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The association between clinicians' legal literacy and the service quality of primary healthcare - evidence from the Greater Bay Area study, China

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Abstract

Background In healthcare facilities, clinicians' legal literacy may influence the implementation of the law, which is one of the determinants of service quality. Studies regarding the association between clinicians' legal literacy and the quality of services provided by medical facilities were insufficient.

Objective To evaluate the association between clinicians' legal literacy and the quality of primary healthcare services in the Greater Bay Area, China.

Methods This study was a cross-sectional design. A general linear model was employed to assess the association between clinicians' legal literacy and the service quality of community health service institutions (CHSIs), controlling for confounding variables. From September 2023 to April 2024, 477 physicians and nurses from 58 CHSIs in the Greater Bay Area, China, engaged in this study. A self-administered questionnaire was utilized to evaluate the clinicians' legal literacy, encompassing legal knowledge, legal attitude, and legal compliance, which was validated by the Delphi method. The National Committee for Quality Assurance Patient-Centered Medical Home (NCQA-PCMH) was employed to assess the service quality of CHSIs.

Results In the adjusting models, higher scores of legal literacy were related to higher scores of NCQA-PCMH significantly (aβ = 1.360, 95%*CI* = 0.091–2.630, *P* = 0.036). Among the six domains of PCMH, PCMH1 (aβ = 0.184, 95%*CI* = 0.080–0.287, *P* = 0.001), PCMH3 (aβ = 0.330, 95%*CI* = 0.052–0.608, *P* = 0.020), and PCMH4 (aβ = 0.660, 95%*CI* = 0.256–1.063, *P* = 0.001) were found to be related to clinicians' legal literacy.

Conclusion This study demonstrated an association between clinicians' legal literacy and the quality of services provided by primary healthcare institutions. The findings offered novel evidence for policymakers and administrators of medical institutions to enhance clinicians' legal literacy with continuing medical education programs, which could improve the overall management framework of contemporary medical facilities.

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Keywords Legal literacy, Primary healthcare, Service quality, Community health service institutions

Introduction

China's healthcare system is structured in three levels: community health service institutions at the base, secondary hospitals in the middle, and tertiary hospitals at the top [1]. Community health service institutions (CHSIs) comprising community health centers (CHCs) and community health stations (CHSs), ensure primary healthcare in urban China [2]. Primary healthcare service is the first step in the healthcare process, it offers diverse services such as health promotion, disease prevention, chronic illness and cancer screening, general outpatient and allied health care [3]. The quality of primary healthcare services has been a global concern for an extended period [4]. Nevertheless, it was indicated that the quality of primary healthcare remained predominantly inadequate worldwide, particularly in low-income and middle-income countries [5]. To provide quality primary healthcare services, several key factors are essential, including good governance, skilled and competent health workforces, financing mechanisms that encourage quality care, intelligent information systems, well-regulated medicines, medical devices, and accessible, well-equipped healthcare facilities [6]. To meet these general requirements, it is essential to investigate specific methods to enhance the quality of primary healthcare services.

To this end, in 2019, China enacted *the Notice on Further Strengthening the Rule of Legal Construction of Medical and Health Institutions (Trial)*, mandating that all medical institutions enhance their legal frameworks to improve risk prevention and mitigation, thereby elevating service quality. Simultaneously, China's inaugural comprehensive legislation on health, *the Basic Healthcare and Health Promotion Law of the People's Republic of China*, delineates the necessity for delivering affordable and high-quality primary healthcare services. Researchers in China are investigating the potential implications of legal frameworks on healthcare. They found that deficiencies in legal norms have influenced the quality of general practitioners' service in China's primary healthcare [7]. There is a gap between the enactment and implementation of the health law. Both the provider-side and the demand-side of healthcare services are involved in bridging the gap. This study explored the association between clinicians' legal literacy and healthcare service quality, which provided evidence and solution for Civil Law Countries to improve the healthcare service quality with the increase of the provider's legal literacy via continuing medical education. Besides, the demand for healthcare services in low- and middle-income countries is transforming from a focus on accessibility to an emphasis on quality. China has adopted legislative tools to address the challenge, which could serve as a model for other countries with similar challenges to China.

There is an increasing apprehension that legislation serves as a social determinant of health, and several studies have examined the impact of laws on the quality of primary healthcare services [8–10]. McHale argued that law can provide checks and balances in healthcare practice, highlighting the role of British law in enhancing role in facilitating the quality of healthcare practice [8]. Another study suggested that the legal literacy of health practitioners influences their ability to improve service quality. Furthermore, legal literacy is deemed essential across all sectors within the transdisciplinary field of public health [11]. A recent study in Hong Kong suggested that the rule of law functions as a mechanism for equitable service delivery by upholding principles of non-discrimination, transparency, and accountability. This framework is especially critical for ensuring fair access to essential services, including healthcare [12]. However, the existing studies regarding the relationship between legislation and the quality of medical service are qualitative [8–10, 13], with a lack of quantifiable evidence.

In medical facilities, clinicians act as the enforcers of laws. Legal literacy was defined as the ability to understand legal terminology, draw conclusions from it, and apply those conclusions in practice [14]. We hypothesized that clinicians' legal literacy was associated with the quality of primary healthcare services. This study aimed to explore the association between clinicians' legal literacy and the service quality of CHSIs in the Greater Bay Area.

Methods

Study population

The study was conducted in CHSIs in Nanshan district of Shenzhen, in the Greater Bay Area (GBA) from September 2023 to April 2024. The GBA, located in southern China represents a major urban agglomeration at the forefront of the nation's economic advancement. Concurrently, the demographic transition and aging population within the GBA are driving a substantial demand for high-quality healthcare services [15]. All 81 CHSIs in Nanshan District were recruited, of which 58 CHSIs ultimately completed the Patient-Centered Medical Home (PCMH) questionnaire, with a response rate of 71.6%. From the 58 CHSIs, we applied random sampling to choose 50% of physicians and nurses from each CHSI and invited them to participate in the survey. Specifically, we employed the RAND function in Microsoft Excel to generate a random decimal between 0 and 1 for all the 1,242 clinicians. Subsequently, we utilized the

RANK function to organize these decimals in descending order, selecting the top 50% of clinicians as the sample for our study. A total of 621 physicians and nurses were chosen, of which 477 completed the individual questionnaire, with a response rate of 76.81% (Fig. 1). We used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline for our reporting.

Written informed consent was obtained from each participant prior to data collection. The study protocol was approved by the Human Studies Committee of Sun

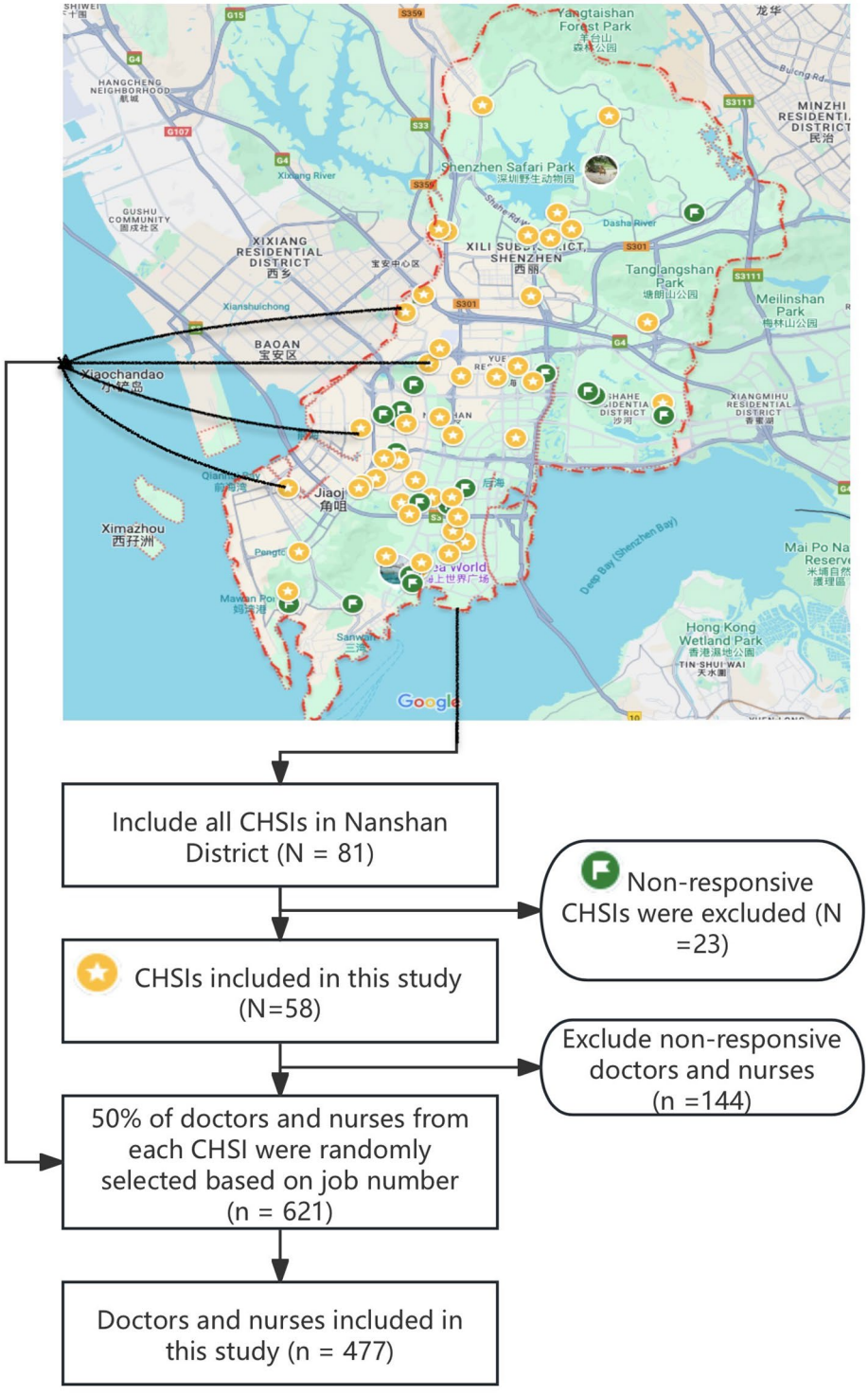

Fig. 1 Sampling strategy

Yat-Sen University (No. IRB2024.100), following the Declaration of Helsinki-Ethical Principles for Medical Research Involving Human Subjects.

Evaluation of CHSI service quality

The National Committee for Quality Assurance (NCQA) has assessed the service quality of medical providers and practices since 2008 [16]. The 2014 NCQA-PCMH comprises 6 domains, including PCMH1 "Patient-Centered Access (Practices ensure access to team-based care for both routine and urgent needs for patient, family, and caregiver needs [17])" scoring 10, PCMH2 "Team-based Care (Practices deliver continuity of care using culturally and linguistically appropriate, team-based approaches)" scoring 12, PCMH3 "Population Health Management (Practices use comprehensive health assessment and evidence-based decision support to oversee the health of entire patient populations [17])" scoring 20, PCMH4 "Management and Support (Practices systematically identify patients, plan, manage, and coordinate care based on need [17])" scoring 20, PCMH5 "Care Coordination and Care Transitions (Practices systematically track tests and coordinates care across specialty care, facility-based care and community organizations)" scoring 18 and PCMH6 "Performance Measurement and Quality Improvement (Practices use performance data to identify opportunities for improvement and acts to improve clinical quality, efficiency and patient experience)" scoring 20. Each domain comprises 3–7 elements, with one mandatory element (totaling 27 elements) and 2–11 specific factors for each element, each containing a key factor. The total score for PCMH is 100, categorized into 3 levels: 35–59 for level 1, 60–84 for level 2, and 85–100 for level 3 [17]. Institutions with PCMH scores below 35 were classified as unrated level. A higher NCQA-PCMH score for a CHSI indicates superior service quality [18].

Assessment of clinicians' legal literacy

The concept of legal literacy pertains to the acquisition of knowledge, understanding and critical judgment about the substance of the law, and enabling its utilization in practice [19], which is in accordance with the knowledge-attitude-practice (KAP) framework [20–22]. Thus, we administered a self-reported questionnaire to assess clinicians' legal literacy, including three sections: legal knowledge, legal attitude, and legal compliance. Legal knowledge encompassed hospital administration, adherence to legal standards, assurance of medical quality, safeguarding patients' rights and interests, and preventing and dealing with medical conflicts. Legal attitude was about the clinicians' perspectives on legal education and services, and whether agreed with including legal compliance in institutional quality evaluation. Legal compliance was about whether clinicians choose lawful methods to address challenges encountered in medical practice (Appendix 1).

The total score of the questionnaire was 81, consisting of three equally weighted components: legal knowledge, legal attitude, and legal compliance, each contributing 27 points. The legal knowledge section included 27 questions, each assigned one score. In the legal attitude section, there were 6 questions: one question was assessed with a binary response of 'yes' or 'no', with 'yes' receiving 1 point, while the remaining 5 questions using a scale from 0 (totally unnecessary/unimportant) to 4 (strongly necessary/very important). The total possible score for legal attitude was 21, and scores were normalized to match the weight of the knowledge section by multiplying by 1.28. Similarly, the legal compliance section included 6 questions, with one binary question where 'yes' was assigned 1 point. The other 5 questions offered options between 'legal means' or 'non-legal means', with 'legal means" assigned 1 point. This section's maximum score was 6, and to ensure equal weighting, scores were multiplied by 4.5. The institutional legal literacy level was determined by assigning the average clinicians' legal literacy score in this CHSI.

For a newly developed questionnaire that incorporates non-scale questions, it is essential to evaluate the content validity of the questionnaire to substantiate the rationale underlying its design [23]. The Delphi method is a primary approach for assessing the validity of questionnaire content. Therefore, we used the Delphi method to validate our questionnaire [24]. To achieve this, we engaged 30 experts from hospitals and medical colleges to participate in the validation process. We gathered their opinions to ascertain consensuses [25]. The reliability analysis was assessed through the panel's coordination and authority. The Cronbach's Alpha for this questionnaire is 0.944 (> 0.8), indicating that the coordination was credible [26]. The authority coefficient for expert consultation in this questionnaire was 3.62 (> 3.5), signifying that the participating experts processed a high level of authority and the result was reliable [27]. The compilation process can be seen in Appendix 2.

Covariates

The demographics and employment characteristics of clinicians were obtained using a self-reported questionnaire. Covariates included participants' age, sex (male, female), position (physician, nurse), duration of employment (less than 5 years, 6–10 years, 11–15 years, 16–20 years, more than 21 years), educational qualification (technical secondary school or below & junior college, bachelor degree, master degree & doctor degree) and professional designation (Intern & Resident doctor (RD) or Nurse practitioner (NP), Attending doctor (AD) or

Nurse-in-charge (NC), Associate chief physician (ACP) & Chief physician (CP) or Associate professor of nursing (APN) & Professor of nursing (PN)) [21, 28].

Institutional variables encompassed the classification of CHSIs (Community health service center, Community health service station) [29], sourced from the official Shenzhen Municipal Health Commission database. For each CHSI, the average age of clinicians, the proportion of clinicians with educational qualifications exceeding junior college (PCEJ; Numerator, the number of clinicians with an educational qualification exceeding junior college in this CHSI; Denominator, the number of clinicians from the CHSI included in this study), the proportion of clinicians with over 10 years of occupational experience (PCTO; Numerator, the number of clinicians with more than 10 years of occupational experience in this CHSI; Denominator, the number of clinicians from the CHSI included in this study), and the proportion of clinicians' professional designation exceeding AD or NC (PCPAN; Numerator, the number of clinicians with a designation exceeding AD or NC in this CHSI; Denominator, the number of clinicians from the CHSI included in this study) were also included [30]. To describe the baseline characteristics of CHSIs, we grouped them according to the levels of NCQA-PCMH (Unrated level & level 1, level 2, level 3) (Appendix 3).

Statistical analysis

Continuous variables were expressed as Means ± Standard Deviations, whereas relative frequencies were computed for categorical variables. The Homogeneity of Variance tests were conducted, and we used Analysis of Variance (ANOVA) tests to analyze clinicians' legal literacy across groups defined by sex, position, duration of employment, educational qualifications, and professional designations. We applied ANOVA test and Least Significant Difference t test (LSD-t) to compare CHSIs' legal literacy across NCQA-PCMH levels. Chi-Square test and ANOVA test were obtained to examine the variations in institutional features among NCQA-PCMH levels. Kruskal-Wallis H test was used to explore the difference in institutional service quality among NCQA-PCMH levels, as the results of the Homogeneity of Variance tests among levels were less than 0.1.

We employed General Linear Model (GLM) to estimate the link between clinicians' legal literacy and the service quality of CHSIs. We estimated adjusted associations after controlling for institutional confounding variables, including the classification of CHSIs, the average age of clinicians, PCEJ, PCTO, and PCPAN [30]. We conducted a subgroup analysis stratified by position to explore whether physicians' and nurses' legal literacy differentially impacts institutional service quality.

To evaluate the robustness of our regression estimates, we applied a sensitive analysis by excluding community health centers ($N = 7$).

All the statistical analyses were conducted with SPSS 26 (SPSS Inc., Chicago, IL, USA). All statistical tests were two-sided with an $\alpha = 0.05$ to determine statistical significance.

Comparative analysis

Comparative analysis is a well-established methodology used to identify similarities and differences among units of analysis [31]. The objective of the comparative analysis in this study was to identify similarities between NCQA-PCMH standards, laws governing medical practices, and the legal literacy questionnaire (Appendix 4). The NCQA-PCMH outlines the criteria for recognizing the quality of care in CHSIs [32]. Laws define the rights and duties of clinicians in the medicine practice [33]. The legal literacy questionnaire, validated by experts, clarifies the precise meaning of clinicians' legal literacy. By synthesizing the common requirements across the above three, we can discern the alignment between the mandatory implementation measures in NCQA-PCMH and the statutory requirements inherent in legal literacy. Thus, the comparative analysis allowed us to explore the consistency of legal requirements between CHSIs' service quality and clinicians' legal literacy and identify the key factors of institutional quality associated with clinicians' legal literacy.

Results

Characteristics and legal literacy of clinicians

Characteristics and legal literacy of clinicians are presented in Table 1. The average age of clinicians was 38.12 ($SD = 7.88$), with 81.6% being women. Clinicians' characteristics stratified by the levels of CHSIs were presented in Appendix 5, and there were significant differences in clinicians' professional designations ($P = 0.035$) among different levels of CHSIs. The distribution of the participant's age, sex, position, duration of employment, and educational qualification was not significantly different among levels of CHSIs (P value from 0.068 to 0.945).

The average legal literacy score of recruited clinicians was 57.81 ($SD = 7.88$). Participants with higher professional designation ($P = 0.010$) tend to have higher legal literacy (Table 1).

The characteristics and legal literacy of CHSIs

Figure 2 showed the legal literacy of CHSIs across NCQA-PCMH levels. The average scores were 56.86 ($SD = 3.07$) for unrated level and level 1, 58.22 ($SD = 3.71$) for level 2, and 59.77 ($SD = 3.32$) for level 3. The average legal literacy for CHSIs at level 3 differed significantly from those in unrated level & level 1 ($P = 0.024$).

Table 1 The characteristics and legal literacy of clinicians

Characteristics	Overall (*n* = 477)	Scores of legal literacy	*P* value*
Age, **M** ± ***SD***	38.12 ± 7.88	NA	NA
Sex, **n (%)**			0.597
female	389 (81.6)	57.78 ± 7.75	
male	88 (18.4)	57.92 ± 8.52	
Position, **n (%)**			0.921
nurse	204 (42.8)	57.81 ± 7.93	
doctor	273 (57.2)	57.80 ± 7.87	
Occupational period, **n (%)**			0.089
less than 5 years	90 (18.9)	56.17 ± 8.20	
6–10 years	96 (20.1)	57.47 ± 7.10	
11–15 years	98 (20.5)	58.02 ± 8.38	
16–20 years	90 (18.9)	58.69 ± 8.45	
more than 21 years	103 (21.6)	58.58 ± 7.19	
Educational qualification, **n (%)**			0.759
technical secondary school or below & junior college	24 (5.0)	57.84 ± 6.40	
bachelor degree	410 (86.0)	57.87 ± 7.80	
master degree & doctor degree	43 (9.0)	57.17 ± 8.08	
Professional designation, **n (%)**			0.010
Intern & RD / NP	66 (13.8)	56.12 ± 7.71	
AD / NC	354 (74.2)	57.82 ± 7.87	
ACP/ APN & CP/ PN	57 (11.9)	59.69 ± 7.88#	

RD, Resident doctor; NP, Nurse Practitioner; AD, Attending doctor; NC, Nurse-in-charge; ACP, Associate chief physician; CP, Chief physician; APN, Associate professor of nursing; PN, Professor of nursing; NA, not available; *ANOVA tests for the differences in average legal literacy among different groups. P values are two-sided, with statistical significance set at $P < 0.05$. # The legal literacy of clinicians who were Intern & RD was statistically different from those who were ACP & CP ($P = 0.037$)

Among the 58 CHSIs, 7 were community health service centers (12.07%), and others were community health service stations (87.93%). Appendix 3 showed the baseline characteristics of CHSIs in different NCQA-PCMH levels, and there were no differences in variables.

Service quality of CHSIs

Table 2 presents the average service quality scores of CHSIs stratified by NCQA-PCMH. The average total score of CHSIs' NCQA-PCMH was 67.91($SD = 16.97$). CHSIs did best in PCMH2, the average score was 9.86 ($SD = 1.53$) with a total score of 12. CHSIs did worst in PCMH6, the average score was 6.51 ($SD = 7.17$) with a total score of 20. Among the 58 CHSIs, 18 CHSIs were identified as unrated level and level 1, 27 as level 2, and 13 as level 3. The scores of NCQA-PCMH and its subdomains were all statistically different among the 3 levels.

Association between clinicians' legal literacy and the service quality of CHSIs

Table 3 showed a positive association between clinicians' legal literacy and the service quality of CHSIs. Adjusting for the classification of CHSIs, the average age of clinicians, PCEJ, PCTO, and PCPAN, clinicians' legal literacy was significantly positively associated with CHSIs' NCQA-PCMH achievement ($a\beta = 1.360$, 95%$CI = 0.091$–2.630, $P = 0.036$).

Among the six domains of NCQA-PCMH, PCMH1, PCMH3 and PCMH4 were positively associated with clinicians' legal literacy of CHSIs (PCMH1: $a\beta = 0.184$, 95%$CI = 0.080$–0.287, $P = 0.001$; PCMH3: $a\beta = 0.330$, 95%$CI = 0.052$–0.608, $P = 0.020$; PCMH4: $a\beta = 0.660$, 95%$CI = 0.256$–1.063, $P = 0.001$). Refer to Appendix 6 for the full adjusting model, results were consistent.

Stratified analysis by position showed that physicians' legal literacy was associated with the total score ($a\beta = 1.429$, 95%$CI = 0.425$–2.434, $P = 0.005$) and three subdomains (PCMH1, PCMH3, PCMH4) of NCQA-PCMH. Nurses' legal literacy was associated with the score of PCMH3 ($a\beta = 0.317$, 95%$CI = 0.100$-0.534, $P = 0.004$) and PCMH4 ($a\beta = 0.434$, 95%$CI = 0.103$–0.766, $P = 0.010$) (Appendix 7).

Appendix 8 showed the results were consistent when we excluded community health centers ($N = 7$).

Consistency of legal requirements between CHSIs' service quality and clinicians' legal literacy

We found eight key factors from PCMH1, PCMH3 and PCMH4 that have aligned legal requirements with clinicians' legal literacy. These factors are detailed in Appendix 4, including patient records, health information transmission safety, adverse drug reaction monitoring, living will, controlled medical expenses, paper-based care plans, and medication assessment and adjustment. For example, one factor from element B in PCMH1 requires that "patient records" include clinical advice. This requirement aligns with the stipulations set forth in the *Civil Code of the People's Republic of China* (articles 1222 & 1225) and *Regulation on the Prevention and Handling of Medical Disputes* (articles 15 & 16). Concurrently, the legal literacy questionnaire emphasizes the necessity for healthcare providers to recognize that medical records possess legal authority and that improper management of patient medical records may result in legal liabilities.

Discussion

The study findings showed that clinicians' legal literacy was positively associated with the service quality of CHSIs determined by NCQA-PCMH, which was consistent with studies conducted in other countries. For instance, Yassine et al. believed that improved legal literacy of public health practitioners is associated with

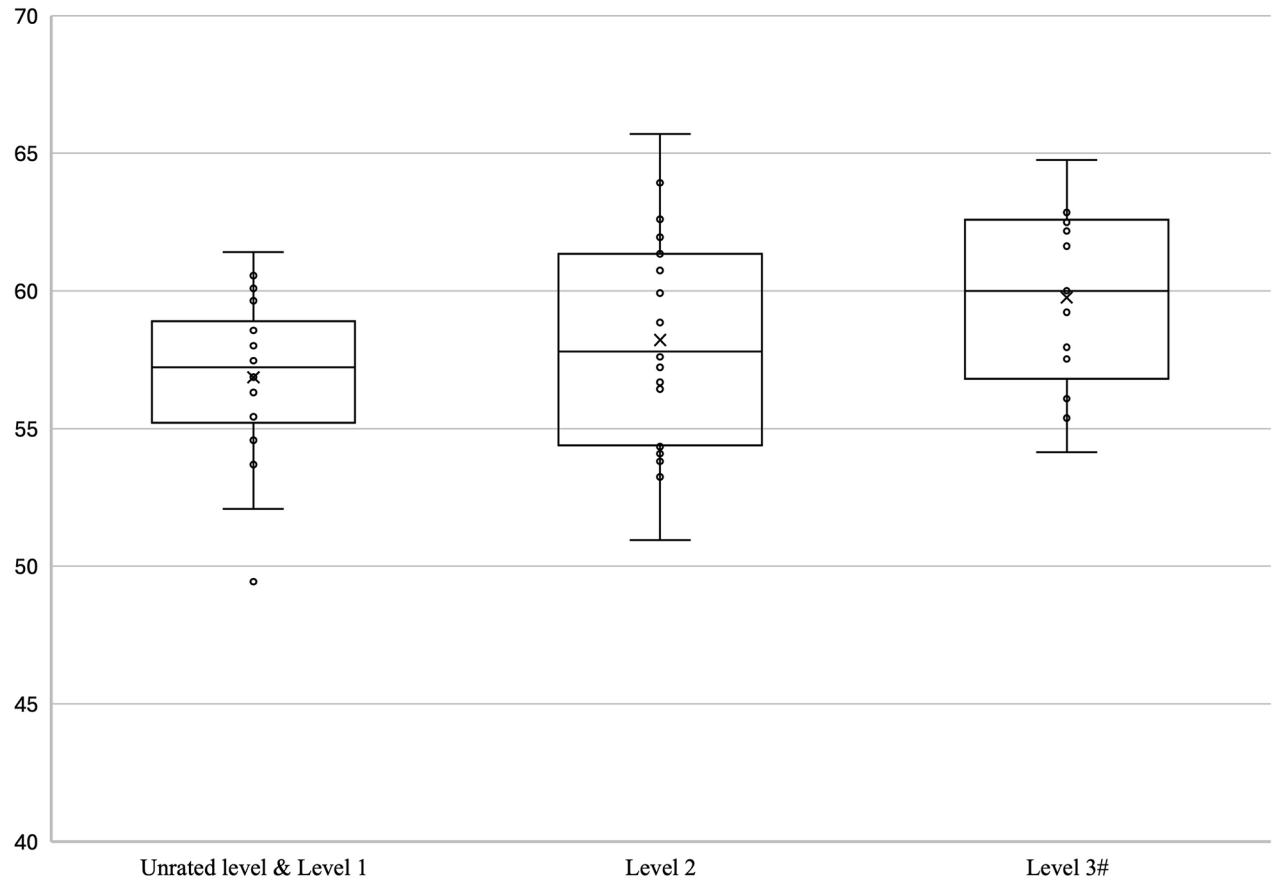

Fig. 2 The legal literacy of CHSIs categorized by the level of NCQA-PCMH
Levels were determined by NCQA-PCMH, which indicates service quality of CHSIs. #ANOVA tests and LSD-t test for the differences of average CHSIs' legal literacy among different NCQA-PCMH levels. The average legal literacy of CHSIs at level 3 exhibited a statistically significant difference compared to that of CHSIs at unrated level & level 1 ($P=0.024$). P values are two-sided, with statistical significance set at $P<0.05$

Table 2 CHSIs' service quality stratified by NCQA-PCMH levels

NCQA-PCMH	Total (*N* = 58)	Unrated Level & Level 1 (*N* = 18)	Level 2 (*N* = 27)	Level 3 (*N* = 13)	*P* value*
Total score	67.91 ± 16.97	47.95 ± 9.34	70.47 ± 6.00	90.22 ± 3.75	< 0.001
PCMH1	8.14 ± 1.47	7.27 ± 1.51	8.11 ± 1.31	9.40 ± 0.71	0.001
PCMH2	9.86 ± 1.53	8.79 ± 2.04	10.10 ± 0.90	10.85 ± 0.72	0.002
PCMH3	16.15 ± 3.78	12.75 ± 4.10	16.84 ± 2.43	19.42 ± 1.18	< 0.001
PCMH4	15.27 ± 5.67	10.36 ± 6.22	16.51 ± 4.19	19.46 ± 1.13	< 0.001
PCMH5	11.90 ± 6.33	4.75 ± 6.03	15.00 ± 3.07	15.46 ± 2.63	< 0.001
PCMH6	6.51 ± 7.17	4.03 ± 4.47	3.78 ± 6.06	15.63 ± 4.48	< 0.001

NCQA-PCMH, Patient-Centered Medical Home from the National Committee for Quality Assurance, which indicates service quality of CHSIs. CHSIs, Community Health Service Institutions. Data are Mean ± SD. *Kruskal-Wallis H test for the differences of service quality between NCQA-PCMH levels as the homogeneity of variance tests of PCMH1-6 all smaller than 0.01. *P* values were two-sided, with statistical significance set at $P<0.05$.

enhanced service quality of public health institutions [11]. McHale illustrated that British law significantly contributes to the enhancement of healthcare practice quality [8].

Among the six NCQA-PCMH domains, the scores of Patient-Centered Access (PCMH1), Population Health Management (PCMH3), and Management and Support (PCMH4) were associated with clinicians' legal literacy. To date, this is the first quantitative study examining the association between clinicians' legal literacy and primary healthcare service quality, offering an objective understanding of their relationship.

Specific factors from NCQA-PCMH related to clinicians' legal literacy

Through comparative analysis (Appendix 4), we identified specific NCQA-PCMH that connected with clinicians' legal literacy. Our findings revealed a consistency in legal requirements between the service quality of CHSIs and clinicians' legal literacy.

Table 3 The association between clinicians' legal literacy and service quality of CHSIs ($N=58$)

NCQA-PCMH[1]	Crude		Adjusted[2]	
	β (95%CI)	*P* value*	β (95%CI)	*P* value*
Total score	1.305 (0.118, 2.492)	0.031	1.360 (0.091, 2.630)	0.036
PCMH 1	0.146 (0.046, 0.246)	0.004	0.184 (0.080, 0.287)	0.001
PCMH 2	0.023 (-0.088, 0.134)	0.686	0.016 (-0.100, 0.133)	0.784
PCMH 3	0.300 (0.036, 0.564)	0.026	0.330 (0.052, 0.608)	0.020
PCMH 4	0.638 (0.260, 1.016)	0.001	0.660 (0.256, 1.063)	0.001
PCMH 5	0.295 (-0.159, 0.749)	0.202	0.260 (-0.213, 0.733)	0.281
PCMH 6	-0.072 (-0.593, 0.449)	0.787	-0.055 (-0.612, 0.502)	0.846

[1]NCQA-PCMH, Patient-Centered Medical Home from the National Committee for Quality Assurance, which indicates service quality of CHSIs. [2] Adjust by the classification of CHSIs, the average age of clinicians, PCEJ, PCTO, and PCPAN.* The general linear model (GLM) for the associations between clinicians' legal literacy and the service quality of CHSIs. *P* values were two-sided, with statistical significance set at $P<0.05$

Patient-Centered Access (PCMH1): documenting clinical advice in patient records and the capacity to send a secure message

Documenting clinical advice in patient records and the capacity to send a secure message are the key factors in PCMH1. Medical records have always been an important factor affecting the incidence of physician-patient disputes in medical institutions [34]. A study revealed that the quality of medical records influenced 6.3% of medical disputes in Shanghai, China [35]. Article 1222 in *the Civil Code of the People's Republic of China* explicates the principle of presumption of fault if a medical institution loses, forges, tumbles, or illegally destroys medical records. The standardization of medical records writing is based on physicians' legal literacy about the law [36].

Privacy, confidentiality, and security are interrelated and supported by information governance, contributing directly to patient safety and service quality [37]. According to Article 28 of *the Personal Information Protection legal of the People's Republic of China*, health information is sensitive personal information, information processors should protect personal health information. With the digital revolution, informational technologies have improved the efficiency and service quality of medical institutions [38]. However, the transmission of massive health information threatens patients' information security [37]. Patients' privacy risks were estimated as high during data sharing in China [39], and the clinicians' legal literacy on protecting patients' healthcare information needs to be strengthened.

The associations between physicians' and nurses' legal literacy and institutional service quality were different in PCMH1 (Appendix 7). Several potential reasons may explain this. Physicians and nurses develop their clinical skills in different practice environments [40]. It is physicians' responsibility to provide clinical advice, while nurses tend to be operators [41]. At the same time, physicians rely on patient information to carry out medical practices, thus physicians may be at greater risk of leaking patient information.

Population health management (PCMH3): advanced care planning and medication monitoring or alert

We found Advanced Care Planning (ACP) and medication monitoring or alerts in this domain were associated with clinicians' legal literacy.

The living will is the main form of ACP in China [42]. *Regulations of the Shenzhen Special Economic Zone on Medical Treatment* bring living wills into law for the first time in the Chinese mainland. The effective conditions of a living will should be strictly limited, due to it is related to the right to life, and clinicians need to know under what circumstances a living will is valid. In other words, the legal literacy of physicians and nurses ensures a legitimate living will that can increase the quality of life of dying persons [43].

Adverse drug reaction (ADR) threatens the safety of patients [44]. With the increasing awareness that drugs may cause body damage, drug safety has been paid more attention. The China Adverse Drug Reaction Monitoring System received 1.676 million reports in 2020 [45]. Patient safety is the cornerstone of high-quality healthcare [46]. *Measures for the Reporting and Monitoring of Adverse Drug Reactions* have clarified the legal responsibility of medical personnel for monitoring adverse drug reactions since 2011, and the protective effect depends on clinicians' understanding, acceptance, and implementation of the law.

Care management and support (PCMH4): high expenses or utilization, provide written form care planning, reconcile medications for patients received from care transitions, and provide information about new prescriptions

We found high expenses or utilization, providing written form care planning, reconciling medications for patients received from care transitions, and providing information about new prescriptions in this domain were associated with clinicians' legal literacy.

The medical expenses paid by individuals remained 34.39% in China till 2023 [47], which brought a great economic burden to some vulnerable families and hindered equity in health. Article 29 of *Legal on Physicians of the People's Republic of China* clearly states that financial considerations should be considered when physicians

prescribe. Controlling medical expenses is patient-centered, and increased clinicians' legal literacy shall intensify their consciousness of expense control, which improves patients' experience at an affordable level.

Article 13 in the *Regulation on the Prevention and Handling of Medical Disputes* stipulates that physicians should interpret the contents of prescriptions to patients in detail to implement informed consent. Written care planning is designed as a mandated process in medical entities [48]. A well-written care plan allows the documentation and sharing of information from conversations with patients, relatives, and carers [49]. Previous studies suggested sharing written medical planning with patients can improve patient-centered communication effectively [50, 51], and ultimately improve service quality. Clinicians have a legal and regulatory duty to be familiar with this and ensure adherence in daily practice.

China had built a hierarchical diagnosis and treatment system, and patients were transferred up to tertiary hospitals or down to CHSIs. NCQA highlights reconciling medication for referred patients as a critical factor. Article 18 in *Measures for the Administration of Medical Quality* stipulates reviewing and reconciling medication for referred patients is required to improve the serviceability of clinical pharmacies. Review medications for referred patients makes sure the suitability of the new prescriptions. It is a specific way to enhance the collaboration between different kinds of medical institutions, and for hospitalized patients, it can reduce morbidity and mortality [52]. We suggested clinicians' higher legal literacy was associated with smoother and safer referrals.

Similar to ADR mentioned in PCMH3, the effect of providing information about new prescriptions to patients also focuses on drug safety. The association between drug safety and clinicians' legal literacy has been discussed above.

Implication of the findings

To the best of our knowledge, until now, no previous studies have tested the association between clinicians' legal literacy and the service quality of primary healthcare institutions. Our study provides quantitative evidence to highlight that the legal literacy of clinicians is associated with the service quality of CHSIs. This study can also provide experience for other developing countries.

Conclusion

The study indicated that clinicians' legal literacy was positively associated with the service quality of CHSIs, particularly in Patient-Centered Access (PCMH1), Population Health Management (PCMH3), and Management and Support (PCMH4). Based on these results, we recommend enhancing the legal literacy of clinicians through carrying out medical education. It is feasible and effective in improving the service quality of primary medical institutions. Our findings inspire policymakers and managers to attach importance to the legal literacy of clinicians, assisting them in formulating policies to improve contemporary management systems in medical facilities.

Strengths and limitations of this study

This study has some strengths. First, we administered a questionnaire validated by the Delphi method to evaluate clinicians' legal literacy. Second, we provided quantitative evidence of the association between clinicians' legal literacy and primary healthcare service quality.

This study has several limitations. First, the study is a cross-sectional analysis, more studies are needed to determine the causal relationship between clinicians' legal literacy and the service quality of CHSIs. Second, the service quality of CHSIs can be influenced by many other factors, which were not included in our adjusted model such as the number of family physician teams.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-07243-2.

Supplementary Material 1

Author contributions

Fang Xie: Data curation, Investigation, Formal analysis, Writing original draft Ruqing Liu: Methodology, Formal analysis, Supervision, Writing- Review & Editing Peng Sun: Conceptualization, Data curation, Resources, Supervision Lingling Zheng: Formal analysis Kaixuan Wang: Data Curation Jianli Chen: Formal analysis Ruwei Hu: Conceptualization, Funding Acquisition, Writing-Review & Editing.

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Data availability

The data and materials presented in this study are available on request from the corresponding author.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Human Studies Committee of Sun Yat-Sen University (No. IRB2024.100), following the Declaration of Helsinki-Ethical Principles for Medical Research Involving Human Subjects. All participants were fully informed about the purpose, procedures, and benefits of this study. Written informed consent was obtained from each participant prior to data collection, and they were assured of voluntary participation in this study. Consent forms are securely stored by the research institution.

Consent for publication

All authors agreed to publish this article.

Competing interests
The authors declare no competing interests.

Completing interests
None reported.

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