



OPEN **Prevalence and influencing factors of medical disputes in the field of neonatology: a cross-sectional survey in the mainland of China**

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Neonatal pediatricians are facing relatively high risk of medical disputes since higher risk of mortality during the neonatal period caused by the increased number of premature births worldwide. However, there is little knowledge about the current status and distribution of medical disputes in Chinese neonatology. We conducted a cross-sectional survey to investigate the prevalence, potential causes, and associated risk factors of medical disputes in neonatology in the mainland of China. The statistical analysis was done by SPSS, including Chi-square test and independent samples t-test, Pearson correlation analysis and binary logistic regression analysis. Among the 12,118 participated neonatal pediatricians, 9,013 (74.4%) experienced medical disputes, and about 96% neonatal pediatricians older than 60 experienced medical disputes. A positive correlation was found between the prevalence of medical disputes and gross domestic product (GDP) per capita of the corresponding city or province. "Overestimation of treatment effects from the perspective of the patients and their families" was the primary cause of medical disputes. Gender, age, educational background, hospital level, and the number of responsible beds were independent risk factors contributing to medical disputes. Information obtained from this study may provide useful clues for reducing the occurrence of medical disputes in neonatology in the mainland of China.

Keywords Medical disputes, Neonatal pediatricians, Cross-sectional study

The neonatal period, globally defined as the first 28 days from birth, is the most vulnerable period in the life of a child^{1,2}. About 2.5 million neonates die per year, and most of these deaths occur in low- or middle-income countries and regions¹. Also, more than 50% of the deaths in children under 5 years of age occurred during the neonatal period². Even worse, the number of worldwide premature births keeps rising, annually accounting for more than 11% of live births³, and the corresponding complications approximately lead to 35% of neonate deaths⁴. With the technological progress in neonatology in the recent decade, the mortality rate in neonatal intensive care units (NICU) has decreased remarkably⁵, but neonatal pediatricians tend to face even higher challenges with the burden of preterm birth gradually increasing⁶.

With the implementation of the fertility policy adjustment in the mainland of China, the number of multiparous mothers or pregnant women over 35 years of age has increased markedly⁷, which may cause higher risk of pregnancy complications, and lead to higher risks of medical disputes^{6,8}. Meanwhile, the shortage of pediatricians has long been a worldwide problem, and especially in the mainland of China^{9,10}, which has placed heavier workload on pediatricians and might increase the risk of medical disputes. However, there is little knowledge about the current status and distribution of medical disputes in neonatology. The purpose of this cross-sectional survey was to clarify the prevalence, associated risk factors and potential causes of medical

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disputes among Chinese neonatal pediatricians, hoping that the results could provide useful references for policy making to reduce the occurrence of medical disputes and consequently optimize the practice environment.

Methods

Survey and research populations

This survey was organized and implemented by the Neonatologist Society of the Chinese Medical Doctor Association (CMDA), using convenience sampling method, as part of the Newborn Healthcare Resources Survey conducted in China¹¹. All methods were performed in accordance with the Declaration of Helsinki and relevant guidelines. The study protocol was reviewed and approved by the research ethics board of the Seventh Medical Center of the Chinese PLA General Hospital (Beijing, China; Approval No. [2018-12]). All participants were informed to constitute their informed consent of participation by completing and submitting the questionnaire. The survey was finalized after multiple discussions with modifications from the administrative and senior neonatal experts of the hospitals. The results were collected by using the self-administered online questionnaire platform named WJX, involving neonatal pediatricians in hospitals equipped with neonatal wards in 31 provinces of the mainland of China. The questionnaire was sent to every neonatal pediatrician (total number = 27,698) in mainland China¹¹, and the content of questionnaire can be found in the supplementary material.

All neonatal pediatricians including Medical Practitioner, Assistant Physician, Physician, Attending Physician, Associate Chief Physician and Chief Physician participate in the survey voluntarily from March to October 2019. In detail, Medical Practitioners are those who possess a minimum level of clinical experience, Assistant Physicians are those who possess a national certificate of physician assistant qualification, Physicians, Attending Physician, Associate Chief Physician and Chief Physician are those who possess a national certificate of physician qualification and they are authorized to prescribe. The medical disputes in our study represents all the disputes between doctors and patients (or the patients' relatives) arising from diagnosis, treatment activities, medical outcomes, medical services, and medical expenses.

The collected data included the basic demographic information (regions, gender, age, educational background, and the marital status) and work-related characteristics (hospital types and levels, professional titles, working years, and the number of responsible beds), and the occurrence of medical disputes. The occurrence of medical disputes was collected including the experience of any medical dispute and the main reason for medical disputes.

Statistical analysis

According to whether the neonatal pediatricians had personal experience of medical disputes or not, they were divided into group A (neonatal pediatricians who had experience of medical disputes) and group B (neonatal pediatricians who had no experience of medical disputes). Categorical variables are summarized using counts with percentages, and numerical variable are shown by the mean with standard deviation (SD). Differences in categorical variables between group A and B were compared by chi-square (χ^2) test; means between two groups were compared by independent samples t test. Pearson correlation analysis was used to analyze the distribution characteristics of medical disputes such as the correlation between the prevalence of medical disputes and gross domestic product (GDP) per capita of the corresponding city or province in 2019. Multivariate analysis was performed by binary logistic regression analysis with a stepwise selection approach employed to examine independent risk factors for medical disputes, with gender, age, region, educational background, marital status, hospital type, hospital level, and the number of responsible beds involved. Software SPSS (version 20.0 and 26.0) was used for data analysis.

Results

Descriptive analysis

A total of 12,118 neonatal pediatricians from 2,854 hospitals in 31 provinces of China participated in the current survey and submitted sufficient answers, which contained 43.75% of the total number of neonatal pediatricians nationwide (27,698). 8,581 females (70.8%) and 3,537 males were included, with a mean age of 36.97 years. Significant differences were found in gender, age, educational background, marital status, professional title, working years and the number of responsible beds between the neonatal pediatricians in group A and group B ($p < 0.05$) (Table 1).

Distribution characteristics of medical disputes

The distribution of medical disputes in neonatology in different regions of the mainland of China was shown in Fig. 1a. A positive correlation ($r = 0.444$, $p = 0.012$) was found between the prevalence of medical disputes and the level of gross domestic product (GDP) per capita of the corresponding city or province (Fig. 1b). Of the 12,118 included subjects, 9,013 (74.3%) experienced medical disputes. 60.5% of neonatal pediatricians aged below 30, 75.6% aged below 45 and 94.3% over 60 had experienced medical disputes. The overall percentage of experiencing medical disputes in male neonatal pediatricians was higher than that in females.

Independent risk factors of medical disputes

Given the close correlation of age with the professional title and working years of neonatal pediatricians, they were subjected to Pearson correlation analysis. The result showed that the correlation coefficient of the professional title and working years against age was 0.788 and 0.819 respectively, both of which were greater than 0.7, showing multicollinearity. Thus, the professional title and working years were excluded from multivariate regression analysis and only age was retained instead. The result of regression analysis showed that gender,

Characteristics	Group A (n=9013)	Group B (n=3105)	Total (n=12118)	p value
Gender				0.000
Male	2897 (32.1%)	640 (20.6%)	3537 (29.2%)	
Female	6116 (67.9%)	2465 (79.4%)	8581 (70.8%)	
Age	38.04±8.033	33.90±6.568	36.97±7.894	0.000
Region				0.154
Eastern	3471 (38.5%)	1149 (37.0%)	4620 (38.1%)	
Central	3081 (34.2%)	1056 (34.0%)	4137 (34.1%)	
Western	2461 (27.3%)	900 (29.0%)	3361 (27.8%)	
Educational background				0.000
Associate degree	364 (4.0%)	175 (5.6%)	539 (4.4%)	
Bachelor's degree	6626 (73.5%)	2194 (70.7%)	8820 (72.8%)	
Master's degree	1765 (19.6%)	678 (21.8%)	2443 (20.2%)	
Doctorate	258 (2.9%)	58 (1.9%)	316 (2.6%)	
Marital status				0.000
Unmarried	1071 (11.9%)	633 (20.4%)	1704 (14.1%)	
Married	7755 (86.0%)	2424 (78.0%)	10,179 (84.0%)	
Divorced	162 (1.8%)	43 (1.4%)	205 (1.7%)	
Widowed	25 (0.3%)	5 (0.2%)	30 (0.2%)	
Hospital type				0.609
Public	8680 (96.3%)	2984 (96.1%)	11,664 (96.3%)	
Private	333 (3.7%)	121 (3.9%)	454 (3.7%)	
Hospital level				0.181
Tertiary	5172 (57.4%)	1739 (56.0%)	6911 (57.0%)	
Non-tertiary	3841 (42.6%)	1366 (44.0%)	5207 (43.0%)	
Professional title				0.000
Physician or below	2929 (32.5%)	1734 (55.8%)	4663 (38.5%)	
Attending physician	3118 (34.6%)	968 (31.2%)	4086 (33.7%)	
Deputy chief physician or above	2966 (32.9%)	403 (13.0%)	3369 (27.8%)	
Working years				0.000
<1	303 (3.4%)	282 (9.1%)	585 (4.8%)	
1–5	2208 (24.5%)	1225 (39.5%)	3433 (28.3%)	
6–10	2278 (25.3%)	855 (27.5%)	3133 (25.9%)	
11–15	1491 (16.5%)	376 (12.1%)	1867 (15.4%)	
16–20	908 (10.1%)	146 (4.7%)	1054 (8.7%)	
>20	1825 (20.2%)	221 (7.1%)	2046 (16.9%)	
Responsible beds				0.000
<5	900 (10.0%)	424 (13.6%)	1324 (10.9%)	
5–10	4398 (48.8%)	1680 (54.1%)	6078 (50.2%)	
11–15	2063 (22.9%)	632 (20.4%)	2695 (22.3%)	
16–20	734 (8.1%)	180 (5.8%)	914 (7.5%)	
>20	918 (10.2%)	189 (6.1%)	1107 (9.1%)	

Table 1. Comparison of the basic and demographic information between neonatal pediatricians in group A and B. *p* values were calculated by chi-square test or independent sample t test.

age, educational background, hospital level, and the number of responsible beds were independent risk factors affecting the occurrence of medical disputes (Fig. 2).

Causes of medical disputes

Overall, the primary cause of medical disputes was “overestimation of treatment effects from the perspective of the patients and their families” (65.0%), following by “poor patient-doctor communication (13.9%), “improper publicity of media” (7.5%), “high medical expenses” (5.0%), and “other reasons” (8.6%). After further grouped by the independent risk factors of medical disputes, “overestimation of treatment effects from the perspective of the patients and their families” was the primary cause chosen by all the subgroups. “Poor patient-doctor communication” was the second cause of medical disputes chosen by all subgroups, except that the “age > 60” group chose “improper publicity of media” instead. The importance of “poor patient-doctor communication” to medical disputes had a positive relationship with educational background higher than having a bachelor's degree,

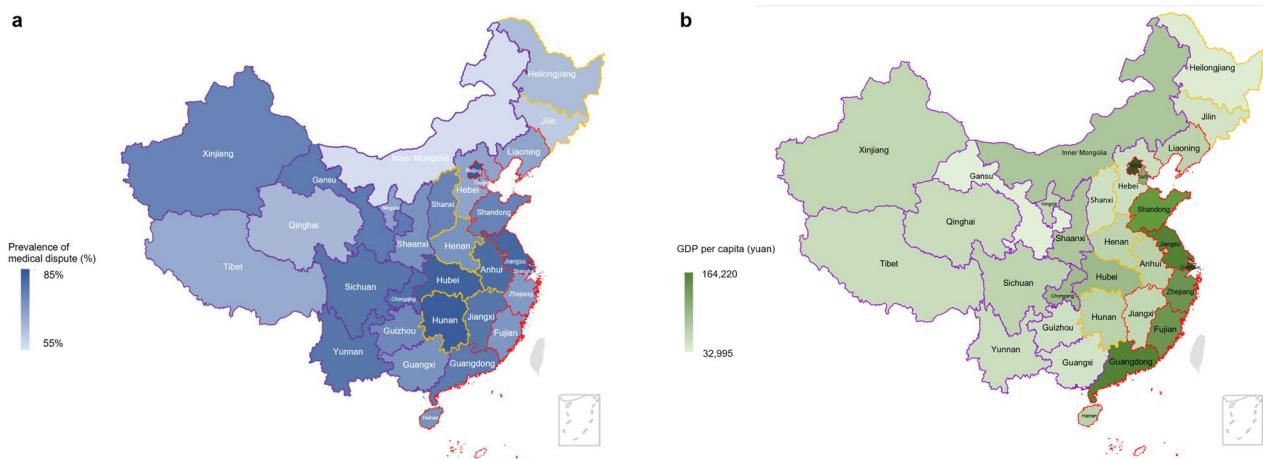


Fig. 1. Characteristics of medical disputes of neonatology in the mainland of China. (A) The percentage of neonatal pediatricians who experienced medical disputes of each city or province in the mainland of China. The geographic heatmap shows the percentage of neonatal pediatricians who experienced medical disputes. The frames of provinces in different colors represent the geographical division (purple: western China, orange: central China, red: eastern China). (B) The gross domestic product (GDP) per capita of each city or province in the mainland of China. The different levels of GDP per capita are shown by geographic heatmap. The frames of provinces in different colors represent the geographical division (purple: western China, orange: central China, red: eastern China).

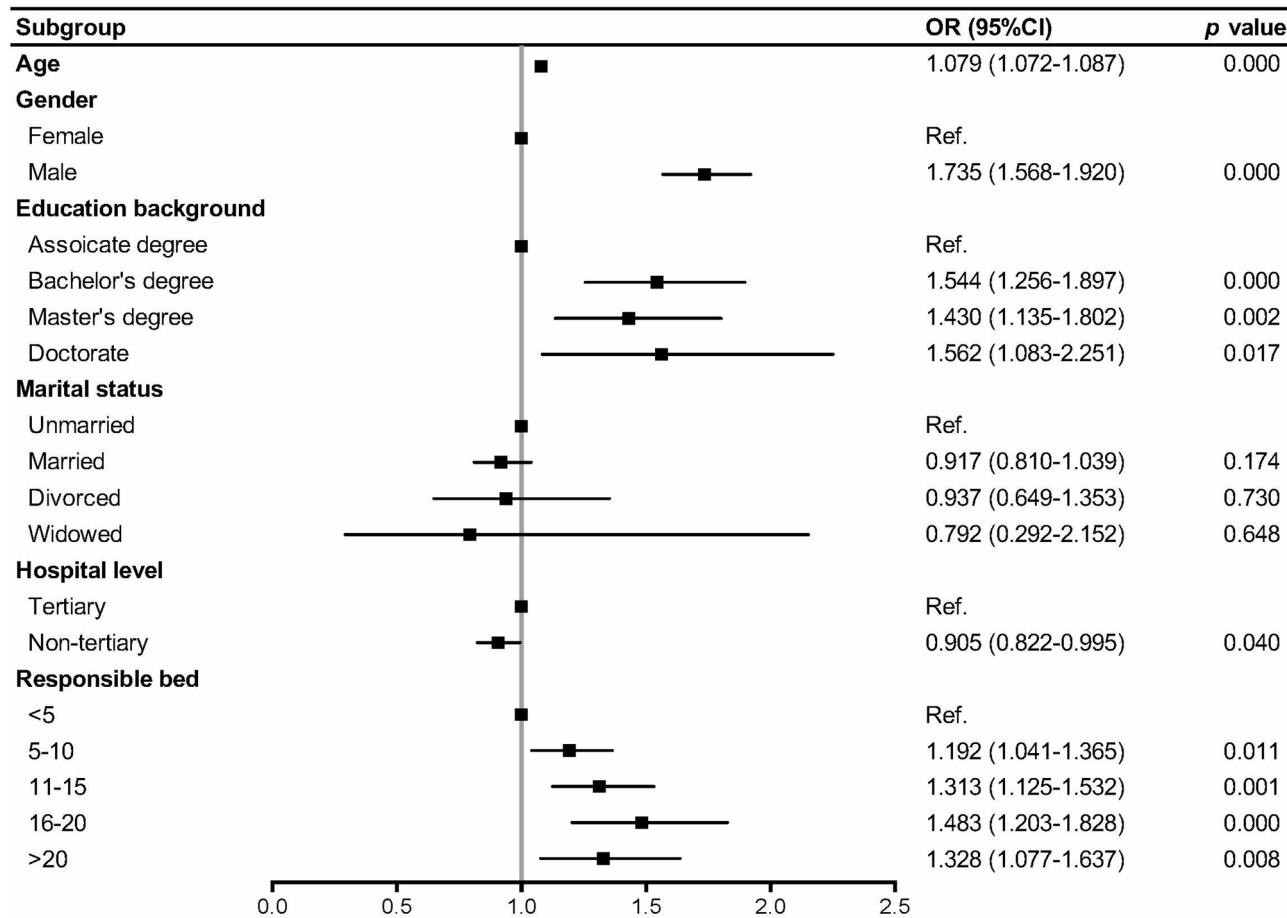


Fig. 2. Independent risk factors contributing to medical disputes among neonatal pediatricians. ORs and 95% CIs were calculated with binary logistic regression model and shown by forest plot.

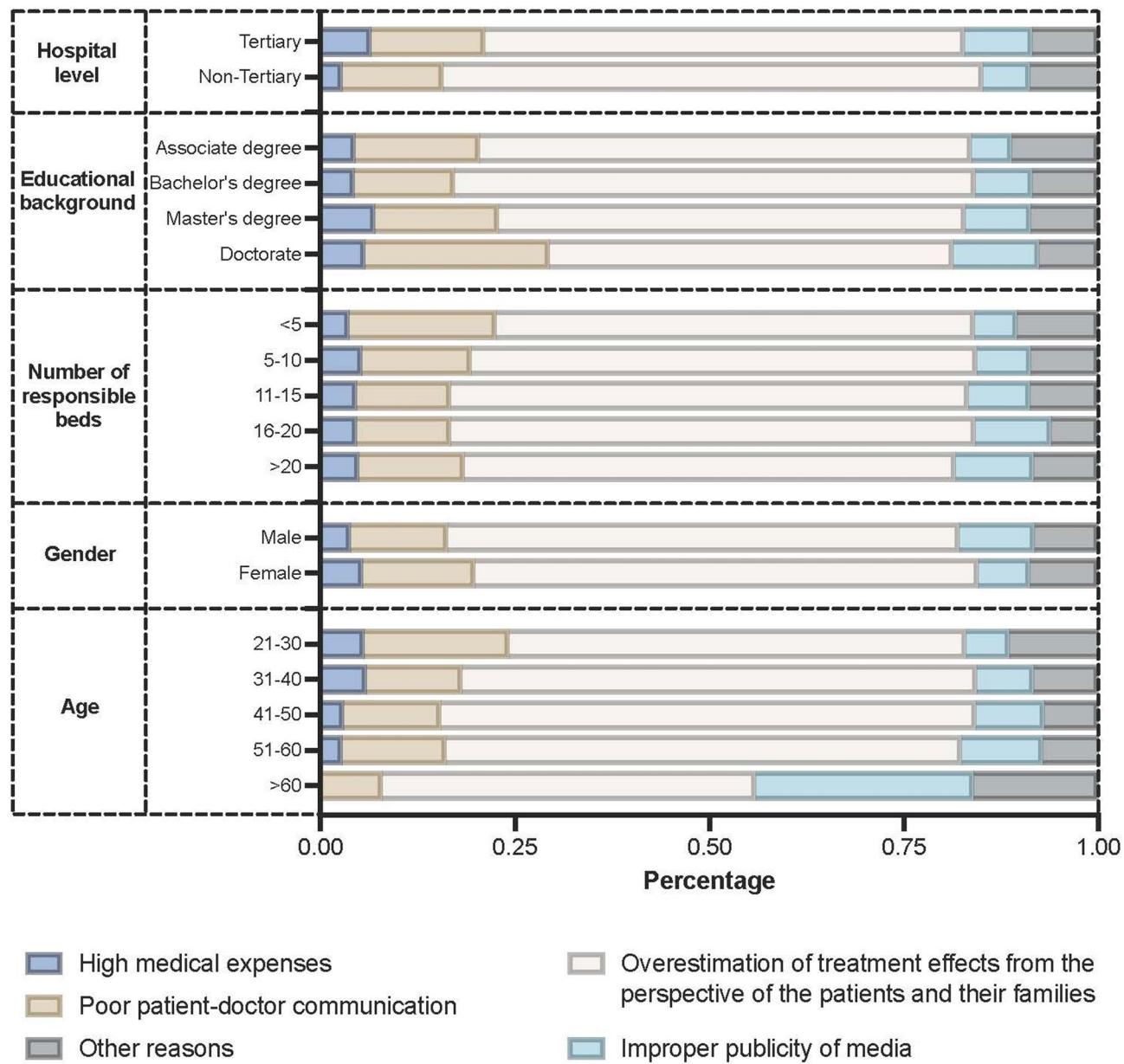


Fig. 3. The primary cause of medical disputes chosen by neonatal pediatricians. The result is grouped by different educational background, age, gender, number of responsible beds, and hospital level. The bar represents the percentage of selection as the primary cause (blue: high medical expenses, brown: poor patient-doctor communication, white: overestimation of treatment effects from the perspective of the patients and their families, light blue: improper publicity of media, gray: other reasons).

and an overall negative relationship with the age of the participating neonatal pediatricians. “High medical expenses” was selected as the least likely cause of medical disputes by all subgroups, which was more likely to cause medical disputes in tertiary hospitals compared to non-tertiary hospitals. The neonatal pediatricians responded that “high medical expenses” had less impact on the occurrence of medical disputes as their age increased, and none of them over 60 years of age chose this option, but “improper publicity of media” was considered in the opposite way (Fig. 3).

Discussion

Neonatal pediatricians are facing a relatively higher risk of medical disputes compared to healthcare workers working in other medical specialties, which has become a major concern affecting the doctor-patient relationship and medical safety¹². This study is the first nationwide survey on medical disputes among neonatal pediatricians in the mainland of China, and the result may provide a reference profile of the current situation and causes of medical disputes in neonatology.

About two-thirds of the participating neonatal pediatricians experienced medical disputes, and this situation increased by age. The high prevalence (96.0%) of medical disputes in neonatal pediatricians older than 60 suggested that neonatology is a specialty facing extremely high probability of medical disputes in the mainland of China. A study from Guangdong province of China¹³ released that about 9.8% of all medical disputes occurred in pediatrics, ranking the first among all departments of internal medicine. Fang et al.¹⁴ found that 56 (27.7%) of the 202 autopsy cases evoked medical disputes, including 28 newborn cases (13.9%). In contrast, pediatrics belonged to one of the lowest risk specialties between 2005 and 2014, which is only higher than psychiatrics¹⁵. Mism diagnosis accounts for the largest proportion among the causes of medical malpractice claims in American pediatric practice, especially in nursing and outpatient settings¹⁶.

Generally, the United States have paid attention to medical disputes earlier than China^{17,18}. Several reforms of relevant policies have been undertaken, such as increasing the liability limitations that are beneficial to healthcare providers and improving the dispute compensation process¹⁹. An American studies found that 43% of NICU doctors had experienced medical disputes in 1993²⁰, and the largest decline (75.8%) in paid malpractice claims was found in pediatrics comparing with other specialties from 1992 to 2014²¹. As a result, it is worth to explore the causes of the sustained high prevalence of medical disputes in Chinese pediatrics, especially in neonatology.

In our study, multiple factors were found to be associated with the occurrence of medical disputes. Although no significant regional difference in the experience of medical disputes was found, the positive correlation between GDP per capita and the occurrence of medical disputes indicated that cities or provinces with better economic foundations had more medical disputes. With the development of social economy, the gradual increase of urban populations potentially causes longer working hours on the part of the doctor, and longer waiting time on the part of the patient, which would lead to higher psychic pressure and higher occurrence probability of medical disputes. On the other hand, provinces with higher GDP per capita often represent more advanced medical conditions. More patients suffering from severe diseases will come attracted by its reputation, which will also result in a higher risk of treatment failure, and consequently, a higher risk of medical disputes.

It was found that more than 70% of the participants were women, but the occurrence rate of medical disputes in female neonatal pediatricians was significantly lower than that in the male neonatal pediatricians. The higher risk in male pediatricians was also concluded by a study conducted in the United States²². Since most NICUs in China have not fully made attempts such as virtual viewing yet, more patient and considerate communications with the families are required in neonatal care practice, and in this aspect, females have advantages than males. In addition, the shortage of pediatricians is seriously faced in China²³, leading to excessive workload, which is also the main reason why the number of responsible beds of neonatal pediatricians becomes an independent risk factor of medical disputes.

Causes of medical disputes are complex. More than 60% of the participating neonatal pediatricians chose overestimation of treatment effects from the perspective of the patients and their families as the primary cause of medical disputes. The neonatal period is a special stage involving the transition from intrauterine to extrauterine life, and about 43% of deaths in children under 5 years of age occurred during this period²⁴. However, most Chinese parents lack full understanding about the diseases and the corresponding prevalence that may occur in newborns. The lack of popular science education has contributed to insufficient understanding of the disease progression among family members, which may also be a significant factor contributing to this situation. In addition, the long-term one-child policy in China has cultivated doting love on the only child of the family²⁵. Excessive anxiety from caring about the health of the infants on the part of the families and their inability to accept unexpected prognosis could both cause medical disputes.

Poor patient-doctor communication is the second cause of medical disputes chosen by the participants. A study from Japan showed that about 40% medical disputes were not associated with medical malpractice, and about two-thirds of these medical disputes belonged to poor patient-doctor communication²⁶. Another study about premature caring in the United States found that 29% of the included legal records were communication-related allegations²⁷. Also, 41.4% of the 806 medical disputes reported by a children's hospital in China were related to improper communication²⁸. Therefore, it is necessary to enhance patient-doctor communication by increasing the communication time and improving the communication skills. Interestingly, we found that the older the neonatal pediatricians, the lower the proportion of choosing poor communication as the primary cause of medical disputes, indicating that communication skills and the confidence in communication increased with the age of neonatal pediatricians.

The lack of truthful reporting by the media is also an important cause of medical disputes²⁹. Due to the inadequacy of managing system in China, problems such as non-neutral reporting stances, unprofessional content, and lack of rigor in the reporting process still persist, especially in the current era of the Internet. Non-objective and unfair reports could aggravate the conflicts between the doctor and the patient. It was found in our study that less than 10% of the neonatal pediatricians considered improper publicity of the media as the primary cause of medical disputes. Meanwhile, only about 5% of the neonatal pediatricians in this study considered high medical expenses as the primary cause of the medical disputes. A survey in China showed that the personal hospitalization cost for neonatal sepsis, hyperbilirubinemia and neonatal pneumonia was less than 10,000 CNY³⁰, which is much lower than that in most developed countries. In addition, the Chinese government has expanded the coverage of pediatric care in health insurance, and numbers of social assistance channels are available to help patients with financial difficulties. Therefore, medical expenses are no longer the main cause of medical disputes.

This cross-sectional study suggests that medical dispute is still a common issue confronted by neonatal pediatricians in the mainland of China, with gender, age, educational background, hospital level, and the number of responsible beds of neonatal pediatricians as independent risk factors. "Overestimation of treatment effects from the perspective of the patients and their families" was the primary cause of medical disputes in neonatology, following by the poor communication and improper media reporting. However, there are some

limitations in this study. Firstly, as a cross-sectional survey, we were not able to get the accurate prevalence data of medical disputes. There was some recall bias due to using doctors' recollections of dispute experiences, but the large sample size in this current study can mitigate the impact on the result. Secondly, the analysis of causes of medical disputes was based on physicians' subjective reports, which did not include perspectives from patients, families, or third-party mediators, which limits the comprehensiveness of the findings. A multi-perspective approach should be incorporated in the future research. Also, the study investigated the general situation of medical disputes without exploring the types and consequences of these medical disputes, and the adjustment of healthcare infrastructure in the analysis for correlation of GDP per capita and medical disputes would improve the accuracy and reliability of the result. Nevertheless, it is convinced that the information obtained from this study could provide useful references for future arrangements to reduce the occurrence of medical disputes among neonatal pediatricians in the mainland of China.

Data availability

The data will be available upon reasonable request submitting to the corresponding authors.

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Author contributions

QPL and ZCF conceived the study. XYJ, LW and LZ performed formal analysis and visualization. ML, ZCF and QPL supervised the study. XYJ drafted the original manuscript. XYJ, LW, LZ, YPZ, SZ, RUJ, XYK, ML, ZCF and QPL reviewed and edited the manuscript. All authors read and approved the final manuscript.

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Declarations

Competing interests

The authors declare no competing interests.

Additional information

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