Journal of Clinical and Nursing Research, 2024, Volume 8, Issue 12
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Analysis of Neonatal Disease Burden in China from 2012 to 2021 Based on the 2021 Global Burden of Disease Data

Feng Jin*, Limin Xie, Huimin Li, Guocheng Wang, Yu Pan, Cuijia Wang

Shunyi Maternal & Children's Hospital of Beijing Children's Hospital, Beijing 101300, China

Corresponding author: Feng Jin, jinfeng78987@126.com

Abstract: This study aimed to provide a reference basis for the prevention and treatment of neonatal diseases in China by examining the incidence of neonatal diseases across three dimensions: trend, region, and gender. Using the 2021 Global Burden of Disease (GBD) database, data on the incidence rates of neonatal premature birth, neonatal encephalopathy due to birth asphyxia and trauma, hemolytic disease and other neonatal jaundice, and neonatal sepsis and other neonatal infections from 2012 to 2021 were collected. The incidence rates of neonatal diseases in China demonstrated a steady decline over the decade. The rates for the four categories of diseases decreased by 1.55%, 7.97%, 26.96%, and 26.53%, respectively. The average incidence rates for these disease categories in China were 16,522.28/10^5, 849.15/10^5, 434.16/10^5, and 218.62/10^5, respectively, which were 56.04%, 14.6%, 83.87%, and 23% lower than the global averages. Regarding gender, the risk of neonatal diseases was higher in males than in females. Male patients accounted for 56%, 60%, 55%, and 63% of cases for the four disease categories, exceeding the global male patient proportions. The findings indicate that while the incidence rates of neonatal diseases in China continue to decline steadily, there remains a significant gap compared with developed countries. Furthermore, the significantly higher incidence rates in male newborns warrant further investigation.

Keywords: Incidence; Neonatal disease; GBD data; Prediction; China

Online publication: December 30, 2024

1. Introduction

The health of newborns is crucial for the development of a country and its society, prompting global attention to the burden of neonatal diseases [1]. Common neonatal diseases primarily include neonatal premature birth, neonatal encephalopathy due to birth asphyxia and trauma, hemolytic disease and other neonatal jaundice, and neonatal sepsis and other neonatal infections.

Neonatal premature birth is closely associated with factors such as premature rupture of membranes, abnormal amniotic fluid, twin or multiple pregnancies, maternal health conditions, umbilical cord entanglement

or prolapse, advanced maternal age, placenta previa, and placental aging [2,3], which can significantly increase the risk of neonatal mortality [4]. Neonatal encephalopathy due to birth asphyxia and trauma often results from conditions such as pregnancy-related toxicity, prolonged gestation, or premature rupture of membranes, and is frequently accompanied by umbilical cord complications [5,6]. This condition can lead to damage to vital organs, including the myocardium and kidneys [7].

Hemolytic disease and other forms of neonatal jaundice are often linked to genetic factors [8], with anemia and jaundice being the primary clinical manifestations [9]. Severe cases may require interventions such as exchange transfusions [10]. Neonatal sepsis and other neonatal infections involve a systemic inflammatory response triggered by pathogens invading the bloodstream, proliferating, and producing toxins [11]. Symptoms typically include changes in body temperature, reduced responsiveness, jaundice, and other clinical indicators [12-15].

Existing research on neonatal diseases often focuses on specific regions and time frames [16,17], limiting its ability to provide a comprehensive overview of the overall neonatal disease burden [18].

This study collected extensive data on neonatal disease burden in China from 2012 to 2021 and conducted a comparative analysis with global incidence data. This approach aims to evaluate the overall burden and trends of neonatal diseases in China, providing valuable references for clinical diagnosis, treatment, and prevention of neonatal diseases.

2. Materials and methods

2.1. Clinical data

The data for this study were sourced from the 2021 Global Burden of Disease (GBD) database (https://www.healthdata.org/). The GBD database provides a comprehensive analysis, modeling, and calculation of the global burden of neonatal diseases, reporting incidence rate data for four types of conditions: premature birth, asphyxia, hemolytic diseases, and septicemia. The database includes an interface that allows classification and tabulation of data such as incidence rates, prevalence rates, and other metrics by country, gender, disease type, and year.

For this study, incidence rate data for four categories of neonatal diseases in China, Japan, and the world were collected for the period from 2012 to 2021. These diseases include neonatal premature birth, neonatal encephalopathy due to birth asphyxia and trauma, hemolytic disease and other neonatal jaundice, and neonatal sepsis and other neonatal infections. Data were categorized by year and gender for analysis.

2.2. Method

Excel software was used for data collation and analysis. Trend charts illustrating changes in incidence rates were created based on disease type, region, and gender. The average incidence rate of each disease, the gender-specific average incidence rates, and the proportion of change in incidence rates were calculated using the software's tools.

First, the temporal trends in incidence rates for the four diseases were analyzed using time-series data, with scatter charts created and trends calculated via linear regression analysis. Second, incidence rates of neonatal diseases in China were compared with those in Japan and the global average based on regional classification. Third, a comparative analysis of incidence rates between male and female neonates was conducted by gender. A P-value of < 0.05 was considered statistically significant.

3. Results

3.1. Trend analysis of disease incidence

The incidence rates of neonatal diseases in China from 2012 to 2021 were analyzed, focusing on four conditions: neonatal premature birth, neonatal encephalopathy due to birth asphyxia and trauma, hemolytic disease and other neonatal jaundice, and neonatal sepsis and other neonatal infections. The incidence rate trends are illustrated in Figure 1, with the horizontal axis representing the year and the vertical axis denoting disease incidence rates. Over the decade, the incidence rates of all four diseases exhibited a gradual decline. Among these, the trends for neonatal premature birth and encephalopathy displayed fluctuations, while the decreases in hemolytic disease and neonatal sepsis showed relative stability. Specifically, the incidence rates for neonatal premature birth, neonatal encephalopathy, hemolytic disease, and neonatal sepsis decreased by 1.55%, 7.97%, 26.96%, and 26.53%, respectively, over 10 years.

Linear regression analysis was employed to model the trends, with time as the independent variable and incidence rate as the dependent variable. Table 1 presents the model parameters, which were all statistically significant. The annual average reduction rates for neonatal premature birth, neonatal encephalopathy, hemolytic disease, and neonatal sepsis were calculated as $10.614/10^5$, $9.297/10^5$, $2.42655/10^5$, and $1.87497/10^5$, respectively, based on the regression slopes.

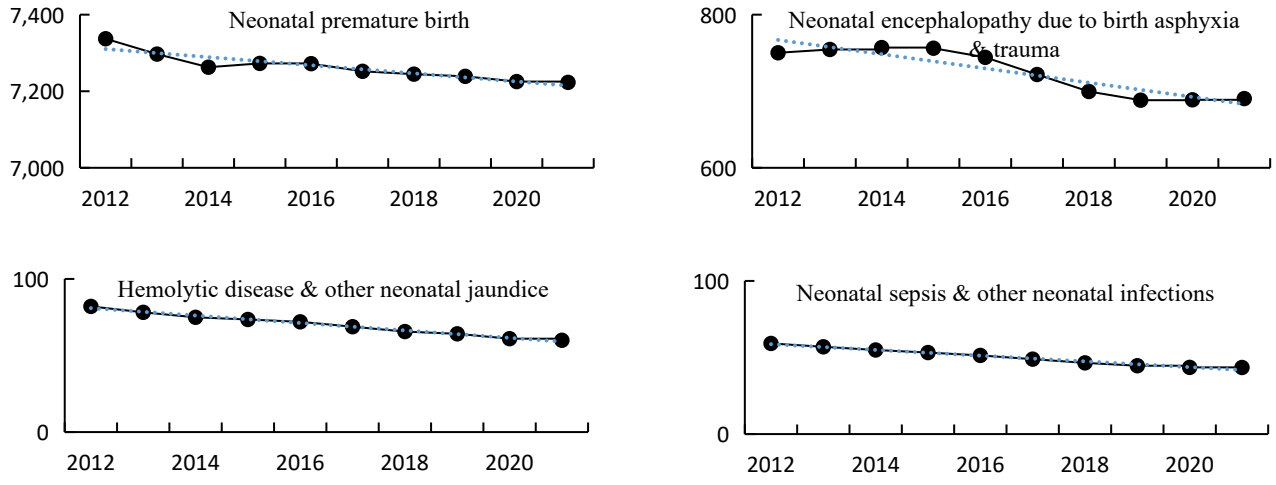

Figure 1. Incidence rate trends of four neonatal diseases in China

Table 1. Linear regression analysis results of the incidence rates for the four neonatal diseases

Neonatal diseases	Parameters of the model			
	Coef. (Year)	Coef. (_cons)	*P*-value	R-squared
Neonatal premature birth	-10.614	28,666.407	0.0001292	0.8548
Neonatal encephalopathy due to birth asphyxia and trauma	-9.297	19,473.191	0.0001448	0.8507
Hemolytic disease and other neonatal jaundice	-2.42655	4,963.14891	2.625e-09	0.9901
Neonatal sepsis and other neonatal infections	-1.87497	3,831.15139	2.302e-08	0.983

3.2. Regional comparative analysis

The study compared neonatal disease incidence rates in China with global data and Japan to assess the national burden of disease. Figure 2 depicts a bar chart illustrating the comparison across regions.

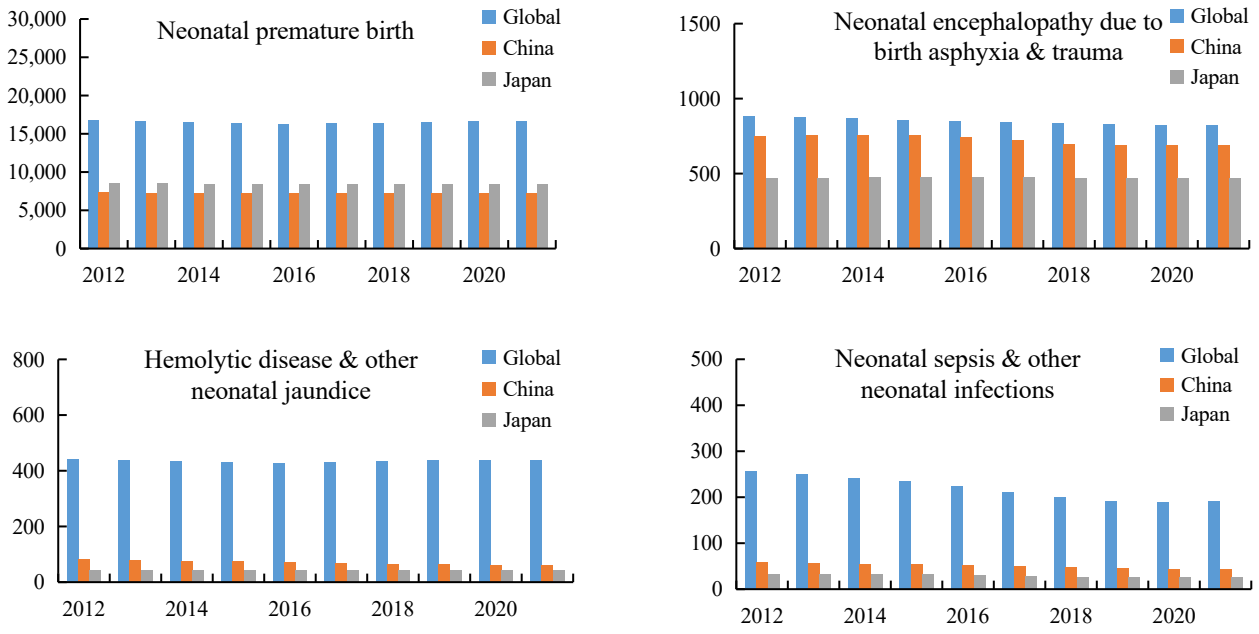

Figure 2. Comparison of incidence rates for the four neonatal diseases across China, Japan, and the global average

From 2012 to 2021, the average incidence rates in China for neonatal premature birth, neonatal encephalopathy, hemolytic disease, and neonatal sepsis were 7,262.54/10^5, 725.12/10^5, 70.02/10^5, and 43.48/10^5, respectively. Globally, the corresponding figures were 16,522.28/10^5, 849.15/10^5, 434.16/10^5, and 218.62/10^5, while in Japan, they were 8,472.84/10^5, 472.34/10^5, 42.20/10^5, and 28.97/10^5, respectively.

The incidence rates in China were significantly lower than global levels, with reductions of 56%, 15%, 84%, and 80% for neonatal premature birth, encephalopathy, hemolytic disease, and neonatal sepsis, respectively. However, compared to Japan, the incidence of neonatal premature birth in China was 14% lower, while the rates of encephalopathy, hemolytic disease, and neonatal sepsis were higher by 54%, 66%, and 50%, respectively.

3.3. Gender comparative analysis

Gender differences in neonatal disease incidence rates were examined, showing that male neonates in China consistently had higher rates than females. The incidence rates for neonatal premature birth, neonatal encephalopathy, hemolytic disease, and neonatal sepsis among male neonates were 8,119.58/10^5, 860.54/10^5, 76.27/10^5, and 61.76/10^5, respectively, accounting for 56%, 60%, 55%, and 63% of total cases. Female neonates, in contrast, accounted for 44%, 40%, 45%, and 37% of these cases.

Globally and in Japan, similar patterns were observed, as detailed in Table 2. For instance, the global incidence rates for neonatal premature birth among males and females were 18,338.73/10^5 and 14,570.49/10^5, respectively. In Japan, the rates were 9,414.78/10^5 for males and 7,482.36/10^5 for females. This trend highlights the higher disease burden in male neonates across different regions.

Table 2. Comparative analysis of average incidence rates of neonatal diseases by gender in China, Japan, and globally

Index	Neonatal diseases	China		Global		Japan	
		Male	Female	Male	Female	Male	Female
Incidence ($/10^5$)	Neonatal premature birth	8,119.58	6,259.23	18,338.73	14,570.49	9,414.78	7,482.36
	Neonatal encephalopathy due to birth asphyxia and trauma	860.54	566.59	691.51	602.03	578.24	360.97
	Hemolytic disease and other neonatal jaundice	76.27	62.71	439.59	428.33	42.6	41.77
	Neonatal sepsis and other neonatal infections	61.76	36.83	263.35	170.55	33.39	24.32
Percentage	Neonatal premature birth	56%	44%	56%	44%	56%	44%
	Neonatal encephalopathy due to birth asphyxia and trauma	60%	40%	53%	47%	62%	38%
	Hemolytic disease and other neonatal jaundice	55%	45%	51%	49%	50%	50%
	Neonatal sepsis and other neonatal infections	63%	37%	61%	39%	58%	42%

4. Discussion

This study analyzed the incidence rates of neonatal diseases in China from 2012 to 2019, focusing on neonatal premature birth, neonatal encephalopathy due to birth asphyxia and trauma, hemolytic disease and other neonatal jaundice, and neonatal sepsis and other neonatal infections. The findings indicate a declining trend in the incidence of these conditions, with hemolytic disease and neonatal sepsis showing the most significant reductions. Comparatively, the incidence rates in China are lower than the global average but remain notably higher than those of developed countries such as Japan. These findings suggest that while progress has been made, further efforts are required to reduce neonatal disease incidence in China to levels observed in advanced countries. Additionally, a consistent disparity was noted, with male neonates exhibiting a significantly higher incidence rate than females across China, the global average, and Japan.

The decline in neonatal disease incidence in China demonstrates substantial progress in prevention and treatment. Over the past decade, the incidence rates of neonatal premature birth, neonatal encephalopathy, hemolytic disease, and neonatal sepsis in China have decreased by 1.55%, 7.97%, 26.96%, and 26.53%, respectively. In comparison, global reductions were 0.41%, 6.99%, 0.83%, and 25.55%, respectively, while Japan experienced changes of 0.33%, -1.07%, 0.02%, and 23.33%, respectively. The linear regression model further indicates a steady downward trend in China, with projections suggesting continued improvements in the coming years.

Despite leading the global average in neonatal disease prevention and treatment, China still lags behind Japan and other advanced nations. Notably, the incidence rates of neonatal encephalopathy, hemolytic disease, and neonatal sepsis in China are 1.54 times, 1.66 times, and 1.50 times those in Japan, respectively. Considering the cultural, genetic, and geographic similarities between the two countries, Japan's achievements provide

valuable insights for enhancing neonatal disease prevention and treatment strategies in China. Based on the regression analysis, it is estimated that China could achieve incidence rates comparable to Japan within 10–20 years, provided sustained efforts are made.

Gender analysis reveals a higher risk of neonatal diseases among male newborns compared to females. In China, male newborns accounted for 56%, 60%, 55%, and 63% of cases of neonatal premature birth, neonatal encephalopathy, hemolytic disease, and neonatal sepsis, respectively. Globally, male newborns accounted for 56%, 53%, 51%, and 61% of cases, while in Japan, the figures were 56%, 62%, 50%, and 58%, respectively. The proportion of male newborns affected in China is significantly higher than the global average, warranting further research into the underlying causes of this disparity.

5. Conclusion

This study systematically analyzed neonatal disease incidence rates in China and compared them with global data and data from Japan. The results demonstrate a steady decline in the incidence rates of neonatal premature birth, neonatal encephalopathy due to birth asphyxia and trauma, hemolytic disease and other neonatal jaundice, and neonatal sepsis and other neonatal infections in China. However, despite this progress, there remains a significant gap between China and advanced countries such as Japan, emphasizing the need for further improvements in neonatal care and disease prevention in China.

The findings also highlight a higher proportion of male patients with neonatal diseases in China compared to the global average and Japan. This gender disparity requires further investigation to identify and address the specific underlying causes, ensuring more equitable health outcomes for neonates in the future.

Funding

This research is supported by the funds of the Shunyi District for Health Improvement and Research (Grant No. Wsjkfzkyzx-2023-q-05).

Disclosure statement

The authors declare no conflict of interest.

References

[1] Kang X, Niu X, Li Q, et al., 2024, Analysis of Disease Spectrum in 18,454 Hospitalized Newborns. Chinese Med Rec, 25(5): 49–52.

[2] Wang S, 2008, Clinical Factors Analysis of Premature Birth in Newborns. Chin Gen Pract, 6(9): 889–890.

[3] Wang W, Jin Z, Mao J, et al., 2003, The Main Factors of Premature Birth and Their Impact on Premature Infants: Clinical Analysis of 285 Cases. Chin J Pract Gynecol Obstet, 2003(2): 31–33.

[4] Jiang H, Chen C, 2024, Survival Status and Trends of Premature Infants of Different Gestational Ages. Chin J Perinat Med, 27(10): 865–870.

[5] Duan Y, 2024, Analysis of Factors Related to Neonatal Asphyxia. China Matern Child Health Care, 2024: 3–10.

[6] Zhang Y, Chen H, Tao F, 2022, Clinical Risk Factors of Neonatal Asphyxia: 246 Cases in Hefei City. J Clin Pathol

Med, 2022(2): 387–393.

[7] Wang Y, 2003, Related Factors and Complications of Neonatal Asphyxia. Chin J Reprod Health, 14(4): 357–361.

[8] Zhang B, Lu M, Zhai R, 2024, Study on the Relationship Between ABO Blood Type IgG Antibody Titers and the Occurrence of Hemolytic Disease of the Newborn. South China Prev Med, 50(4): 372–374.

[9] Wu Y, Kui F, Yang Y, 2020, Research Progress on Immune Hemolytic Diseases of Fetuses and Newborns. Chin J Perinat Med, 23(1): 8–13.

[10] Fan S, 2003, Hemolytic Diseases of Newborns. Pediatr Emerg Med, 10(5): 2–8.

[11] Chang L, 2006, Neonatal Sepsis. New Med, 2006: 52–53 + 59.

[12] Yu Y, 2024, Progress in Clinical Management of Neonatal Sepsis. Chin J Contemp Pediatr, 26(5): 518–522.

[13] Chen C, Chen C, Chen D, 2024, Clinical Characteristics and Related Factors of Neonatal Sepsis. Rare Dis J, 31(5): 113–114.

[14] Tu X, Tang M, Luo X, 2024, Establishment and Validation of a Predictive Model for 28-day Mortality Rate of Neonatal Sepsis. Chin Med Innov, 21(16): 10–15.

[15] Zhang S, Yang X, Lan J, et al., 2024, Clinical Characteristics of Neonatal Sepsis with Acute Kidney Injury. Med J Wuhan Univ, 45(8): 985–988.

[16] Shu L, Zheng J, Xiang L, 2023, Analysis of Screening for 11,224 Neonatal Diseases. Chin Sci Technol J Database (Med Health), 2023(8): 9–13.

[17] Yuan J, Zhao F, Wang J, et al., 2022, Clinical Characteristics and Epidemiological Investigation of 13,476 Critically Ill Newborns in Yinchuan City from 2014 to 2019. China Matern Child Health Care, 37(20): 3798–3802.

[18] Shao H, Liu W, He H, et al., 2015, Disease Burden and Trends of Neonatal Diseases in China from 1990 to 2010. Dis Surveill, 2015(8): 5–10.