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Systematic review and meta-analysis of workload among medical records coders in China

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Abstract

Importance The homepage of medical records holds significant importance for national performance assessments, DIP settlement lists, and DRG payments. Coders, as auditors of the codes, wield a crucial influence on the quality of the medical records' homepage.

Objective To analyze the general situation of the allocation of medical record full-time coders in China.

Data source CNKI, Wanfang, VIP, PubMed and other databases were searched from database inception to November 31, 2023.

Main outcomes and measures The primary outcome was the allocation of medical records to full-time coders, with the workload of the coders being the primary focus. Secondary outcomes encompassed the professional background of the coders, including their academic qualifications, professional titles, possession of medical coding certificates, and years of experience in coding.

Results Eleven studies, comprising data from 1783 hospitals and 4448 coders, were analyzed. Among the coders, 61% had a medical-related professional background, 62% held a bachelor's degree or higher, 54% possessed an intermediate title or higher, 61% had coding certificates, and 51% had less than 5 years of work experience. The summary findings regarding the number of coders and coded medical records in secondary and tertiary hospitals indicated an average discharge rate of 22,704.0 per hospital in China. The number of coded cases averaged around 11,300. Specifically, coders in tertiary hospitals coded approximately 12,049 medical records on average, while those in secondary hospitals coded around 7,399 medical records.

Conclusion and relevance Our study highlights the shortage of medical record coding personnel in the majority of hospitals, coupled with a significant coding workload, low educational qualifications among staff, short working hours, and an imbalanced title structure. Given these findings, hospitals and relevant management authorities should prioritize the recruitment of highly educated professionals, streamline the assessment process for professional titles, alleviate the coding workload, and enhance coding quality.

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Highlights

- This systematic review and meta-analysis uncovered that in China, there's a shortage of medical records coding staff, coupled with heavy coding workloads.
- The insights gleaned from analyzing the allocation of medical records to full-time coders in China offer valuable guidance and benchmarks for hospitals in allocating these tasks.
- Ensuring accurate coding is pivotal for reliable data collection and the effective implementation of Diagnosis-Related Groups (DRGs) and Diagnosis Intervention Package (DIP) systems nationwide.

Keywords Medical record, Coding personnel, Meta-analysis, Cross-sectional study, The workload of the coders

Introduction

The front page of inpatient medical records serves as a pivotal "window," condensing, refining, and summarizing comprehensive information regarding the entire hospitalization process into specific data. Among these, the summary of patients' inpatient diagnosis and treatment stands out as the most concentrated, vital, and core component of the entire medical record dataset [1, 2]. This section encompasses various medical evaluation indicators, bearing significant importance as Diagnosis-Related Groups (DRGs) and performance assessments of tertiary public hospitals advance [3–5]. The accuracy of filling in the front page of inpatient medical records is closely intertwined with medical statistics precision and the outcomes of medical quality evaluations [6].

The introduction of the Diagnose-Intervention Packet (DIP) in Jiangsu Province in 2003 marked a significant step forward [7]. By 2020, DIP had been trialed in 71 cities across China, notably enhancing the quality of medical record home pages [8]. Emphasizing the importance of this aspect, the Opinions on Performance Appraisal of Tertiary Public Hospitals (No. 4 [2019] of the General Office of the State Council) highlighted the imperative to enhance the quality of medical record home pages and bolster their upload procedures [9]. In response, the National Health Commission initiated the performance assessment of national third-level public hospitals in 2019, mandating meticulous data completion and uniform utilization of disease and surgical operation codes [10].

Further reinforcing these standards, the Evaluation Standards for Tertiary General Hospitals (2020 edition) stipulated the utilization of relevant codes from the International Classification of Diseases, Tenth Revision (ICD-10) for medical safety indicators [11]. Subsequently, the "14th Five-Year Plan for National Clinical Specialty Capacity Building" (National Health Medical Development (2021) No. 31) emphasized the assessment of inpatient medical service capabilities based on DRG groups, Case-Mix Index (CMI), and surgical procedure proportions—all reliant on codes from the front page of medical records [12].

In line with ongoing efforts to enhance medical quality, the "National Medical Quality and Safety Improvement Goal in 2021," issued by the General Office of the National Health Commission in March 2021, designated the improvement of the main diagnosis code accuracy rate on medical record home pages as a focal point of professional quality control efforts from 2021 to 2023. The overarching goal is to achieve a 90% accuracy rate for main diagnosis coding on medical record home pages by 2025 [13].

Medical records coding entails a blend of professionalism, technical proficiency, and comprehensive knowledge spanning basic medicine, clinical medicine, and coding regulations. It involves intricate and abstract processes, along with repetitive tasks that, though mundane, are prone to errors [14, 15]. The National Medical Records Management Quality Control Center's examination of home page data quality highlighted significant issues, notably lapses among physicians and coders in understanding main diagnosis principles and encountering errors in filling and coding [16–18].

Furthermore, variances in coding rules stemming from distinct requirements set by the National Health Commission and the National Health Security Administration of the People's Republic of China contribute to discrepancies in first-page medical records. To meet the data quality standards mandated by health commissions and medical insurance bureaus, many hospitals resort to "double coding," exacerbating the coding workload burden [19, 20]. As the gatekeepers of coding accuracy, coders play a pivotal role, directly influencing the quality and rigor of medical records homepages [21]. The presence of coders in different countries is important. In the United States, coders influence the accuracy of health care payments and the assessment of quality of care; In the UK, coders can effectively help with healthcare resource planning and public health surveillance; In Japan, coders play an important role in medical research and hospital management; In Australia, coders are the foundation of healthcare data analysis and quality control. Coders provide strong support for the efficient operation and sustainable development of national healthcare systems by accurately encoding patient medical records information.

In this study, we employed a meta-analysis approach to examine the distribution of full-time medical record coders in China. Our findings offer valuable insights and guidance for the allocation of hospital resources toward full-time medical record coders, thereby ensuring coding accuracy. Additionally, our research provides a scientific foundation for enhancing the timeliness, comprehensiveness, standardization, and accuracy of medical data.

Materials and methods

Search strategy

CNKI, Wanfang, VIP, CBM, Web of Science, EMbase, and PubMedwere searched from establishment to December 31, 2023. The text terms used were as follows: ["case management" OR "management of medical records" OR "medical records department" OR "coding clerk"] AND ["status survey" OR "status analysis" OR "status statistics"].

Inclusion and exclusion criteria

The inclusion criteria were as follows: (1) Comprehensive data, covering key points such as the number of coders, their titles, professions, possession of coding certificates, years of experience, and workload. (2) Studies conducted in China. The exclusion criteria were as follows: (1) Literature reviews and conference reports; (2) Unavailable or incomplete raw data; (3) Studies not aligned with the research theme; and (4) Studies conducted in countries other than China.

Literature screening and data extraction

After retrieving the literature, duplicates were removed using NoteExpress software. Subsequently, two investigators independently evaluated and screened the titles and abstracts of the remaining studies. If either investigator deemed that a particular article met the inclusion criteria based on its title and abstract, the full text was carefully reviewed by both investigators to determine its eligibility for inclusion. Following this, data extraction and quality assessment were conducted. In case of any discrepancies during these processes, they were resolved through discussion between the investigators or by involving a third party for decision-making. The extracted data included details such as the first author of the literature, the survey year, the study area, sample size, sampling method, and research indices.

Quality assessment

As this study was observational in nature, the quality of the final included studies was assessed using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement [22]. STROBE provides a comprehensive list of items that should be included in reports of observational studies, encompassing various designs in epidemiology such as cohort studies, case- control studies, and cross-sectional studies. By adhering to STROBE guidelines, researchers can enhance the methodological rigor of their studies, facilitate comprehensive reporting, and enable more informed decision-making regarding the timing and objectives of future research endeavors. The STROBE checklist comprises 22 items organized into 6 sections, including title and abstract, introduction (background/rationale, objectives), methods (study design, setting, participants, variables, data sources/measurement, bias, study size, quantitative variables, and statistical methods), results (participants, descriptive data, outcome data, main results, and other analyses), discussion (key results, limitations, interpretation, and generalizability), and other relevant information (funding).

Statistical analysis

The meta-analysis was conducted using Review Manager (RevMan) 5.4 software. Based on the results of the heterogeneity test, the random effects model was employed for analysis ($I2>50\%$ and $P<0.05$). The relative percentage change served as the effect size to estimate the combined effect and its 95% confidence interval (CI). To evaluate publication bias, a funnel plot was utilized.

The average annual number of discharged patients was calculated using the formula: (number of secondary hospitals * average annual number of discharged patients in secondary hospitals + number of tertiary hospitals * average annual number of discharged patients in tertiary hospitals)/(number of secondary hospitals + number of tertiary hospitals).

For the annual number of coded medical records per coder, calculations were based on data extracted from the included literature. If the coding was expressed as the number of annual medical records per capita, the formula used was: (number of annual medical records per capita in secondary hospitals * number of coders in secondary hospitals + number of annual medical records per capita in tertiary hospitals * number of coders in tertiary hospitals)/(number of coders in secondary hospitals + number of coders in tertiary hospitals).

Similarly, if the coding was represented as the number of medical records per capita per month, the formula employed was: (number of monthly medical records per capita in secondary hospitals * number of coders in secondary hospitals + monthly number of medical records per capita in tertiary hospitals * number of coders in tertiary hospitals) *12/(number of coders in secondary hospitals + number of coders in tertiary hospitals).

Finally, if coding was denoted as the number of cases per capita per day, the formula used was: (monthly number of cases per capita in secondary hospitals * number of coders in secondary hospitals + monthly number of cases

per capita in tertiary hospitals * number of coders in tertiary hospitals) *220 (number of working days per year of coders)/(number of coders in secondary hospitals + number of coders in tertiary hospitals).

Results

Literature screening results

A total of 557 studies were initially screened across 7 electronic libraries. After removing duplicate studies, 278 unique studies remained. Subsequently, 167 studies were excluded due to inconsistencies in titles and abstracts, resulting in 111 studies for further evaluation. Following a careful examination of the full texts, 100 studies were excluded. Ultimately, 11 studies met the inclusion criteria and were included in the analysis. The literature screening process is illustrated in Fig. 1.

Characteristics of included studies

The investigation encompassed a total of 1,783 hospitals, distributed across different regions of China: 295 in the central region, 378 in the eastern region, and 996 in the western region. Notably, 114 hospitals did not specify the survey region in the studies. The survey involved 4,448 coders over the period from 2016 to 2020. The largest survey was conducted in Sichuan, with 755 hospitals surveyed, encompassing 1,279 coders [23]. Conversely, Taiyuan conducted the fewest hospital surveys, with only 18 hospitals and 116 coders included in the study [24]. Anyang had the lowest number of surveyed coders, with only 83 individuals included [25]. Table 1 presents the basic characteristics of the included studies.

Meta-analysis of the professional background of the coders

Ten studies were included in the analysis of the medical-related professional background, with heterogeneity testing revealing I2 = 97% ($P<0.05$). The analysis was conducted using a random effects model. The findings indicated that coders with medical-related professional backgrounds constituted 61% of the total coders (95% CI: 53–70%, $P<0.001$) (Fig. 2).

Additionally, nine studies were included in the analysis of health information statistical management or medical records management professionals, with heterogeneity testing showing I2 = 95% ($P<0.05$). Analyzed using a random effects model, the results revealed that coders with backgrounds in health information statistical management or medical records management accounted for 20% of the total coders (95% CI: 13–27%, $P<0.001$) (Fig. 2). No evidence of publication bias was found according to Begg's funnel plot (Fig. S1).

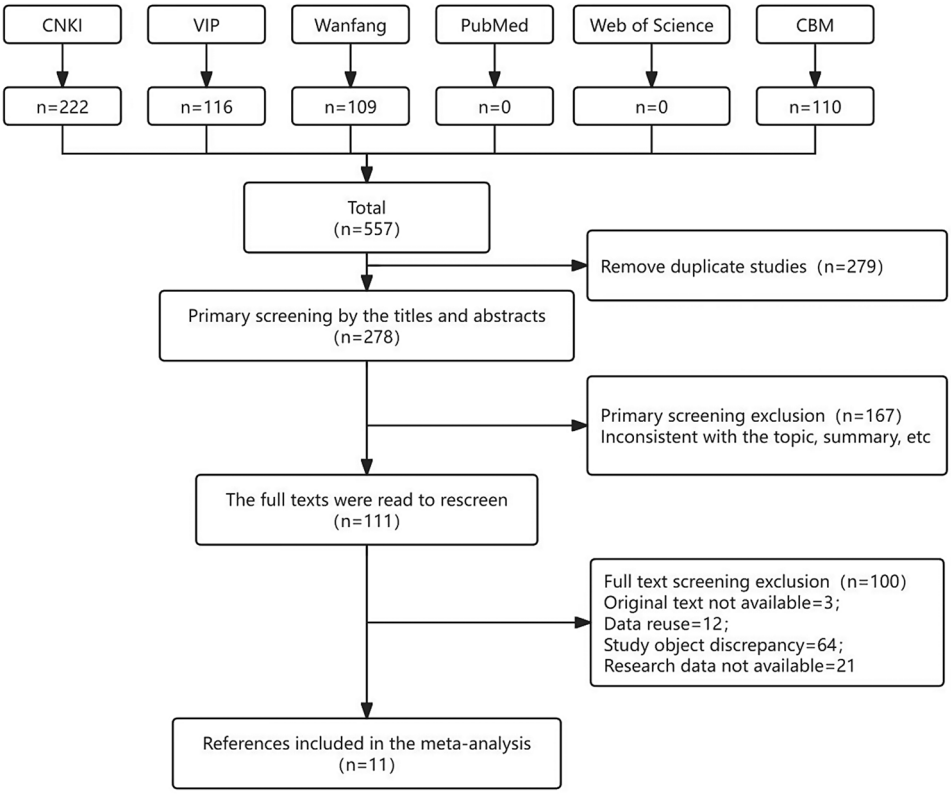

Fig. 1 The flowchart of literature screening

Table 1 Characteristics of the included studies

First author	Publication year	Location	Area	Method of investigation	Hospitals (*n*)	Coders (*n*)	Survey date	Strobe score
Liu (a) [26]	2020	Hubei	Central	Online submission	108	404	January 2018-December 2018	11
Wang [27]	2022	Guangxi	Western	Questionnaire survey	223	850	January 2020-December 2020	12
Liu (b) [28]	2020	Henan	Central	Questionnaire survey	51	211	September 2019	15
Wan [25]	2021	Anyang	Central	Questionnaire survey	27	83	April 2020-May 2020	13
Han [29]	2019	-	-	E-mail	87	125	-	11
Ma [30]	2017	Anhui	Eastern	Questionnaire survey	182	302	May 2016	13
Xin [31]	2022	Guangdong	Eastern	Online submission	196	558/776	2018 / 2020	15
Li [32]	2019	Hunan	Central	Questionnaire survey	109	216	May 2017-June 2017	12
Yue [33]	2022	-	-	E-mail	27	86	-December 2020	14
Wei [23]	2021	Sichuan	Western	Questionnaire survey	755	1279	January 2019-December 2019	13
Zhang [24]	2022	Taiyuan	Western	Questionnaire survey	18	116	October 2020	14

Notes: "-": Not mentioned in the studies

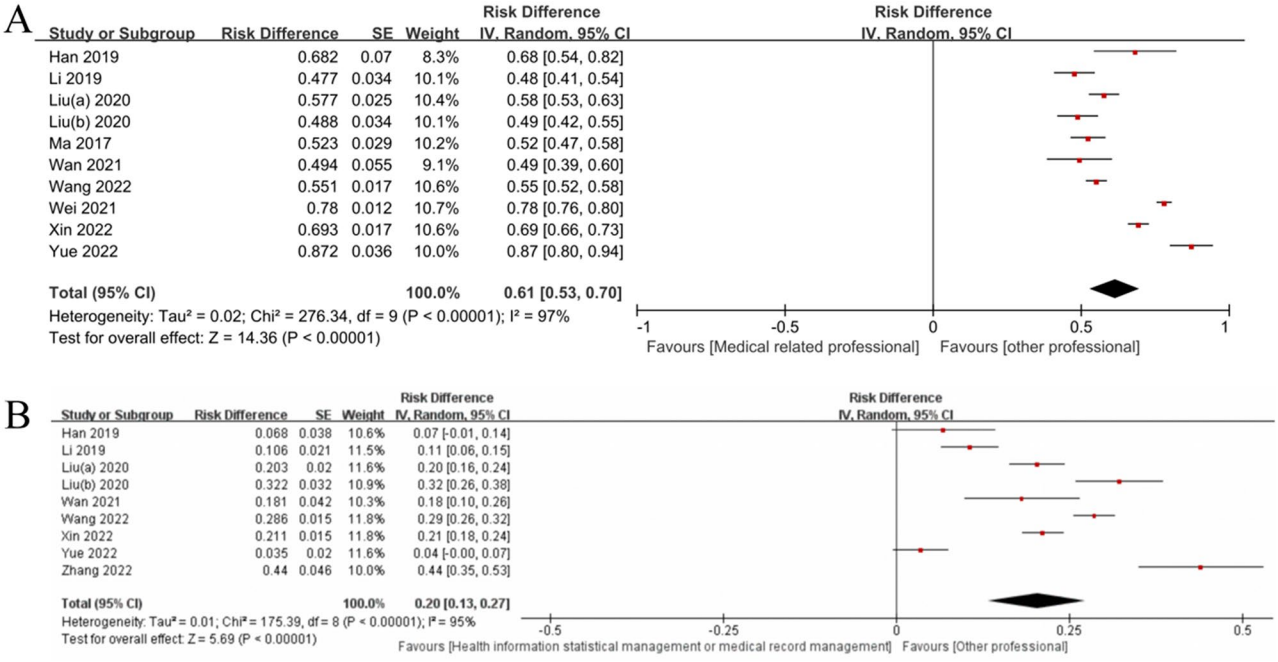

Fig. 2 Meta-analysis of the professional background of the coders. (**A**): Meta-analysis of the medical related professional background, medical related professional: Medical information, Clinical Medicine Science, Nursing, Medical laboratory, Preventive medicine, etc. (**B**): Meta- analysis of health information statistical management or medical record management professionals. Xin study extracted data for 2020

Meta-analysis of coders' academic qualifications and professional titles

Ten studies were included in the analysis of academic qualifications, with heterogeneity testing revealing I2=97% ($P<0.05$). Analyzed using a random effects model, the results showed that 62% of coders possessed a bachelor 's degree or above (95% CI: 52–72%, $P<0.001$) (Fig. 3).

Furthermore, eight studies were included in the analysis of professional titles, with heterogeneity testing showing I2=97% ($P<0.05$). Analyzed using a random effects model, the findings indicated that 54% of coders held intermediate professional titles or above (95% CI: 42–65%, $P<0.001$) (Fig. 3).

Additionally, a summary analysis of coders with senior titles was conducted, totaling 227 coders, representing only 12% of the total (95% CI: 8–15%, $P<0.001$) (Fig. 3). No evidence of publication bias was detected according to Begg's funnel plot (Fig. S1).

Meta-analysis of medical coding certificate* and coding working years

Four articles addressed whether coders held coding certificates. Heterogeneity testing yielded I2=97% ($P<0.05$), and data were analyzed using a random effects model.

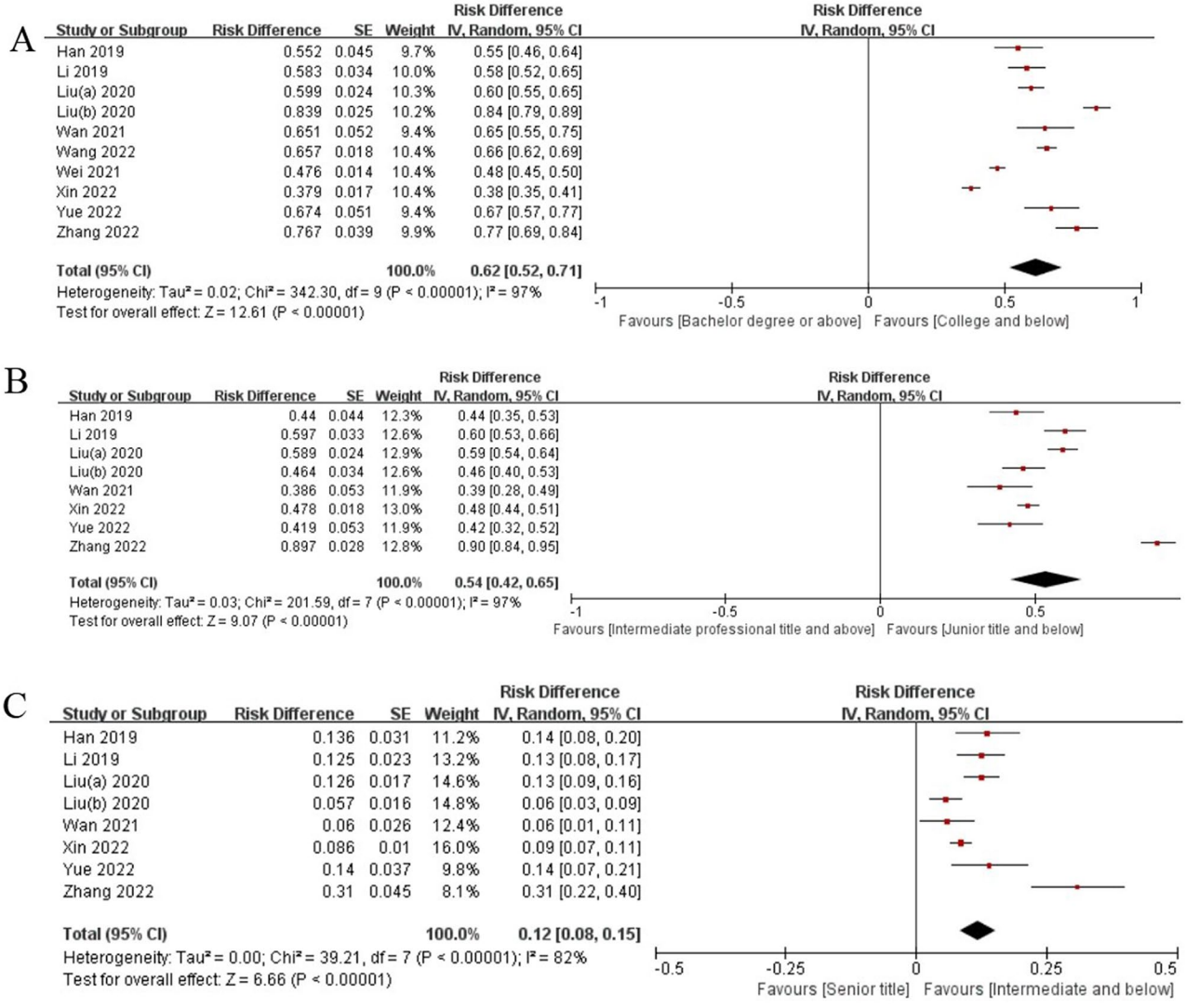

Fig. 3 Meta-analysis of coders' academic qualifications and professional titles. (**A**): Meta-analysis of the academic qualifications of the coders. (**B**): Meta-analysis of coders with intermediate titles and above. (**C**): Meta-analysis of coders with senior titles. Xin study extracted data for 2020

The findings revealed that 61% of coders possessed coding certificates (95% CI: 40–83%, $P<0.001$) (Fig. 4).

Additionally, four studies discussed the duration coders spent coding. Heterogeneity testing indicated I2 = 99% ($P<0.05$), and data were analyzed using a random effects model. The results showed that 51% of coders had a working life of less than 5 years (95% CI: 19–83%, $P<0.001$) (Fig. 4). No evidence of publication bias was observed based on Begg's funnel plot (Fig. S1).

The workload of coders

Six articles included in the analysis discussed the workload of coders. However, Wang Junxuan's survey [27] did not specify the number of coded medical records, so it was excluded from the study. We synthesized data on the annual number of discharged patients and coded medical records from secondary and tertiary hospitals. The findings revealed that the average number of discharged patients per hospital in China was 22,704.0 (range: 14, 194.5–45,420.2). The annual number of coded medical records by coders was approximately 11,300 (range: 8,400 − 32, 100). Specifically, the average number of coded medical records by coders in tertiary hospitals was approximately 12,049, while in secondary hospitals, it was approximately 7,399. Detailed results are provided in Table S1.

Discussion

In recent decades, China has witnessed a rapid increase in total medical expenditure [34], which has been attributed to the prolonged use of fee-for-service payments for inpatient treatment, leading to issues such as overtreatment and induced demand [35–37]. Consequently, in 2019, the Chinese government initiated a reform of the

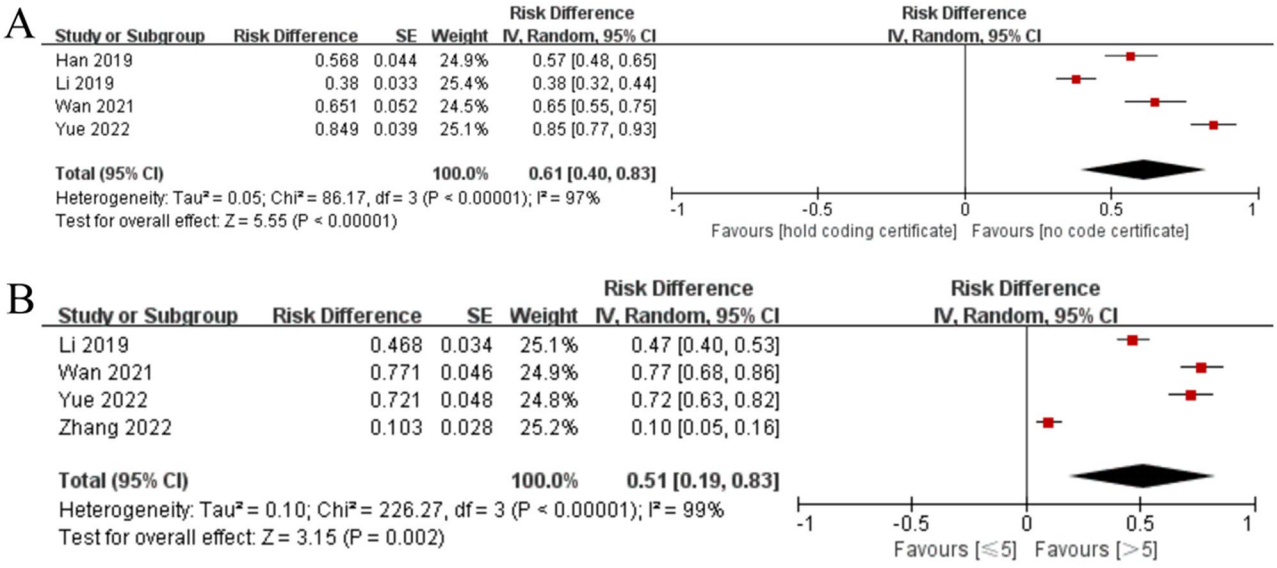

Fig. 4 Meta-analysis of medical coding certificate and coding working years. (**A**): Meta- analysis of medical coding certificate. *Coding certificate: Classification of diseases and surgical operation classification coding skill level training certificate. (**B**): Meta-analysis of coding working years

Diagnosis-Related Groups (DRG) payment system to curb the escalation of healthcare spending [38]. However, the implementation of DRG payment systems necessitates significant administrative costs and sophisticated information systems [39]. To address these challenges, the Chinese government opted to develop an innovative case payment system with a standardized design framework, aiming to mitigate some of the shortcomings associated with existing DRG payment models [40, 41]. Subsequently, in 2020, the Chinese government introduced an innovative case-based payment system under regional global budgets, known as Diagnosis- Intervention Packet (DIP) payments [42, 43].

In November 2021, the National Healthcare Security Administration issued the "DRG/DIP payment mode reform three-year action plan," which advocates for the comprehensive promotion of a nationally unified, top-down coordinated approach, emphasizing standards, norms, and efficient medical insurance payment mechanisms [44]. Acting as the intermediary between DRGs and DIP applications, coders assume critical roles as "medical record quality controllers" and "coding translators," ensuring the accuracy of medical record information, facilitating correct DRG/DIP enrollment, and facilitating fair medical insurance payments for hospitals [45].

With the ongoing evaluation of tertiary hospitals, the performance assessment of public healthcare institutions, and the nationwide implementation of DRGs/DIP, the significance of medical record home page data and medical insurance settlement lists will continue to rise, placing greater demands on coders within hospitals.

To the best of our knowledge, this study represents the first attempt to utilize meta analysis in assessing workload among medical records coders in China. We ultimately analyzed 11 studies to provide insights into the situation of coders, revealing that 39% of coders lacked a medical-related professional background, while only 20% were engaged in health information statistics management or medical records management. This deficiency stems from hospitals not adequately prioritizing coder roles, with many coders being transferred from clinical positions [46, 47]. Despite their medical background, disease coding entails complex principles, and medical records departments oversee coding across all hospital departments, presenting significant challenges in execution [48].

Moreover, medical records coding demands robust professionalism and knowledge, and individuals lacking proper medical records management expertise and a solid medical foundation are ill-equipped for this role. Unfortunately, only 61% of coders in our country possess coding certificates, indicating that nearly half lack systematic coding training and may possess only rudimentary coding knowledge. Furthermore, nonmedical professionals, lacking clinical knowledge and familiarity with the International Classification of Diseases, struggle to comprehend medical records fully and accurately translate diseases. This deficiency contributes to errors in disease coding, consequently compromising the accuracy of data input into Diagnosis-Related Groups (DRGs) and Diagnosis-Intervention Packet (DIP) systems, thereby undermining data authenticity and precision [49].

The analysis of academic qualifications and professional titles reveals that 38% of coders hold college

degrees or below, with nearly half possessing junior professional titles or lower. Only 227 coders hold senior titles, comprising a mere 12% of the total. In many Chinese hospitals, the absence of relevant title evaluation criteria prompts individuals to prioritize titles aligned with their educational backgrounds to expedite promotion exams. Consequently, coders with nonmedical backgrounds find it challenging to pursue titles closely linked to medical records, such as medical records information technicians.

Elevated professional titles not only augment income and resources but also validate one's competency. Hospital promotions tied to professional titles can attract highly educated individuals to coding roles. However, limited promotional opportunities hinder the advancement of coding work. The current practice of conferring only intermediate titles fails to motivate staff adequately, contributing to the scarcity of highly educated coders.

As pivotal management figures in medical records departments, coders play a crucial role in hospital development. Hospitals must recognize that focusing solely on the first page of inpatient medical records neglects the vital contribution of coders in extracting medical records information. To address this, hospitals should prioritize the recruitment of highly educated professionals in health information statistics management, increase investment in coder education, and facilitate ongoing professional development opportunities for coders to stay abreast of evolving practices.

Our analysis of coding workload reveals that each coder handles approximately 11,300 encoded medical records annually, with the highest burden observed in tertiary hospitals in Taiyuan city, where coders manage roughly 32, 100 records per person per year. Conversely, secondary hospitals in Sichuan Province exhibit the lowest coder burden, averaging approximately 6,300 records per person annually. Further examination of coder workload in secondary and tertiary hospitals indicates an average annual coder count of 12,049 in tertiary hospitals and 7,399 in secondary hospitals. Notably, the workload in tertiary hospitals significantly surpasses that in secondary hospitals.

Additionally, our findings show that 12. 11% of the 223 hospitals surveyed in Guangxi Province lacked full-time coders [27]. Assuming a full-time coder works 220 days a year for 8 h per day, they would need to process an average of 6.42 inpatient medical records per hour. This process, from reviewing the first page of medical records to code assignment, must be completed within 10 min, placing significant time pressure and accuracy demands on coders. Such intensive work with stringent time constraints tests coders' professional competence and mental resilience.

Furthermore, our analysis indicates that over half of coders have less than five years of coding experience, rendering them less proficient in practical operations and more susceptible to errors [50]. To address this, coders should engage closely with clinical departments, deepen their understanding of clinical diseases, and enhance their skill set [51]. Moreover, incorporating medical records informatics as an elective course in medical school-related majors can promote clinical writing standardization and enhance comprehension of first-page medical record filling requirements [52].

By understanding the current situation of coders in China, this study can give other countries the opportunity to recognize the importance of medical coders and the need for cross-departmental collaboration in terms of role perception, professional competence development, information technology construction, and quality control, emphasize the importance of medical knowledge and continuous learning, and learn to establish a quality control system and a coding audit feedback by learning from the experience of information system support and data quality management Quality Control Mechanisms.

Lastly, hospitals can leverage modern information technology to continually improve input methods, streamline processes, boost efficiency, and enhance coder motivation.

In the future, we will further explore the impact of experience, academic background, and whether or not you are in a full-time role on hospital Medicare payments. Specifically, we will comprehensively consider the differences in the role of medical coders with different levels of experience in their work on Medicare payments, analyze how coders with different academic backgrounds use their expertise to bring about changes in Medicare payments in hospitals, and examine the different impacts of full-time and part-time coders in this process. At the same time, we will also focus on in-depth analysis of the differences between medical coders in China and other countries. By comparing the differences of different countries in the scope of responsibility, professional skill requirements, working mode and career development path of medical coders, we can draw useful experience and inspiration, and provide more innovative and feasible ideas for the allocation of medical coders in China.

Limitations

This study encountered several limitations that warrant acknowledgment. Firstly, it represents the inaugural meta-analysis conducted on Chinese coders. Given that the included studies predominantly comprised observational research, discrepancies in observation methods, study duration, scope, and sample sizes may have contributed to heterogeneity. Secondly, the scarcity of studies focusing on coders in China presents a challenge.

Most available literature offers only surface-level analyses, with limited exploration into the nuanced workload of coders. Moreover, even when workload is addressed, specific coding figures are often omitted. Consequently, our workload analysis was based on approximately six articles, potentially introducing bias into our findings. Lastly, due to the constraints of our research, we were unable to compare the status of domestic coders with their foreign counterparts, limiting our scope to domestic studies exclusively. Moving forward, we aim to integrate additional relevant studies to enhance the robustness of our conclusions. This study analyzes the current state of the nation's coders, and future research focuses more on the impact of coder coding quality on payments to different types of hospitals in different regions of China.

Conclusion

In conclusion, our research underscores the prevalent challenges within hospital coding departments: insufficient staffing, heavy workloads, low educational qualifications among personnel, short coding durations, and an inequitable title structure. It is imperative for hospitals and relevant management authorities to prioritize the recruitment of highly educated professionals, bolster comprehensive coding training programs — particularly for medical institutions below Level II—enhance the evaluation criteria for professional titles, and invest in robust information infrastructure to facilitate coding tasks. By addressing these issues, the burden on coding staff can be alleviated, ultimately improving the efficiency and accuracy of medical record coding processes.

Abbreviations

DRGs	Diagnosis-related groups
DIP	Diagnose-intervention packet
ICD-10	The international classification of diseases, tenth revision
CMI	Case-mix index
STROBE	The strengthening the reporting of observational studies in epidemiology
CI	Confidence interval
RevMan	Review manager

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12911-024-02750-6.

Supplementary Material 1

Supplementary Material 2

Acknowledgements

Not applicable.

Author contributions

YL contributed to the design, data curation, methodology, writing-original draft. CW and YL also make significant contributions in the areas of study design, study evaluation, data analysis and interpretation. MLC contributed significantly to the conception and design of this study. She was also involved in the development of electronic search strategies. CYL and ZQZ revised the original draft and was responsible for discussing their differences with YL and CW. ZQZ screens titles and abstracts and participates in research evaluation and data extraction for full-text studies. WJO was the main person responsible for the study design, and he also rigorously revised the manuscript as the corresponding author. All authors then read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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