR, YLL, and YLD) for both sexes (see Table 1). The ASMR decreased from 45.8 to 31.3 per 100,000 for both sexes combined, with males experiencing a reduction from 73.7 to 49.8, and females from 21.2 to 13.2.

Similarly, the ASDR fell from 2460.8 to 1635.2 per 100,000, with males decreasing from 3908.8 to 2575.1, and females from 1246.7 to 693.2. Regarding YLL, the rate dropped from 2238.8 to 1487.4 per 100,000, with males decreasing from 3606.0 to 2361.0, and females from 1095.0 to 607.2. Finally, the YLD also saw a decline from 222.0 to 147.7 per 100,000, with males reducing from 302.8 to 214.0, and females from 151.6 to 85.9.

As illustrated in Table 2, road injury burden across four GBD-specified age groups in the last three decades showed a consistent decline in all indicators (ASMR, ASDR, YLL, and YLD). The highest reduction in ASMR was observed in the 0–14 age group, with a decrease of −3.1 % annually, from 22.6 to 8.1 per 100,000. The 15–49, 50–69, and 70+ age groups also exhibited declines, with rates dropping from 42.2 to 32.7, 82.1 to 48.2, and 84.0 to 59.5, respectively.

The trend in ASDR followed a similar pattern, with the steepest reduction in the 0–14 age group (−3.2 %), from 1979.2 to 700.8 per 100,000. In YLL, the 0–14 group experienced the highest decrease of −3.2 %, from 1922.8 to 678.1 per 100,000. The 70+ group had the most

Table 3
Road injury trends in Afghanistan (1990–2021) by injury type: age-standardized mortality rate, disability-adjusted life years rate, years of life lost, and years lived with disability per 100,000 population, with average annual percentage change and 95 % confidence intervals.

Measure	RI type	1990	2021	1990–2021
		95 % UI (100,000)	95 % UI (per 100,000)	AAPC (95 % CI)
ASMR	Pedestrian	18.0(10.6–27.6)	12.7(7.9–18.2)	−1.0(−1.5, −0.6)
	Cyclist RI	N/A	N/A	N/A
	Motor vehicle	24.3(14.9–34.1)	16.0(11.6–22.6)	−1.3(−1.6, −1.0)
	Motorcyclist	3.3(1.1–5.5)	2.4(1.2–3.9)	−0.9(−1.4, −0.3)
	Other RI	N/A	N/A	N/A
ASDR	Pedestrian	918.3 (571.4–1348.3)	620.8 (393.1–864.8)	−1.3(−1.4, −1.2)
	Cyclist RI	9.9 (7.4–13.1)	9.7 (7.2–12.4)	−0.2(−0.3, −0.0)
	Motor vehicle	1323.5 (900.6–1786.3)	844.4 (635.3–1143.2)	−1.6(−1.7, −1.5)
	Motorcyclist	195.3 (78.3–313.1)	150.1 (84.2–231.0)	−0.2(−0.3, −0.1)
	Other RI	13.7 (9.7–18.4)	10.0 (7.1–13.4)	−1.0(−1.1, −0.9)
YLL	Pedestrian	860.5 (518.4–1284.1)	582.5 (358.6–831.5)	−1.2(−1.7, −0.7)
	Cyclist RI	N/A	N/A	N/A
	Motor vehicle	1199.8 (771.3–1660.4)	769.9 (561.0–1075.7)	−1.2(−1.5, −1.0)
	Motorcyclist	176.8 (58.2–294.1)	132.9 (66.0–213.2)	−0.6(−1.0, −0.2)
	Other RI	N/A	N/A	N/A
YLD	Pedestrian	57.7 (41.8–76.9)	38.3 (27.5–50.9)	−1.3(−1.4, −1.2)
	Cyclist RI	8.5 (6.1–11.4)	7.9 (5.6–10.5)	−0.2(−0.3, −0.0)
	Motor vehicle	123.6 (89.4–161.7)	74.4 (53.4–98.0)	−1.6(−1.7, −1.5)
	Motorcyclist	18.4 (13.3–24.0)	17.2 (12.5–22.5)	−0.2(−0.3, −0.1)
	Other RI	13.5 (9.5–18.3)	9.7 (6.9–13.1)	−1.0(−1.1, −0.9)

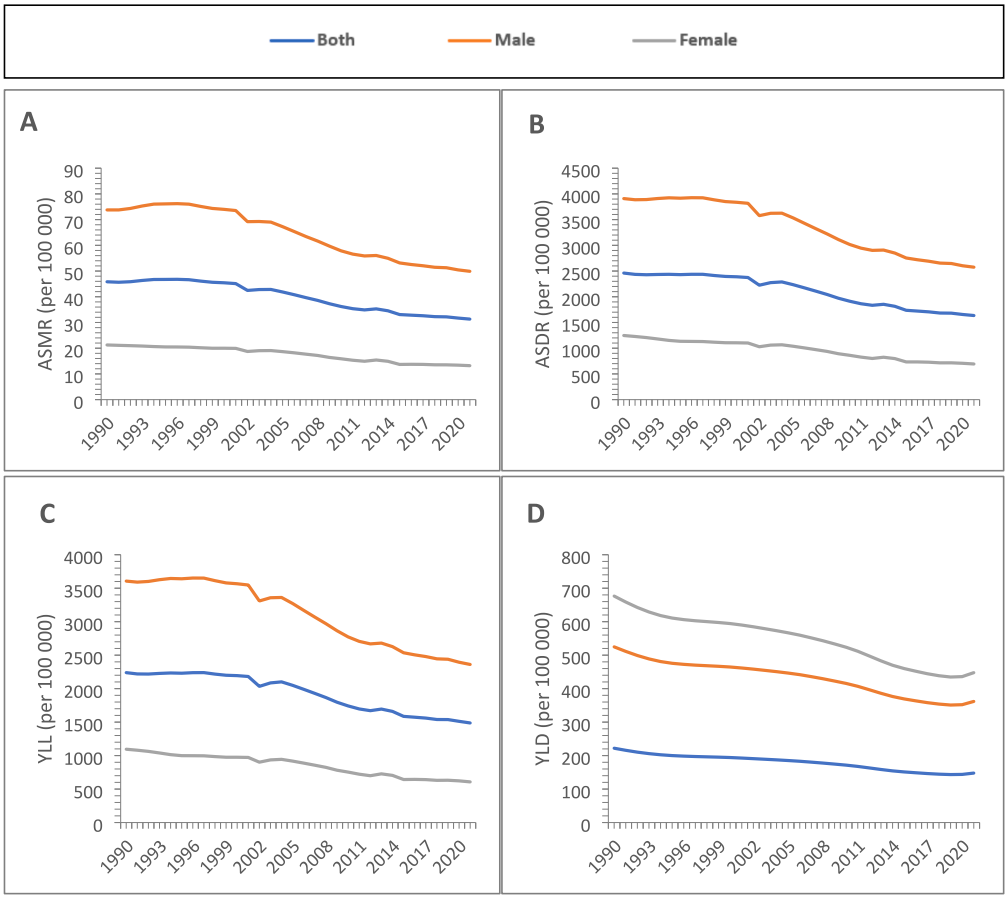

Fig. 1. Segmented trends in age-standardized mortality rate, disability-adjusted life years rate, years of life lost, and years lived with disability per 100,000 population for road injuries by sex in Afghanistan (1990–2021). *Age-standardized mortality rate (ASMR), Age-standardized DALY rate (ASDR), Year of life lost (YLL), years lived with disability (YLD),*

modest decline in all indicators. Regarding YLD, the 0–14 group showed the highest reduction of −2.9 %, while the 70+ group had the lowest decrease at −0.9 %.

As mentioned in Table 3, from 1990 to 2021, the road injury burden by injury type demonstrated a consistent decline across all indicators (ASMR, ASDR, YLL, and YLD). The ASMR for pedestrian injuries decreased from 18.0 to 12.7 per 100,000, with a reduction of −1.0 % annually. Motor vehicle injuries showed the highest decline of −1.3 %, dropping from 24.3 to 16.0 per 100,000 population.

Motorcyclist injuries experienced a modest reduction of −0.9 %, from 3.3 to 2.4 per 100,000. For ASDR, pedestrian injuries decreased by −1.3 % annually, from 918.3 to 620.8 per 100,000, while motor vehicle injuries saw a sharper decline of −1.6 %, from 1323.5 to 844.4 per 100,000. Motorcyclist injuries had a minimal reduction in ASDR (−0.2 %) from 195.3 to 150.1.

Regarding YLL, pedestrian injuries reduced by −1.2 %, from 860.5 to 582.5, and motor vehicle injuries decreased by −1.2 %, from 1199.8 to 769.9 per 100,000. Motorcyclist injuries saw a more modest reduction of −0.6 %, from 176.8 to 132.9. Finally, YLD for pedestrian injuries decreased by −1.3 %, from 57.7 to 38.3, while motor vehicle injuries declined by −1.6 %, from 123.6 to 74.4 per 100,000.

3.3. Segmented trend of road injury burden: APC analysis

As illustrated in Fig. 1 and detailed in Supplemental Table 1, road injury burden exhibited distinct temporal patterns across ASMR, ASDR, YLL, and YLD.ASMR showed a slight increase from 1990 to 1997, APC = 0.3 %, followed by a steady decline, peaking between 2005 and 2011, APC = −2.7 %. The decline was steeper in males, whereas females experienced a more consistent downward trend. A comparable pattern was observed for ASDR, with the sharpest reduction from 2005 to 2011 APC = −2.9 %, particularly in females during 2005–2015 APC = −3.2 %. YLL exhibited the most pronounced reduction from 2005 to 2011, APC = −3.0 %, with males experiencing a sharper decline from 2005 to 2010, APC = −3.3 %, while females saw their largest decrease from 2006 to 2011, APC = −4.2 %. Conversely, YLD followed a gradual decline until 2018, then increased slightly from 2018 to 2021, APC- 0.9 % (95 %, with a noticeable rise in males.

As illustrated in Fig. 2 and detailed in Supplemental Table 2, trends in road injury burden varied significantly across age groups (0–14, 15–49, 50–69, and 70+), with distinct shifts over time. ASMR, ASDR, and YLL showed the steepest declines in children (0–14 years), particularly in 1990–1995 (−5.2 % to −5.1 % annually) and 2005–2009 (−8.0 % to −8.1 % per year). The 15–49 age group initially saw a slight increase (1990–1997: +1.0 % to +1.7 % per year) before transitioning into a sustained decline. Older adults (50–69 and 70+) followed a similar trajectory, with an early modest increase before a long-term reduction, most pronounced in the 50–69 group (−2.8 % to −3.0 % per year, 2001–2018).

However, a slight resurgence was noted in the 70+ group after 2010. YLD patterns were more variable. The 0–14 group showed the sharpest declines during 1990–1994 (−3.8 %) and 2008–2011 (−4.7 %), stabilizing thereafter. The 15–49 group had an initial decline (1990–1994: −3.6 %), followed by stagnation (1994–2006), then resumed its downward trend. Notably, in older adults (70+), YLD reductions accelerated post-2008 but reversed in 2017–2021, with a rising trend in disability burden (50–69: +1.1 %, 70+: +2.2 %). While road injury burden has generally declined, the recent increase in disability among older adults

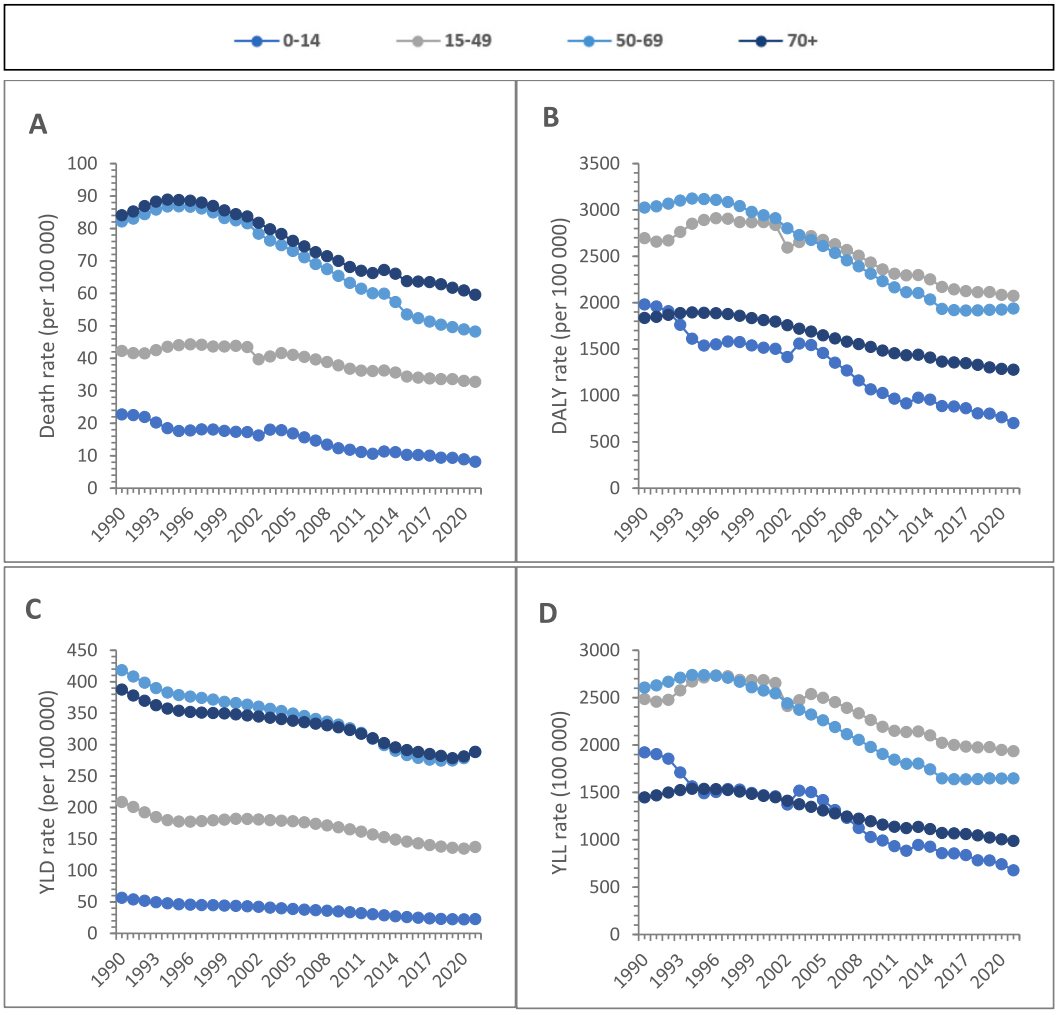

Fig. 2. Age-specific segmented trends in age-standardized mortality rate, disability-adjusted life years rate, years of life lost, and years lived with disability per 100,000 population for road injuries in Afghanistan (1990–2021).

highlights a growing concern requiring targeted interventions.

Trends in road injury burden varied by subtype, with distinct shifts over time. As illustrated in Fig. 3 in the main text and detailed in Supplemental Table 3, ASMR showed an initial increase among pedestrians (1990–1994, APC = 2.8 %, followed by a continuous decline APC = −1.2 %. Motor vehicle and motorcyclist mortality peaked in the 1990s before declining sharply between 2000 and 2014 (APC -2.7 % to −3.3 %), though motorcycle fatalities stabilized after 2014. Due to insufficient data, cyclists and other road injuries were not analyzed in ASMR. ASDR and YLL followed similar patterns, with steady declines across all subtypes, particularly among motor vehicle APC = −2.6 %, and pedestrian injuries APC = −2.0 % from the mid-2000s. However, a slight resurgence was noted post-2018 in most categories.

Cyclists and other road injuries in YLL were also excluded due to limited data. YLD showed a decreasing trend until 2018, after which pedestrian, cyclist, and other road injury-related disabilities exhibited a modest rise (APC 1.1 % to 1.3 %). While the road injury burden has declined overall, the recent increase in certain subtypes highlights areas requiring continued focus.

4. Discussion

The findings of this study indicate a sustained decline in the burden of road injuries over the past three decades, with reductions observed across all major indicators (ASMR, ASDR, YLL, and YLD), age groups, injury types, and both sexes. While this downward trend is notable, it is important to interpret these patterns within a broader demographic and epidemiological context.

A key consideration is that reductions in road injury burden rates should not be assumed to reflect major improvements in road safety or emergency response systems. Given Afghanistan's population growth, a decline in ASMR may partly stem from a shift in population structure rather than fundamental changes in road injury prevention or post-crash care. This pattern aligns with findings from Iran, where a 57 % reduction in ASMR was observed between 1990 and 2019, but young males remained the most affected demographic due to continued exposure risks (Sadeghian Tafti et al., 2023). The observed age-group-specific trends highlight meaningful differences. The most pronounced reductions were observed in children (0–14 years), particularly in ASMR and YLL. This finding aligns with two observational GBD-based studies in India (1990–2021 and 1990–2019), which reported a substantial decline in road injury mortality rates within this age group (Ohlan et al., 2025; Behera et al., 2022). One possible explanation could be shifts in exposure patterns, such as reduced mobility among children or increased caregiver awareness of road safety risks. Similar trends have been reported in other conflict-affected settings, where reductions in child mortality were attributed to shifting mobility patterns and potential improvements in pediatric trauma care (Noh et al., 2022b). In contrast, the decline was more modest among older adults (70+), who continue to face a persistent injury burden. The post-2018 resurgence in YLD among 15–49, 50–69, and particularly 70+ age groups underscores a growing challenge in disability management, which may be linked to

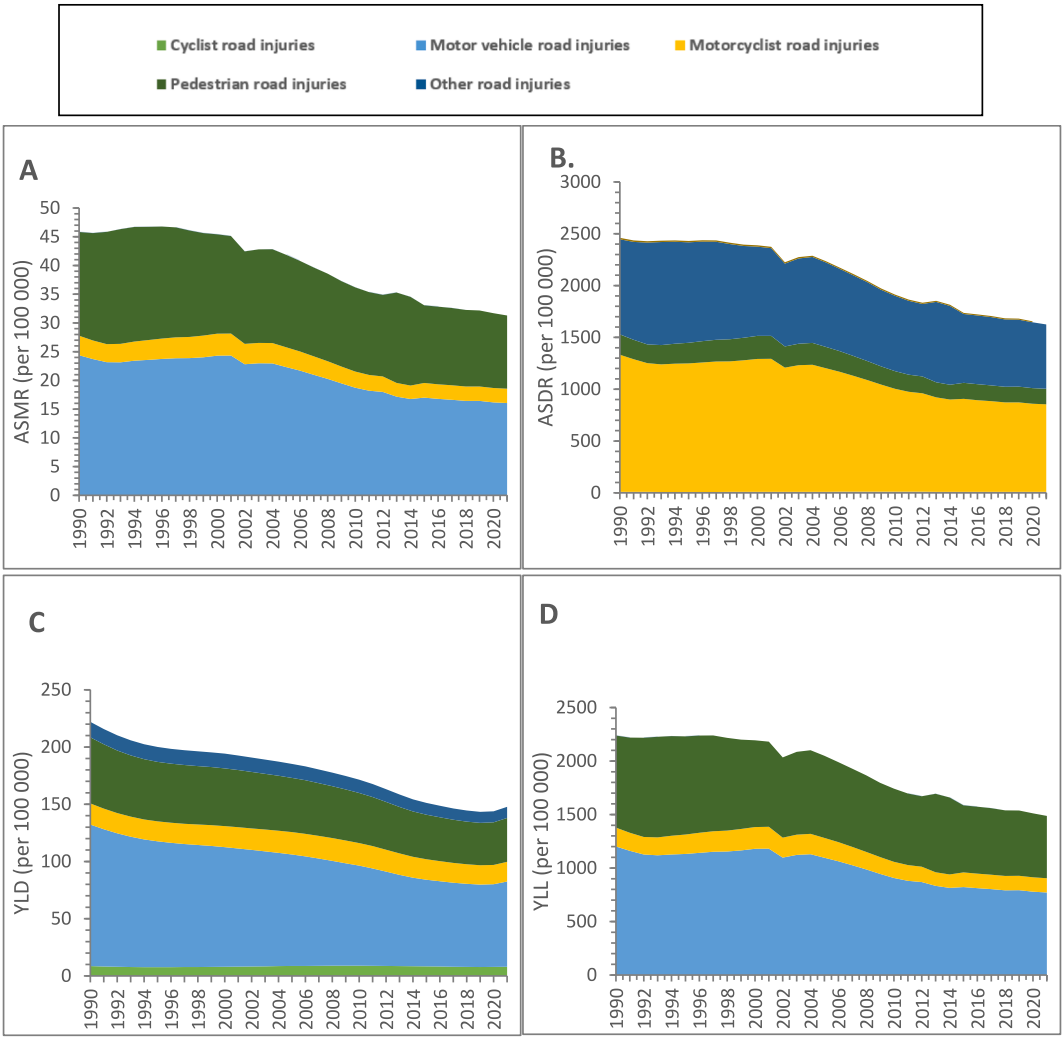

Fig. 3. Trends in age-standardized mortality rate, disability-adjusted life years rate, years of life lost, and years lived with disability per 100,000 population across road injury types in Afghanistan (1990–2021).

increased road exposure, limited rehabilitation access, or the greater vulnerability of older adults to long-term impairments following road injuries (Wilmut and Purcell, 2022).

Sex differences in road injury burden are also notable. Although both males and females experienced declines across all indicators, males consistently exhibited higher ASMR, ASDR, and YLL rates. This aligns with established global trends, where men face a greater risk of road injuries due to higher exposure to traffic, riskier driving behaviors, and greater use of motorized transport (Massahikhaleghi et al., 2018b; James, 2020; McCarty and Kim, 2024). The reduction in road injury burden among males was steeper in earlier periods, whereas females showed a more consistent downward trend. However, the increase in YLD among males in recent years suggests that while fatality rates have declined, the long-term health consequences of road injuries among men may be increasing. Similar patterns have been observed in Iraq, where war-related injuries have compounded the burden of road injuries, particularly among young males, and also similar findings in a systematic review regarding the risk of older adults (Wilmut and Purcell, 2022).

Road Injury-type-specific patterns further reveal complexities in road injury burden trends. While mortality rates have declined among pedestrians and motor vehicle occupants, the reduction in motorcyclist-related injuries has been less pronounced. Motorcycle-related mortality stabilized after 2014, raising concerns about the effectiveness of existing safety measures, a pattern also observed in other developing countries where weak helmet law enforcement and inadequate infrastructure contribute to sustained fatality rates (Tafti et al., 2023; Organization, W. H, 2023).

A more concerning trend is the post-2018 increase in ASDR and YLD across all road injury types, particularly among pedestrians and motorcyclists. This shift suggests that while mortality has declined, the burden of non-fatal injuries is growing, indicating persistent gaps in post-crash care and rehabilitation. Similar trends have been reported in other conflict-affected regions, where improvements in emergency response have reduced fatalities but not the long-term health impacts of road injuries (Crawford, 2013). The rising YLD burden underscores the need for stronger disability management strategies, particularly as aging populations face greater risks of long-term impairments following road injuries (Wilmut and Purcell, 2022; Hyder et al., 2009).

These findings highlight the limitations of current road safety interventions. While earlier gains in mortality reduction are notable, the increasing non-fatal injury burden suggests that road safety efforts must evolve beyond crash prevention to include comprehensive post-injury care and rehabilitation services. Strengthening the enforcement of safety regulations, improving trauma care systems, and expanding access to rehabilitation could help mitigate the rising disability burden associated with road injuries (Organization, W.H, 2023).

In conclusion, this study reveals a decline in ASMR over the past three decades in Afghanistan. However, the recent increase in non-fatal injury burden, particularly among pedestrians and motorcyclists,

highlights ongoing challenges in post-crash care. Age and sex disparities remain notable, with men and older individuals facing longer-term road injury disability burdens. These findings emphasize the need for a more comprehensive approach to road safety, focusing not only on crash prevention but also on strengthening emergency response systems and expanding access to rehabilitation services. Future research should focus on evaluating the effectiveness of road safety policies in Afghanistan, improving post-crash care systems, and identifying socio-economic factors that contribute to vulnerability.

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Najeebullah Faizi: Investigation, Formal analysis, Conceptualization.

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Declaration of competing interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2025.103061.

Data availability

Data for this study were sourced from the GBD 2021 database by IHME, available at https://ghdx.healthdata.org/gbd-2021.

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