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Spinal Cord Injury: The Global Incidence, Prevalence, and Disability From the Global Burden of Disease Study 2019

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Study Design. A retrospective cohort study.

Objective. The authors aimed to estimate the incidence, prevalence and years lived with disability (YLDs) of spinal cord injury (SCI) by location, sex, age, injury site and socio-demographic index (SDI) based on the data of the Global Burden of Disease Study (GBD) 2019.

Summary of Background Data. GBD 2019 estimates the burden of 369 diseases and injuries worldwide in 2019 and the temporal trends in the past 30 years. SCI is estimated as a result of injury from various causes.

Methods. A Bayesian meta-regression tool, DisMod-MR2.1, was used to produce the estimates. Estimated annual percentage change (EAPC) was calculated based on a linear regression mode of the age standardized rates and the calendar year to represent the temporal trends of the age standardized rates. Spearman rank order correlation was used to determine the correlation between SDI and the incidence and burden of SCI.

Results. Globally, there were 0.9 [95% uncertainty interval (UI), 0.7 to 1.2] million incident cases, 20.6 (95% UI, 18.9–23.6) million prevalent cases and 6.2 (95% UI, 4.5–8.2) million YLDs of total SCI in 2019. The ASPR increased (EAPC, 0.1; 95% confidence interval, −0.01 to 0.2), while the age standardized incidence rate (ASIR) (EAPC, −0.08; 95% UI, −0.24 to 0.09) and age standardized YLD rate (ASYR) (EAPC, −0.08; 95% confidence interval, −0.24 to 0.09) decreased. Males had higher ASIR and ASYR, and the rate of incidence, prevalence and YLD increased with age. Spinal injuries at neck level caused higher ASYR than injuries below neck level. A positive correlation existed between SDI and ASIR ($\rho = 0.1626$, $P < 0.05$), while a negative correlation was observed between SDI and EAPC of ASYR ($\rho = -0.2421$, $P < 0.01$).

Conclusion. Conclusively, the incidence and burden of SCI has increased over the last 30 years. Males and the elderly were affected to a greater degree than females and younger individuals.

Key words: spinal cord injury, GBD 2019, incidence, prevalence, years lived with disability

Level of Evidence Level: 3

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Spinal cord injury (SCI) can be caused by either traumatic injuries such as vertebral fractures or non-traumatic causes like infections and vascular damages.[1] Currently, it is still difficult for patients to completely recover from severe SCI, due to the reduced growth capacity of mature neurons in the spinal cord. Consequently, patients with severe SCI will suffer perpetual loss in sensation and motion ability.[1,2]

Patients with SCI may develop both physical and psychological dysfunctions. After SCI, the impaired vessel and muscle and dysregulated neural-endocrine factors can result in rapid and intense bone loss, leading to osteoporosis and fractures.[3] Cognitive impairment has also been reported in patients following SCI, as a result of concurrent brain injury or other complications.[4]

Many injuries can result in SCI, among which falls and road injuries were the leading causes in most regions.[5] In 2016, the annual incidence rate of SCI in the United States was 54 cases per million population,[1] and the prevalence rate was 721 to 906 per million people.[6] In 1990, the annual cost of medical management for SCI was estimated to be 4 billion dollars in America, causing enormous burden to both

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patients' family and the society.[6] Overall, the incidence and prevalence of SCI vary from nation to nation, and most surveys were conducted in developed regions.[1] The is still a lack of up-to-date data about the epidemiology and burden of SCI and the temporal trends worldwide and in each country.

In this study, we explored the epidemiology and health burden of SCI worldwide based on the data from the Global Burden of Diseases (GBD) Study 2019. We aimed to provide a comprehensive description about the incidence, prevalence and burden of SCI. In addition, we also evaluated the association between social development and disease burden. These findings could provide a comprehensive understanding of the current burden of SCI.

METHODS

Data Source and Injury Definition

In this study, the incidence, prevalence and attributable burden of SCI were estimated based on data from GBD 2019. In the study, SCI was estimated as a kind of injury from various causes, and the International Classification of Diseases (ICD) system was used to define each injury.

Measurements

We reported the age standardized incidence rate (ASIR), prevalence rate (ASPR), and years lived with disability (YLD) rate (ASYR) of SCI. The explanation for these abbreviations is presented in Table 1 for better understanding. Briefly, YLDs are the measurement for the burden and are defined as the total years that a patient lived with disability due to SCI. The socio-demographic index (SDI) was used to represent the influence of background social and economic conditions on health outcomes. It was developed based on the methodology of the Human Development Index by the United Nations. Mean education for those 15 years old and older, total fertility rate for those younger than 25 years old, and lag-distributed income per capital were used to calculate SDI.

The Estimation for Incidence, Prevalence, and YLD

The methods for injury-related burden estimation in GBD 2019 has been summarized in a previously published article.[7] Briefly, the primary data for modeling and estimating were pooled from vital registration systems, hospital medical records, insurance claims. As the database estimates the disease and injury burden during a wide range of time, there are potential bias from changes in ICD coding (*e.g.*, from ICD 9 to ICD 10) for a disease or injury. These alternative definitions were adjusted before putting the data into the estimating process. After adjusting for coding bias, the primary data were used to estimate the incidence of injuries in DisMod-MR2.1, a Bayesian-based tool. In the GBD study, there are two kinds of injuries, the cause-
of-injury and the-nature-of injury. Cause-of injuries are the direct causes on the body, such as falls and road injuries, while the nature-of-injury are the consequences of the causes (SCI in this study). The incidence, prevalence and YLD were estimated for the nature of injury. As one cause-of-injury may result in more than one nature-of-injuries and one nature-of-injury may be result of multiple causes, the GBD study developed a severity hierarchy to determine the nature of injury for a specific cause (Data, Supplemental Digital Content 3, http://links.lww.com/BRS/B864). The severity hierarchy was also used to estimate the incidence of each nature-of-injury. Subsequently, the incidence was multiplied by the duration of nature-of-injury to estimate the prevalence of short time disability. For long-term disability, the changes in incidence over time was considered and was integrated in the DisMod-MR2.1. Finally, the prevalence was multiplied by disability weights to estimate the YLD for the injury. The definition and calculation for disability weights can be learned elsewhere.[8]

Statistical Analysis

For each estimate, the Bayesian-based tool DisMod-MR2.1 provides a 95% uncertainty interval (95% UI). The temporal trends of the ASIR, ASPR or ASYR were represented by the estimated annual percentage change (EAPC). The EAPC are calculated based on a linear regression mode of the age standardized rates (ASRs) and the calendar year. Detailed methods can be learned from our previously published article.[7] Unlike the estimates produced by

TABLE 1. The Full form and Explanations of Abbreviations

Abbreviations	Full Form	Explanations
YLD	Years lived with disability	The sum of years that patients lived with disability due to SCI
ASIR	Age standardized incidence rate	The incidence rate of SCI in a specific time and region after age standardization
ASPR	Age standardized prevalence rate	The prevalence rate of SCI in a specific time and region after age standardization
ASYR	Age standardized YLD rate	The YLD rate of SCI in a specific time and region after age standardization
EAPC	Estimated annual percentage change	EAPC are calculated based on a linear regression mode of the age standardized rates and the calendar year to represent temporal trends
SDI	Socio-demographic index	The sociodemographic development level of countries

DisMod-MR2.1, we presented the 95% confidence interval (95% CI) for each EAPC. Correlation analysis was conducted using the Spearman rank order correlation methods. *P* value <0.05 was considered statistically significant. All data analysis and visualization were done in the R software (version 3.6.3).

RESULTS

The Incidence, Prevalence, and Changes of SCI

Globally, there were estimated to be 0.9 (95% UI, 0.7–1.2) million incident cases of total SCI in 2019 for both sexes, with an ASIR of 12 (95% UI, 9–15) per 100,000 (Table 2). The ASIR of SCI at the neck level (EAPC, –0.09; 95% CI, –0.32 to 0.14) and below the neck level (EAPC, –0.06; 95% CI, –0.2 to 0.08) both presented a decreasing trend from 1990 to 2019. However, on the regional level, the ASIR increased in developing regions, among which North Africa and Middle East had the highest increase (EAPC, 2.2; 95% CI, 1.06–3.36). For developed regions, Australia had increased ASIR (EAPC, 0.3; 95% CI, 0.27–0.34). The ASIR and ASPR in high-income North America were both the highest among other regions (Data, Supplemental Digital Content 1, http://links.lww.com/BRS/B862). Western, Eastern and Central Europe also had relatively higher ASIR and ASPR than other less developed regions. At the national level, the highest ASIR and ASPR were seen in Afghanistan and Syria, respectively (Fig. 1).

The Burden Attributed to SCI in the Global and Regional Level

The global YLD number of total SCI in 2019 was estimated to be 6.2 (95% UI, 4.5–8.2) million, with an ASYR of 76 (95% UI, 55–100) per 100,000, which remained unchanged from 1990 to 2019 (EAPC, –0.08; –0.24 to 0.09) (Data, Supplemental Digital Content 2, http://links.lww.com/BRS/B863). The ASYR of SCI at the neck level was 52 (95% UI, 35–72) per 100,000, and was 24 (95% UI, 17–32) per 100,000 below the neck level. High-income North America had the highest ASYR of 113 (95% UI, 80–146) per 100,000, followed by Australia (97 per 100,000) and Tropical Latin America (97 per 100,000). The highest increase of ASYR was seen in North Africa and Middle East, while the highest decrease was in Central and Eastern Sub-Sahara. Figure 2 shows the geographical distribution of ASYR for 204 countries. Syria, Afghanistan and Palestine were the three leading countries in SCI related disabilities worldwide (Fig. 2).

The Leading Cause of SCI

Falls were the leading cause of SCI, followed by road injuries and conflict and terrorism (Data, Supplemental Digital Content 3, http://links.lww.com/BRS/B864). In 2019, fall-related incident cases of SCI were estimated to be 0.5 (95% UI, 0.3–0.7) million, with an ASIR of 6.06 (95% UI, 4.17–8.75) per 100,000. From 2010 to 2019, increasing trends were observed for ASIR, ASPR and ASYR caused by falls (Data, Supplemental Digital Content 4, http://links.lww.com/BRS/B865). The ASIR, ASPR, and ASYR caused by road injuries exhibited a minor decrement during 2010–2015 and a moderate increment during 2015–2019. The ASIR by conflict and terrorism increased significantly during 2010–2015 and decreased during 2015–2019, yet the corresponding ASPR and ASYR mildly rose from 2010 to 2019.

The Incidence and Burden of SCI by SDI, Sex, Injury Site, and Age

High SDI regions had higher ASIR than low SDI regions (Figure 3). Spearman rank order correlation analyses showed a positive correlation between SDI and ASIR ($\rho = 0.1626$, $P < 0.05$; Figure 3A), but the temporal changes in ASIR from 1990 to 2019 were not correlated to SDI (Figure 3C). For the burden of SCI, the ASYR were comparable among countries with different SDI. However, the EAPC of ASYR was negatively correlated to SDI, indicating that high SDI countries tended to have lower increases or even decreased in SCI related burden when compared with that in low SDI countries. In terms of ASPR, a significant positive correlation existed between SDI and ASPR ($\rho = 0.2128$, $P < 0.01$; Data, Supplemental Digital Content 5, http://links.lww.com/BRS/B866), and a significant negative correlation was observed between SDI and EAPC in ASPR ($\rho = -0.2935$, $P < 0.01$; Data, Supplemental Digital Content 5, http://links.lww.com/BRS/B866).

In terms of sex, males had both higher ASIR and ASYR in all years from 1990 to 2019. Males and females presented similar patterns during this period. The ASIR gradually went down with fluctuations from 1990 to 2011 but increased from 2011 to 2017, for both sexes (Figure 4A). The ASYR steadily decreased from 1990 to 2005 but slightly increased from 2005 to 2019 (Figure 4B).

Considering injury sites, SCI at the neck level had both higher ASIR and ASYR from 1990 to 2019 and fluctuated with years (Figure 4C, D). The ASPR of SCI was also higher in males and at the neck level in all years from 1990 to 2019. In terms of age, the incidence, prevalence and YLD rates increased with age for females of all ages. For males, the trend of incidence rate was similar to that in females, while the prevalence and YLD rates decreased with age in males older than 70 years (Figure 5A–C). Regarding the injury site, the incidence, prevalence and YLD rates of SCI at the neck and below the neck level all increased with age for both sexes (Figure 5D–F). The temporal trends of ASPR by sexes and injury sites were also reported (Data, Supplemental Digital Content 6, http://links.lww.com/BRS/B867).

DISCUSSION

Globally, the burden of SCI was still worrying. The global incidence, prevalence and YLD remained high, despite a minor descending trend. Although global ASRs of SCI have not changed much, the increase in the absolute cases and

TABLE 2. The Incidence of Spinal Cord Injuries, Spinal Cord Lesion at and Below Neck Level

Location	Spinal Injuries			Spinal Cord Lesion at Neck Level			Spinal Cord Lesion Below Neck Level		
	Incidence Number (×1000)	ASIR per 100,000 in 2019	EAPC From 1990 to 2019	Incidence Number (×1000)	ASIR per 100,000 in 2019	EAPC From 1990 to 2019	Incidence Number (×1000)	ASIR per 100,000 in 2019	EAPC From 1990 to 2019
Global	909 (707–1156)	12 (9–15)	−0.08 (−0.24 to 0.09)	492 (354–675)	6 (5–9)	−0.09 (−0.32 to 0.14)	417 (290–585)	5 (4–7)	−0.06 (−0.2 to 0.08)
East Asia	236 (173–315)	13 (10–18)	0.7 (0.32 to 1.09)	123 (79–187)	7 (5–11)	0.72 (0.34–1.1)	113 (72–173)	6 (4–10)	0.69 (0.3–1.08)
Southeast Asia	47 (38–60)	7 (6–9)	−0.6 (−1.41 to 0.22)	26 (19–35)	4 (3–5)	−0.8 (−1.56 to −0.04)	22 (16–31)	3 (2–5)	−0.34 (−1.23 to 0.55)
Oceania	1 (0–1)	5 (4–6)	−0.37 (−1.6 to 0.87)	0 (0–0)	3 (2–4)	−0.5 (−1.63 to 0.65)	0 (0–0)	2 (2–3)	−0.21 (−1.55 to 1.15)
Central Asia	6 (5–7)	7 (6–8)	−1.26 (−2.15 to −0.35)	3 (3–4)	4 (3–5)	−1.84 (−3.1 to −0.56)	3 (2–4)	3 (2–4)	−0.18 (−0.31 to −0.05)
Central Europe	17 (14–22)	13 (11–16)	−1.08 (−1.38 to −0.77)	9 (7–12)	7 (5–9)	−1.51 (−2.01 to −1.01)	8 (6–11)	6 (5–8)	−0.5 (−0.56 to −0.44)
Eastern Europe	30 (24–38)	13 (11–16)	−0.57 (−0.83 to −0.32)	16 (12–22)	7 (5–9)	−0.59 (−0.93 to −0.25)	14 (10–19)	6 (4–8)	−0.55 (−0.73 to −0.37)
High-income Asia Pacific	33 (25–43)	12 (9–15)	−0.49 (−0.57 to −0.41)	17 (12–25)	6 (4–8)	−0.5 (−0.58 to −0.42)	16 (11–22)	6 (4–8)	−0.47 (−0.55 to −0.39)
Australasia	5 (4–6)	14 (11–17)	0.3 (0.27 to 0.34)	3 (2–4)	7 (5–10)	0.31 (0.28–0.34)	2 (2–3)	7 (5–9)	0.29 (0.26–0.33)
Western Europe	61 (46–81)	10 (8–12)	−0.36 (−0.42 to −0.3)	32 (21–47)	5 (4–7)	−0.36 (−0.43 to −0.3)	29 (20–42)	5 (3–6)	−0.36 (−0.42 to −0.29)
Southern Latin America	5 (4–6)	8 (6–9)	−0.02 (−0.07 to 0.03)	3 (2–4)	4 (3–5)	−0.05 (−0.1 to −0.01)	3 (2–3)	4 (3–5)	0.01 (−0.05 to 0.07)
High-income North America	114 (85–156)	23 (17–30)	−0.08 (−0.28 to 0.11)	59 (39–90)	12 (8–17)	−0.08 (−0.27 to 0.11)	55 (37–83)	11 (8–16)	−0.08 (−0.28 to 0.12)
Caribbean	3 (3–4)	7 (6–9)	0.99 (−1.28 to 3.31)	2 (1–2)	4 (3–5)	0.86 (−1.34 to 3.11)	2 (1–2)	3 (2–4)	1.14 (−1.2 to 3.54)
Andean Latin America	3 (2–3)	5 (4–5)	−1.05 (−1.57 to −0.53)	2 (1–2)	2 (2–3)	−1.76 (−2.58 to −0.94)	1 (1–2)	2 (2–3)	0.09 (−0.03 to 0.21)
Central Latin America	25 (20–31)	10 (8–13)	−0.12 (−0.46 to 0.23)	13 (9– 18)	5 (4–7)	−0.36 (−0.69 to −0.02)	12 (9–16)	5 (3–7)	0.17 (−0.2 to 0.53)
Tropical Latin America	33 (25–44)	14 (11–19)	−0.19 (−0.27 to −0.12)	17 (12–26)	8 (5–11)	−0.19 (−0.26 to −0.11)	16 (11–23)	7 (5–10)	−0.2 (−0.27 to −0.12)
North Africa and Middle East	53 (35–98)	9 (6–17)	2.2 (1.06–3.36)	38 (21–81)	7 (4–14)	3.27 (1.95–4.6)	15 (11–20)	3 (2–3)	−0.6 (−1.54 to 0.35)
South Asia	156 (120–201)	9 (7–12)	0.05 (−0.29 to 0.4)	86 (60–123)	5 (4–7)	0.08 (−0.26 to 0.41)	70 (48–100)	4 (3–6)	0.03 (−0.35 to 0.4)
Central sub-Saharan Africa	5 (4–8)	5 (4–6)	−2.69 (−4.88 to −0.46)	3 (2–6)	3 (2–5)	−3.39 (−6.12 to −0.59)	2 (1–3)	2 (1–3)	0.04 (−0.07 to 0.16)
Eastern sub-Saharan Africa	29 (22–38)	9 (7–12)	−2.85 (−4.19 to −1.48)	16 (11–22)	5 (3–7)	−4.03 (−5.81 to −2.22)	13 (9–20)	4 (3–6)	−0.08 (−0.17 to 0.02)
Southern Sub-Saharan Africa	7 (5–9)	9 (7–12)	−0.27 (−0.46 to −0.09)	3 (2–5)	5 (3–7)	−0.33 (−0.52 to −0.14)	3 (2–5)	4 (3–7)	−0.21 (−0.4 to −0.02)
Western Sub-Saharan Africa	38 (28–52)	11 (8–15)	0.24 (0.06–0.41)	21 (14–31)	6 (4–9)	0.15 (−0.16 to 0.45)	17 (11–28)	5 (3–9)	0.35 (0.28–0.42)

ASIR indicates age standardized incidence rate; EAPC, estimated annual percentage rate.

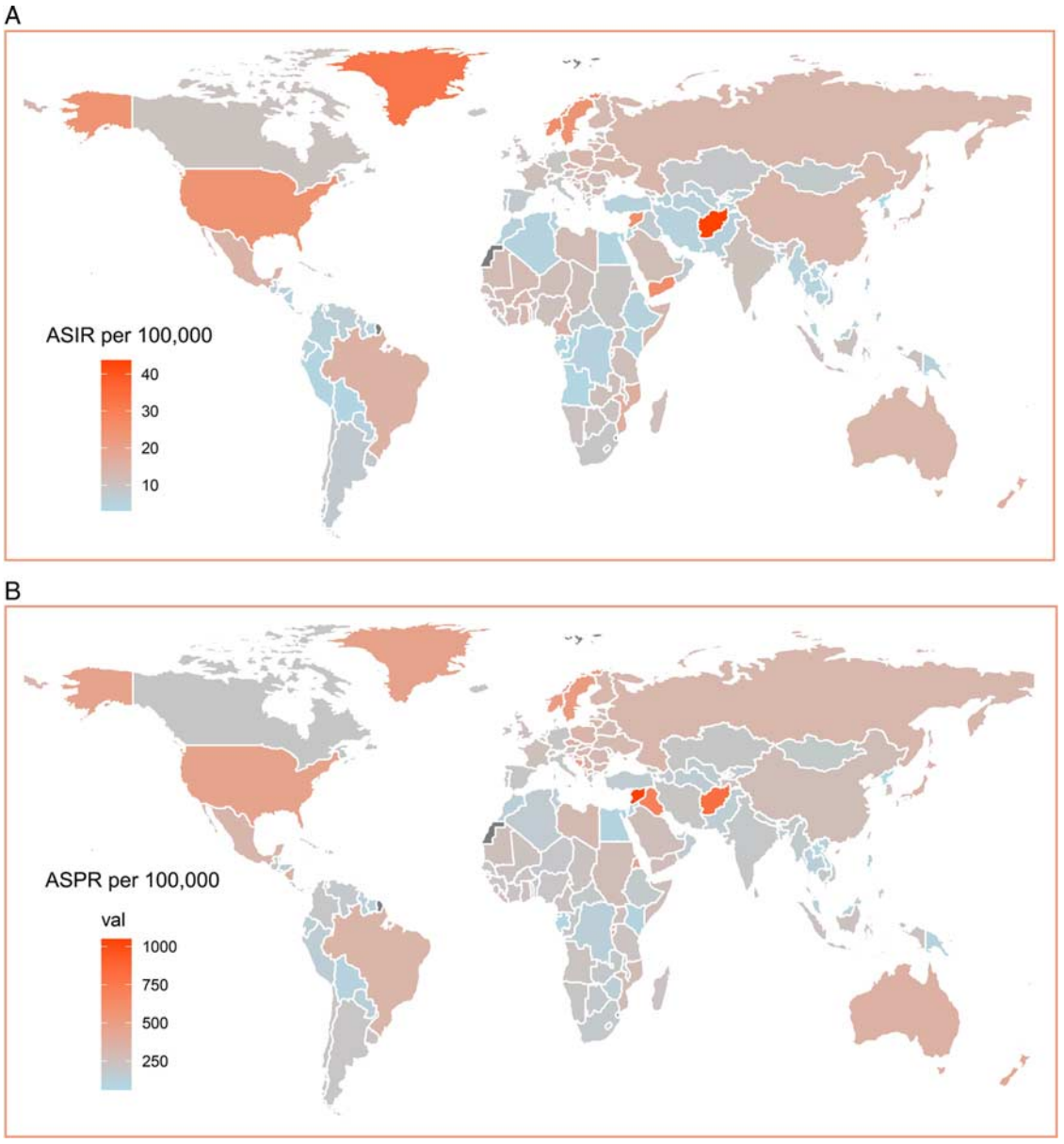

Figure 1. ASIR (A) and ASPR (B) of spinal cord injury in 2019 in 204 countries and territories, for both sexes. ASIR indicates age standardized incidence rate; ASPR, age standardized prevalence rate. full color online

related disabilities represent a great burden as result of the rapidly growing population. From 1981 to 2017, the pace of global population growth has been largely linear, increasing by an average of 83.6 (95% UI, 79.8–87.5) million people per year.[8] Much of the increase occurred in South Asia, sub-Saharan Africa, Latin America, Caribbean, North Africa, and the Middle East, mainly developing regions.[9,10] On the other hand, the low fertility and low mortality result in a slow population increase but aging structure in high-income countries.[8] Global life expectancy increased from 65.4 (95% UI, 65.0–65.8) years in 1990 to 73.5 (95% UI, 72.8–74.3) years in 2019.[10] As the incidence and YLD rates of SCI increase with age, high-income countries will also face great challenges in alleviating SCI related burden. Overall, both developed and developing countries faced severe health burden caused by SCI.

Among all the injury sites, SCI at the neck level had more incident and prevalent cases, and resulted in more disabilities. It was reported that cervical SCI accounts for over 50% traumatic SCIs and the morbidity was much higher than injuries at thoracic and lumbar level.[11] Multiple organ dysfunctions often occurred after traumatic SCI, in which cardiovascular system and respiratory system frequently fail, thus causing deaths after SCI.[11] Another study called for more attentions on pediatric cervical SCI, because up to 80% of spine injuries occur in the cervical region in children compared with 30% in adult.[12] The cervical SCI in children and adolescents can be directly caused by contact sports. Among 468 sports-related cervical fractures, 103 patients had cervical cord injuries.[12] High cervical injury incidences in children may be probably caused by the greater head to body ratio and relatively underdeveloped paraspinal

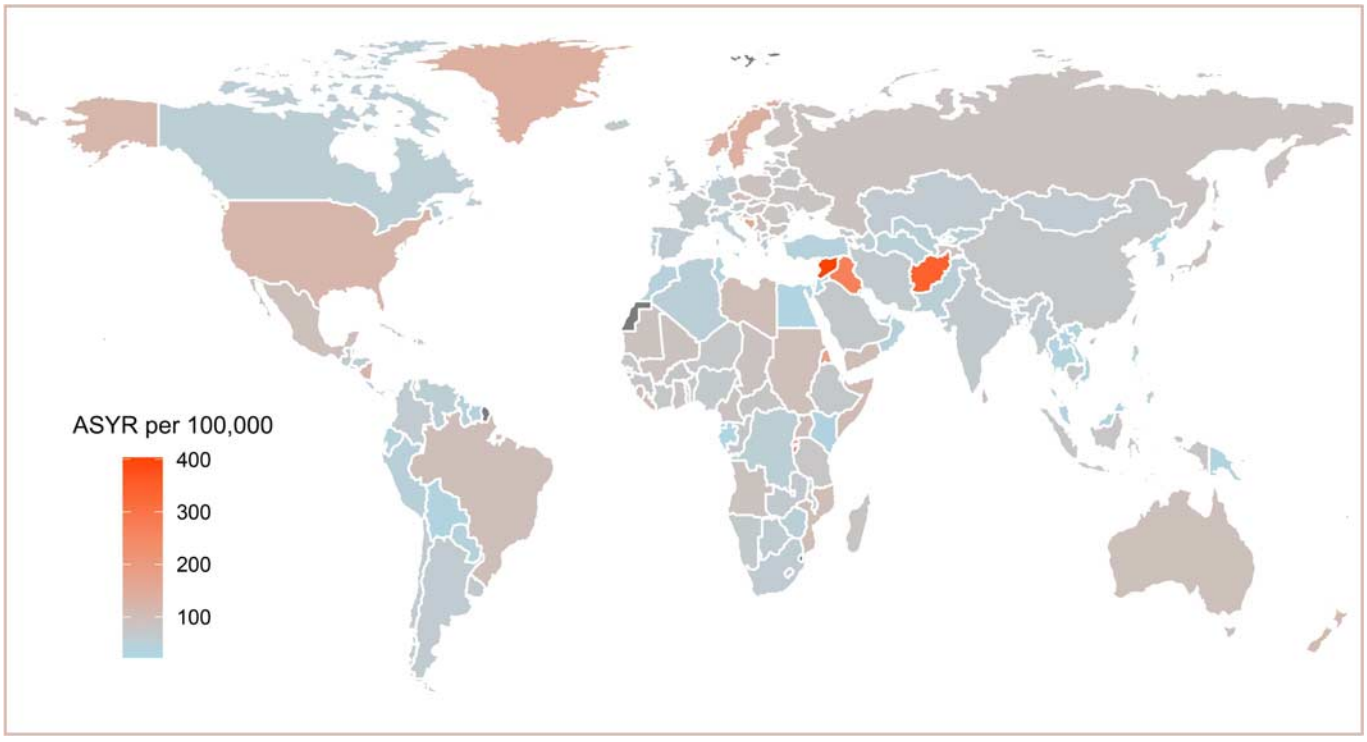

Figure 2. ASYR of spinal cord injury in 2019 in 204 countries and territories, for both sexes. ASYR indicates age standardized YLD rate; YLD, years lived with disability. full color online

musculature.[12,13] Surprisingly, it has been also reported that 1 in 60,000 newborns are complicated by SCI as a consequence of prolonged delivery and abnormal position of the neonate during delivery. Damage to the cervical spinal cord can lead to paralysis and respiratory compromise, which could be fatal.[13]

With respect to age and sex, elderly and male people had higher incidences and were more burdened by SCI than

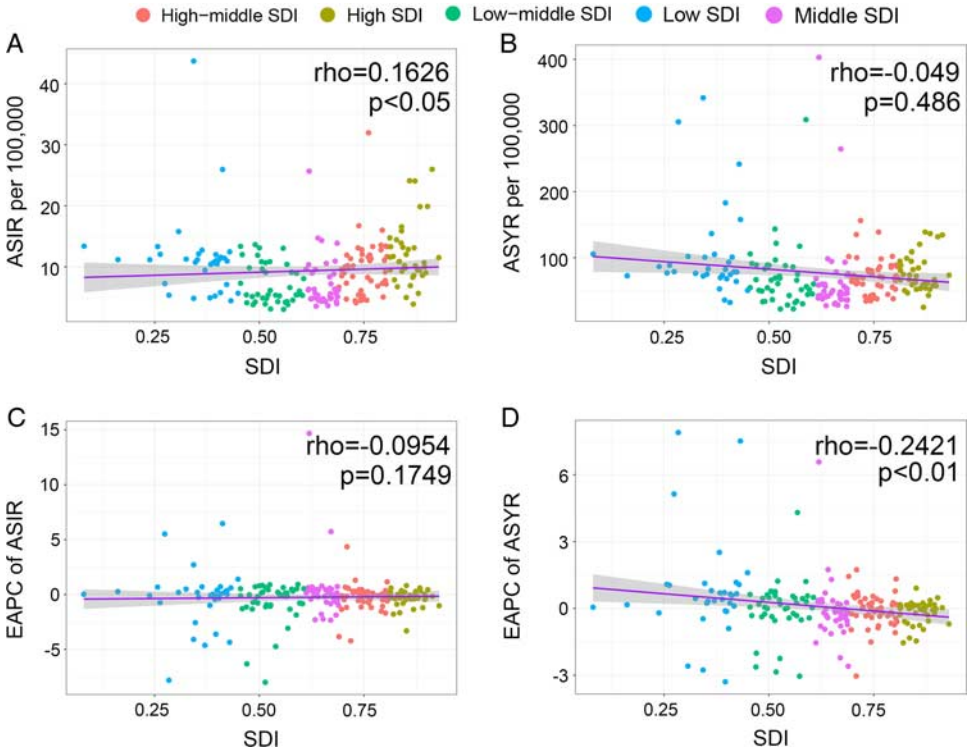

Figure 3. (A-D) The correlation between age standardized incidence rate, age standardized YLD rate, EAPC of spinal cord injury, and SDI. EAPC indicates estimated annual percentage change; SDI, socio-demographic index; YLD, years lived with disability. full color online

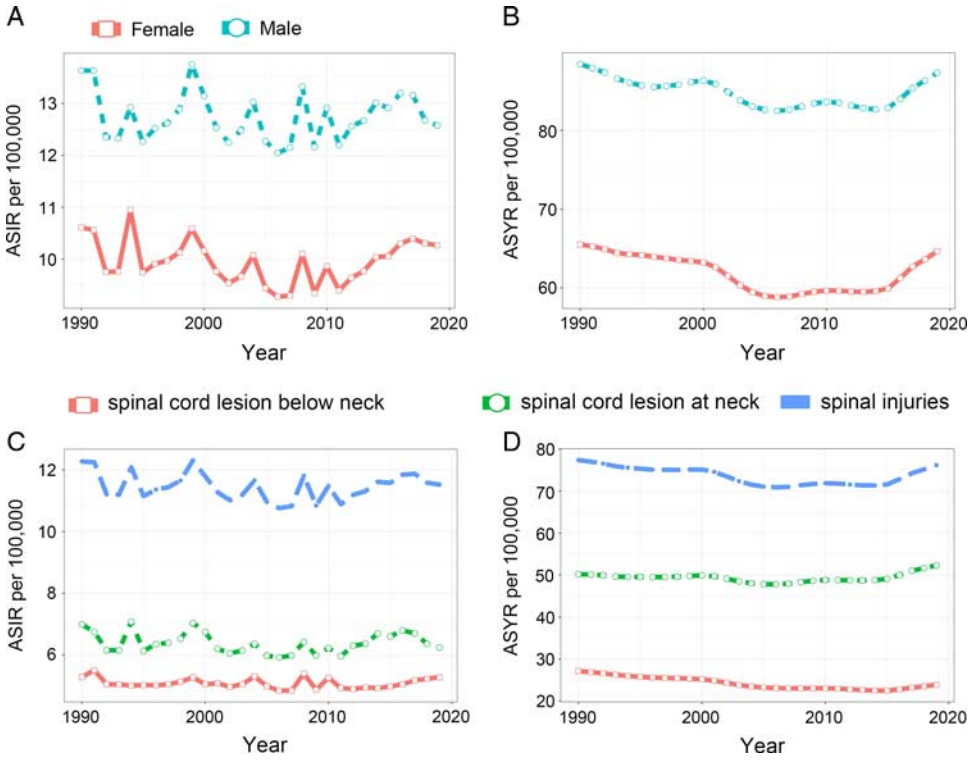

Figure 4. (A-D) ASIR and years lived with disability rate of spinal cord injury by sexes and injury sites from 1990 to 2019. ASIR indicates age standardized incidence rate; ASPR, age standardized prevalence rate. full color online

young and female people. With population aging, the mean age of patients with SCI increased from 28.3 years during the 1970s to 37.1 years in 2008 in the United States, and increased from 26.0 years before 2003 to 37.9 years after 2009 in Brazil.[14] The elderly tended to have SCI mainly because of the underlying health conditions. Present cohort study suggested that increased life expectancy was also accompanied by increased incidence of osteoporosis, spinal stenosis and high probability of fall-induced injuries, increasing the risk of SCI.[15] Falls and falls-induced injuries

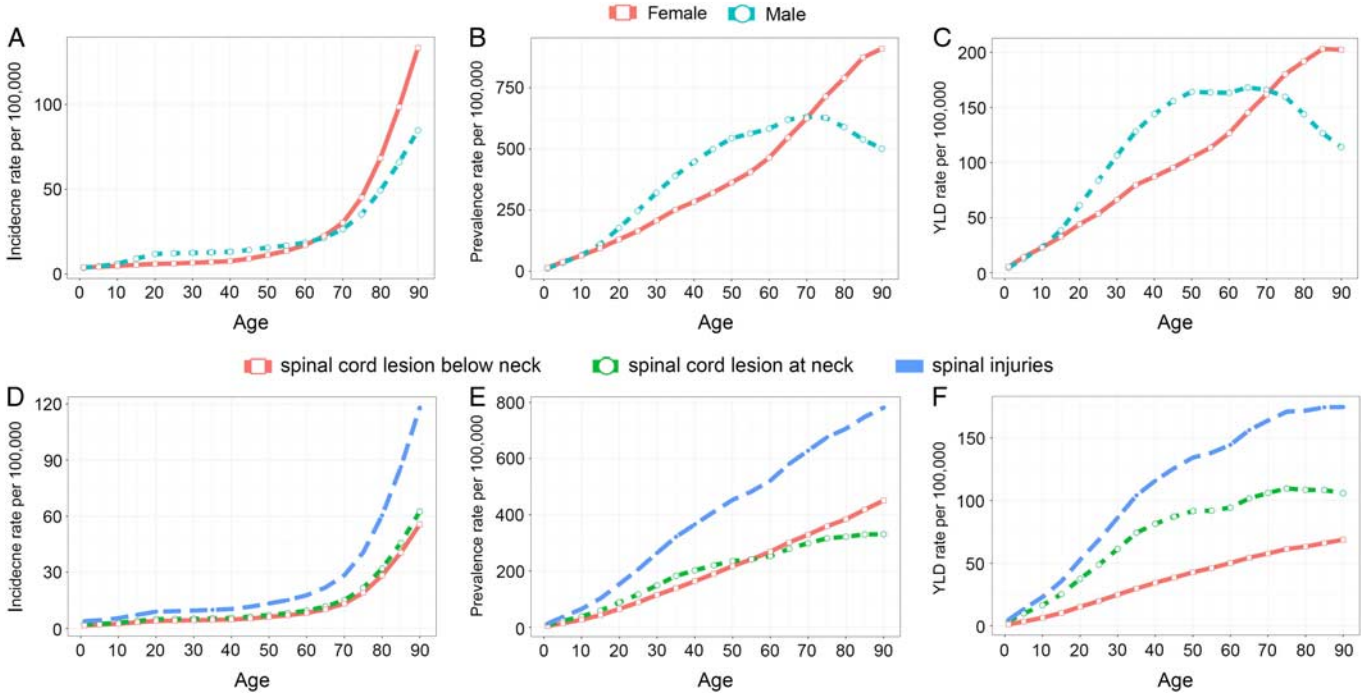

Figure 5. (A-F) The incidence, prevalence and YLD rate of spinal cord injury at all ages by sexes and injury sites in 2019. YLD indicates years lived with disability. full color online

were common in elderly population and increased with age. Due to the decreased physical function and health condition, the elderly was more likely to fall and then have fractures, SCIs or other injuries. Regular exercise, vitamin D and calcium supplementation were suggested to prevent the falls and injuries.[16] The incidence and YLD rates of SCI in men were nearly 2 times of those in women, which was consistent with the male/female ratios ranging from 1.6 to 8 in SCI worldwide as formerly reported.[14] Male people are at higher risk of SCI possibility because of more frequent participation in social and high-energy sport activities, while women devote more to domestic activities and sedentary life, protecting them from injury.[14] The incidence of SCI in children and adolescents has also been reported by other researchers. In a study in Taiwan, male children are more likely to have SCI than females, and young teenagers are more likely to have SCI than preschool children. Children in families of lower socioeconomic status are also more likely to have SCI.[17]

We noticed that ASIR was positively correlated with SDI, but ASYR was negatively associated with SDI, which suggested that low SDI countries had lower incidence but higher burden from SCI. This may result from the more common high-energy activities in high SDI regions. However, high SDI regions also have better medical education and doctor training and could offer better medical services to reduce disabilities. Moreover, social relationships and social status are also powerful determinants of individual health, and high SDI regions could provide more social supports and welfare, contributing to better recovery.[18] The welfare and social policies in high SDI regions could, to a great extent, diminish the considerable financial gap between people with and without a disability. On the contrary, the higher burden in low-SDI countries may result from the prehospital emergency system and poor health care conditions.

This study is limited to the general defects of GBD study. The primary limitation is the access to the raw data. Disease materials were not available in all the countries, and due to the diversity of data resources, the standards for identifications and measurements may vary and result in bias. The results presented here were mainly from the modeled data through the process in DisMod-MR 2.1 tool, which can be affected by the quality of data used to conduct the predicting tool. Even so, GBD study offers advanced methodology and extensive and comprehensive data. This study still has high value in evaluating the disease burden.

CONCLUSIONS

With population growth worldwide, the global incidence, prevalence, and YLD of SCI increased, while the ASIR, ASPR, and ASYR decreased between 1990 and 2019. Males and the elderly were impacted by SCI to a greater degree than females and the young. Cervical SCI carried the most severe consequences in terms of the impact on disability. Further development, in terms of effective measures to prevent and manage SCI remain critical in order to manage the growing population of patients with SCI.

➢ Key points

- ❑ Globally, there were 0.9 million incident cases, 20.6 million prevalent cases and 6.2 million YLDs of total SCI in 2019. The ASPR increased, while the ASIR and ASYR decreased.
- ❑ Males had higher ASIR and ASYR in all years from 1990 to 2019. The rate of incidence, prevalence and YLD increased with age.
- ❑ Spinal injuries at neck level caused higher ASYR than injuries below neck level.
- ❑ A positive correlation existed between SDI and ASIR, while a negative correlation was observed between SDI and EAPC of ASYR.

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