

Incidence of multiple sclerosis and neuromyelitis optica spectrum disorder in China: a national population-based study

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Background

Multiple sclerosis (MS) and Neuromyelitis Optica Spectrum Disorder (NMOSD) are leading causes of disability among young adults and lead to considerable social and economic burdens. Data of MS and NMOSD incidence in China at the national level is lacking.

Methods

Data sources and collection The Hospital Quality Monitoring System (HQMS), was launched in 2011. It is a nationwide mandatory database covering all 1665 tertiary hospitals and is maintained by National Health Commission of China. As part of China's health system reform, the HQMS is designed to monitor the quality of medical care as well as provide metrics for performance appraisal of all tertiary public hospitals. The database is designed to link hospital information systems and automatically compile the inpatient medical record of every public tertiary hospital.

Study population We retrieved 240,401 hospitalization records from the HQMS database between 1st, January 2016 to 31st, December 2018 based on the diagnosis of inflammatory demyelinating disease (IDD). The study population (denominator) included the entire population, from all ages throughout 2016 to 2018, according to annual reports of the National Bureau of Statistics of China which provides precise and in-depth information on China's mainland patient population.

Case ascertainment MS was defined by the 2010 International Panel criteria for MS and was identified by ICD-10 code (G35.0). NMOSD was defined according to the ICD-10 code (G36.0), diagnosis is based upon the 2015 International Panel for Neuromyelitis Optica Diagnosis criteria. HQMS requires a Quality Assurance Physician and coder for each medical record, the former reviews the diagnosis, and the coder affirms the ICD-10 code.

Results

We identified 33,489 hospital admissions for 17,416 patients of NMOSD from 2016 to 2018 (**Figure 1**). We identified 27,336 hospital admissions for 15,060 MS patients from 2016 to 2018; amongst these patients, 9,879 were newly diagnosed. For NMOSD, 33,489 hospital admissions for 17,416 patients were identified and 11,973 were newly diagnosed.

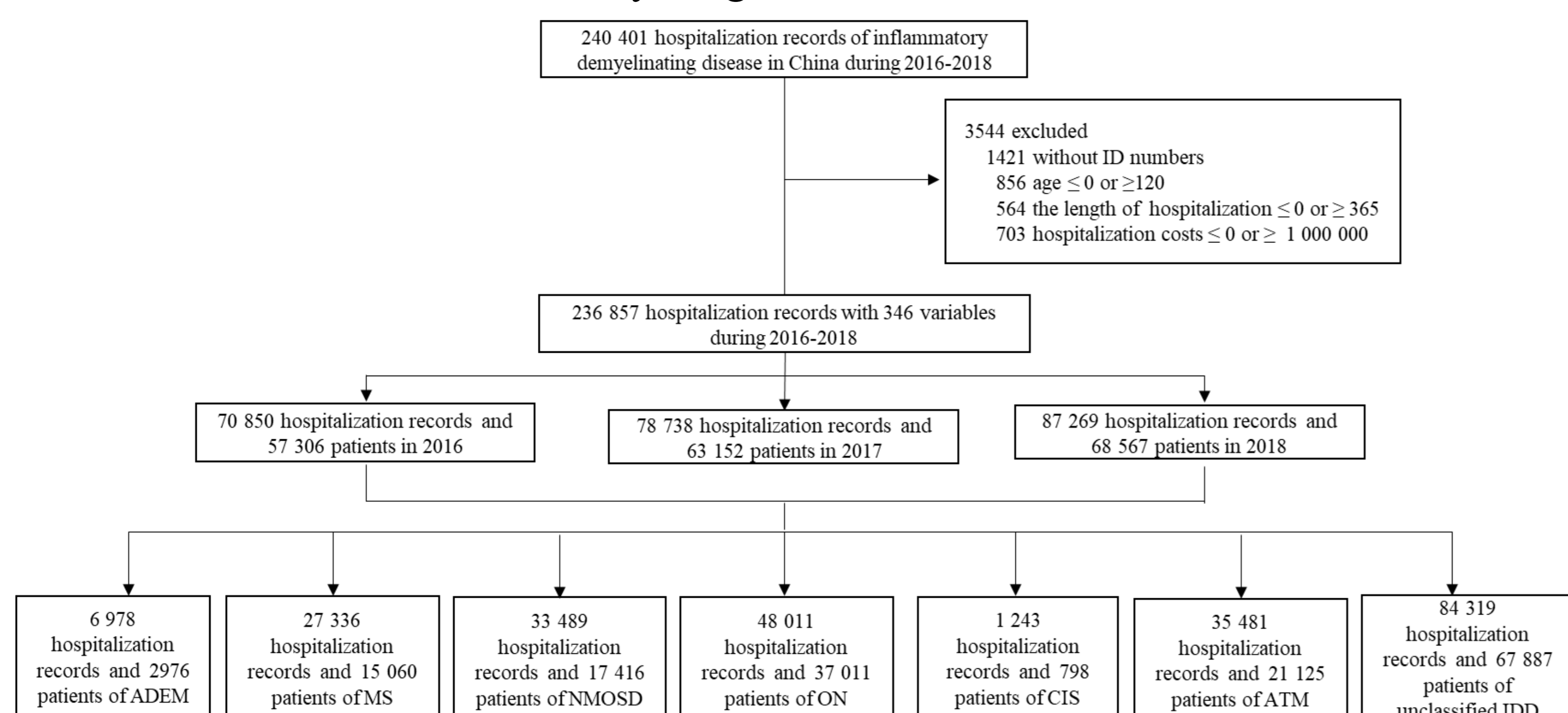


Figure 1. The incidence of MS and NMOSD in China: flowchart of study population selection. ADEM: acute disseminated encephalomyelitis; ON: optic neuritis; ATM: acute transverse myelitis; uIDD: unclassified IDD. MS: multiple sclerosis; NMOSD: neuromyelitis optica spectrum disorders; ADEM: acute disseminated encephalomyelitis; ON: optic neuritis; ATM: acute transverse myelitis; uIDD: unclassified IDD.

This study includes a total of 1665 tertiary hospitals in 31 provinces and municipalities throughout mainland China and excludes special administrative zones of Hong Kong and Macau (**Figure 2**).

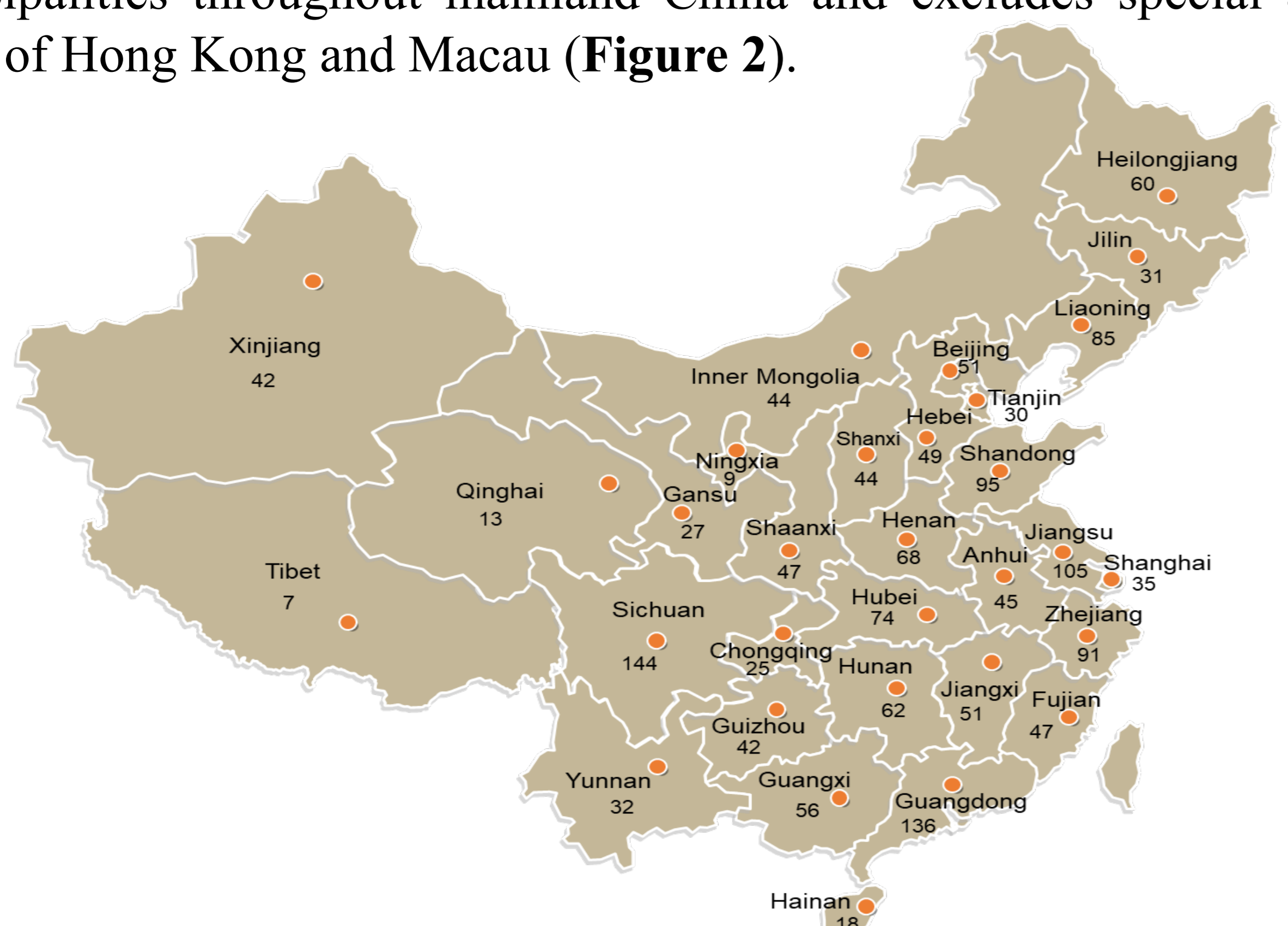


Figure 2. The number and geographical distribution of tertiary hospitals in this study. The study was conducted in mainland China. Hong Kong and Macao were not included.

Disclosure and Conflict of Interest

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Conflict of Interest: None.

Incidence of MS in China 27,336 hospital admissions from 15,060 MS patients in 2016 to 2018 were identified for evaluation (**Figure 1**). Amongst these patients, 9,879 people with MS were newly diagnosed: 3,917 in 2016, 3,107 in 2017, and 2,855 in 2018. The age- and sex-adjusted incidence of MS in Chinese was estimated as 0.235 (95% confidence interval [CI] 0.230-0.240) per 100,000 person years during the study period. The estimated crude incidence in the context of geographic distribution varied from 0.049 (95% CI 0.006-0.093) in Tibet (30° N) to 0.541 (95% CI 0.488-0.593) in Inner Mongolia (40° N). The global spatial correlation analysis of MS incidence data for 2016-2018 shows that the distribution of MS incidence is dispersed rather than randomly distributed (Moran's $I > 0$, $P > 0.05$, $Z < 1.96$). Inner Mongolia was a high incidence cluster from 2016-2018; Guangdong was a high-incidence gathering place in 2016; Jiangxi, Fujian, Jiangsu and Shanghai were low-value gathering places in 2016, and Anhui and Shanghai were low-value gathering places in 2017 (appendix). The risk of MS is lower in mid-latitudes ($\beta = -0.203$, standard error (SE) = 0.05, $p < 0.05$) and low-latitudes ($\beta = -0.135$, SE = 0.05, $p < 0.05$) compared to high-latitudes. The incidence of the low-altitude eastern regions compared with the high-altitude western regions, find that residents in lower-altitude areas were less likely to develop MS ($\beta = -0.145$, standard error (SE) = 0.04, $p < 0.01$) (**Figure 3**).

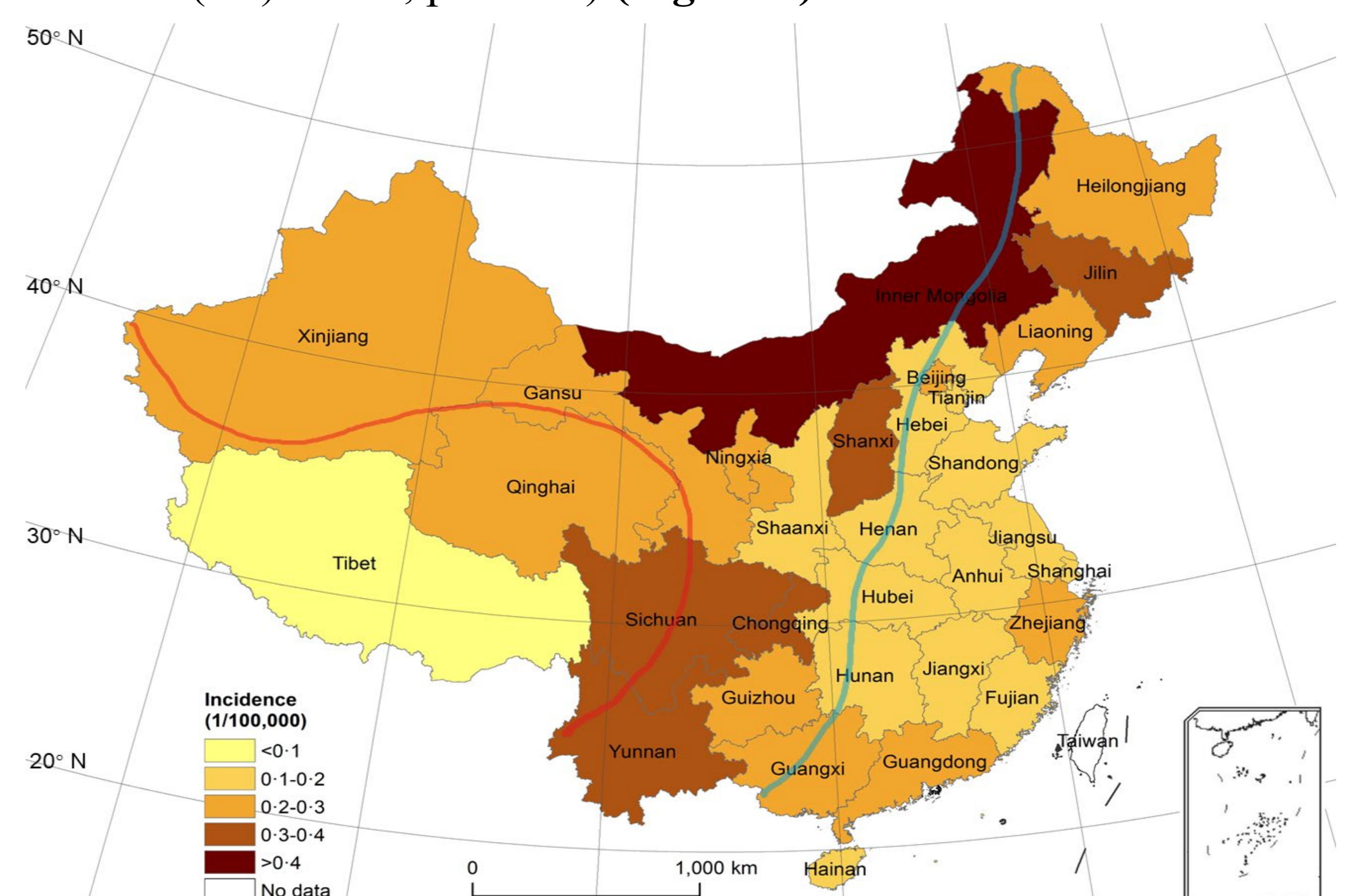


Figure 3. Incidence map of MS in China, 2016-2018. The study was conducted in mainland China. Hong Kong and Macao were not included.

Incidence of NMOSD in China We identified 33,489 hospital admissions for 17,416 patients of NMOSD from 2016 to 2018. Amongst these patients, 11,973 people with NMOSD were newly diagnosed: 3796 in 2016, 3923 in 2017, and 4254 in 2018. The overall crude incidence of NMOSD in the Chinese is 0.287 (95% CI, 0.282-0.292) per 100,000 person years during the study period, with 0.074 (0.069-0.08) in children, and 0.347 (0.341-0.354) in adults. The age and sex adjusted incidence per 100,000 person years was 0.278 (95% CI, 0.273-0.283), with 0.075 (0.069-0.08) in children and 0.347 (0.34-0.353) in adults. The incidence of NMOSD in adults is significantly higher than children ($p < 0.001$). Table 1. summarizes the incidence of NMOSD in these different age groups. The peak incidence was among those aged 45-65 years, range from 0.431 (95% CI, 0.41-0.452) to 0.462 (95% CI, 0.44-0.485). A female pre-dominance was observed, where the female to male ratio was 4.71 (95% CI, 4.50-4.94, $p < 0.001$). The latitude gradient discovered for MS risk was not seen in NMOSD in our study ($B = -0.002$, $p = 0.306$).²¹ The estimated crude incidence of NMOSD per 100,000 person-years varied from 0.159 (0.081-0.237) in Tibet (latitude 30° N) and 0.155 (0.132-0.178) in Heilongjiang (latitude 46° N) to 0.416 (0.383-0.449) in Guangxi (latitude 23° N) and 0.425 (0.387-0.463) in Shanxi (latitude 36° N) (**Figure 4**).

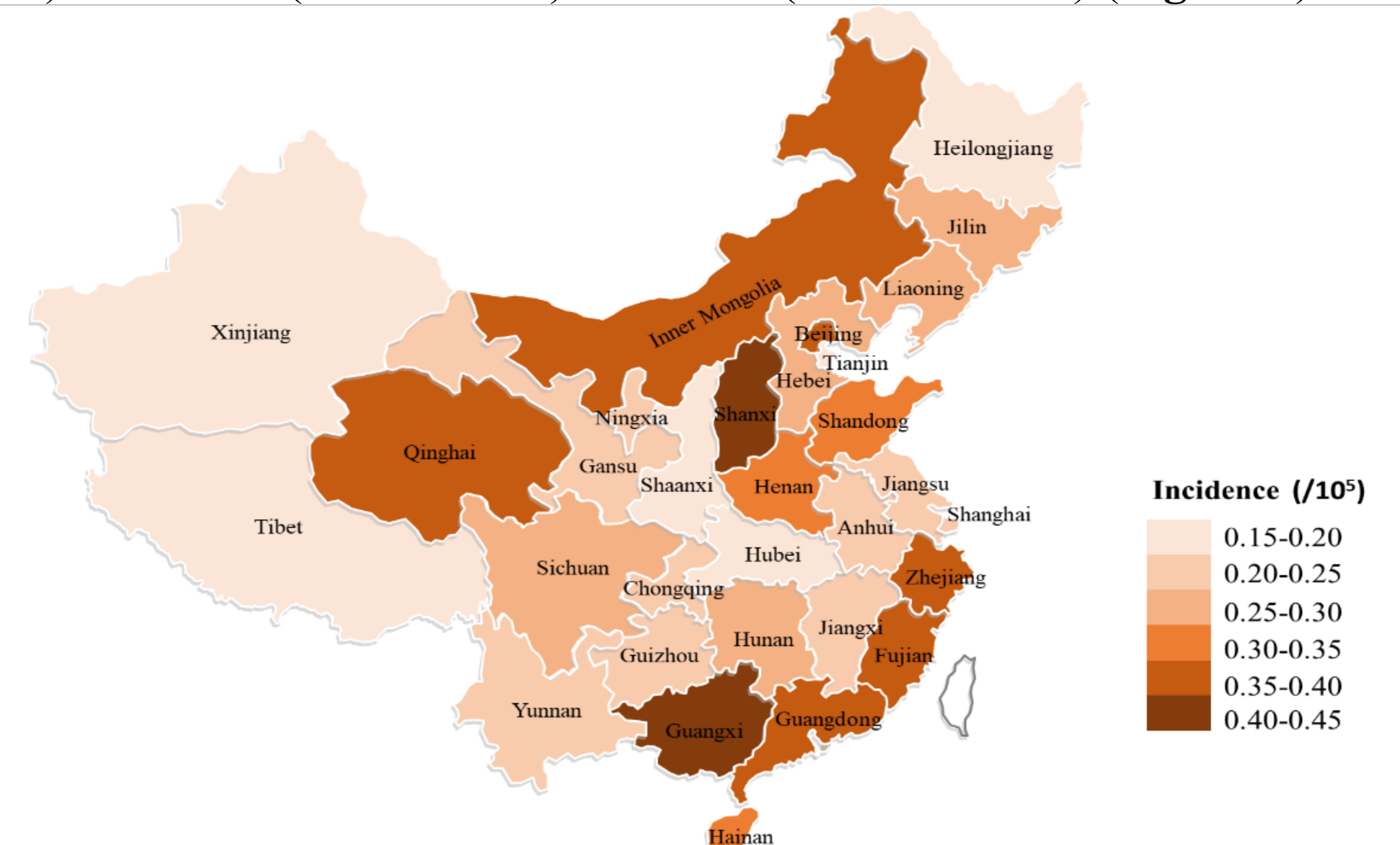


Figure 4. Incidence map of NMOSD in China, 2016-2018. The study was conducted in mainland China. Hong Kong and Macao were not included.

Conclusion and Limitations

For the first time, we obtain the national incidence of MS and NMOSD as 0.235 and 0.278 per 100,000 in China mainland. The ratio of NMOSD to MS among the Chinese was 1.21:1.0. The geographical distribution of MS incidence presented a north-south latitude gradient and a west-east altitude gradient.

Limitations: As some milder cases of MS and NMOSD may have been missed, the incidence of MS and NMOSD may be underestimated in this study.