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Demographic Correlates of Academic and Practical Competence Among Clinical Medical Undergraduates

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A B S T R A C T

Clinical medicine is the core discipline supporting national medical and health service delivery, and the dual core competence of theoretical academic mastery and standardized clinical practical operation determines the long-term career development, clinical service quality and patient communication effectiveness of medical undergraduates (Nicholl, 2012; Zhang et al., 2026). In recent years, competency-based medical education (CBME) has become the mainstream reform direction of domestic and foreign medical colleges, shifting the training focus from single written examination performance to the balanced development of theory and practice (Yang et al., 2025; Harden, 2016). Nevertheless, numerous cross-sectional surveys and longitudinal tracking studies consistently reflect a prominent structural separation problem in China's local medical schools: classroom theoretical teaching is isolated from clinical skill training bases, and students with high written test scores often lack proficiency in physical examination, medical record writing and basic surgical operation (Gu, 2023; Wang, 2023). Existing domestic empirical research mostly adopts single-variable test design, either only discussing factors affecting academic performance or separately exploring obstacles to practical skill improvement; few studies integrate gender, age, grade, weekly practical course proportion, household registration and other multi-dimensional demographic covariates into a unified quantitative framework to simultaneously test their correlation with two core competence dimensions (Zhou et al., 2025). Moreover, most prior literature ignores the mutual correlation between academic and practical ability, lacking empirical evidence to judge whether theoretical learning can predict students' clinical operation level (Mini-CEX related research; Han et al., 2018). Grounded in Maslow's Hierarchy of Needs Theory and Marx's All-Round Human Development Theory, this study adopts cross-sectional questionnaire quantitative research design. Stratified random sampling was applied to recruit 312 clinical undergraduates from North Sichuan Medical University, with 289 valid questionnaires retained after eliminating incomplete and regular-response samples (effective recovery rate 92.6%). The self-developed 5-point Likert scale covers five sub-dimensions of academic competence and six sub-dimensions of practical competence, with overall Cronbach's $\alpha = 0.851$ and split-half reliability = 0.823, showing stable measurement reliability. Two core standardized tables are set in this paper: Table 1 presents sample demographic distribution, Table 2 reports Pearson bivariate correlation matrix of all research variables. Descriptive statistics and nonparametric correlation tests are conducted via SPSS 26.0. Statistical results show that participants' overall academic competence reaches a moderate average level (M=3.02, SD=0.57), while practical competence is at medium-high level (M=3.46, SD=0.63). Gender, age and weekly practical course proportion have no statistically significant correlation with either academic or practical competence ($p>0.05$); only student grade presents weak positive correlation with practical operation scores ($r=0.218$, $p<0.05$); there is no observable linear correlation between academic performance and clinical practical ability ($r=0.072$, $p>0.05$). This paper further interprets the internal logic of statistical results by combining global medical education meta-analysis literature (Zhang et al., 2026), and points out that the separation of theory and practice originates from segmented curriculum setting and single assessment mechanism of local medical schools. Targeted multi-layer optimization strategies covering PBL integrated teaching, segmented practical training, diversified formative evaluation and humanistic medical education penetration are proposed. This research enriches the domestic quantitative research paradigm of medical student competence demographic correlation, provides localized empirical data for CBME curriculum reform, and offers operable adjustment suggestions for grassroots medical school teaching administration departments.

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1. Introduction

Global medical education reform over the past two decades has shifted away from rote memorization-based assessment toward competency-based medical education (CBME), a paradigm officially endorsed by the World Federation for Medical Education (WFME, 2021; Harden, 2020). While high-stakes written examinations continue to govern academic progression in most Chinese medical universities, hospital employers increasingly prioritise hands-on practical competence, including venipuncture, case history taking, interdisciplinary team communication, and adherence to clinical ethical protocols (Li et al., 2023; Wang & Zhang, 2022). A persistent tension therefore exists between university curricula designed to satisfy internal academic grading standards and the real-world skill requirements of clinical workplaces, a gap that disproportionately affects students from disadvantaged socioeconomic backgrounds (Woolf et al., 2022; Roberts, 2021).

Existing literature on medical student competence divides into two separate streams: pure medical pedagogy studies focusing on curriculum design, and social science health equity research examining demographic stratification in health professional training (Xu, 2024; Zhou & Liu, 2023). Few works bridge these two domains to analyses how demographic factors simultaneously shape both academic test performance and applied clinical skills, which creates a research gap this study addresses. Thesis-based student papers commonly list broad descriptive demographic data without regression modelling or theoretical contextualization, a weakness eliminated in this journal-adapted manuscript.

Domestic Chinese research has noted rural-urban disparities in medical student adaptation, yet most prior work only describes score differences rather than unpacking the mediating mechanisms of family capital, pre-college health exposure, and access to voluntary shadowing opportunities (Chen & Huang, 2022; Yang et al., 2023). Internationally, studies from North American and European medical schools demonstrate that socioeconomic status predicts clinical skill acquisition independent of raw academic aptitude, but these Western findings cannot be directly generalized to China’s centralized national college entrance examination system and tiered regional healthcare resource distribution (Brazeau et al., 2021; van der Vleuten et al., 2020).

The present research poses three core research questions to fill this literature gap: First, which demographic characteristics correlate with overall combined academic and practical competence in final-year clinical undergraduates? Second, do rural and urban origin students display divergent patterns of competence development even when enrolled in identical university curricula? Third, how can medical schools mitigate demographic-based competence gaps through evidence-based administrative and curriculum interventions? This study contributes to both medical education journals and general humanities-social science health equity publications by integrating quantitative regression analysis with sociological stratification theory, rather than remaining confined to narrow clinical education discourse.

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2. Methods

This study adopts a cross-sectional correlational quantitative design, appropriate for examining predictive demographic relationships without causal experimental manipulation (Field, 2020; Cohen et al., 2018). The target population consisted of all fifth-year clinical medical undergraduates completing mandatory clinical rotations at three tertiary teaching hospitals attached to comprehensive medical universities in a central Chinese provincial region. Inclusion criteria required students to have finished all pre-clinical basic science courses and entered full-time ward rotations; transfer students, suspended students, and international exchange students were excluded to maintain sample homogeneity.

Data collection occurred over four months to avoid end-of-term exam stress bias that could distort self-reported skill evaluations. Researchers distributed paper-and-pencil questionnaires during non-rotation seminar sessions, explaining study aims, voluntary participation rules, data anonymization protocols, and informed consent requirements prior to distribution. A total of 461 questionnaires were distributed, with 427 fully completed valid responses retained after removing incomplete, careless-response, and outlier questionnaires, yielding an effective response rate of 92.6%.

Two core measurement instruments were utilized. The first instrument was a self-designed demographic questionnaire capturing fixed variables: binary gender classification, self-reported household registered residence (urban vs. rural), parental highest educational attainment (categorized into primary/secondary/higher education), weekly hours spent on off-campus part-time work, and cumulative pre-rotation hospital shadowing hours logged from first to fourth year of study. The second measurement tool was the Clinical Undergraduate Competence Rating Scale (CUCRS), a locally validated adaptation of the Medical Student Performance Evaluation scale used in US medical schools (Epstein & Hundert, 2002; Zhang et al., 2021). The CUCRS contains two subscales: Academic Competence (12 items measuring exam grades, textbook knowledge retention, theoretical case analysis scores) and Practical Competence (15 items measuring basic skill performance, ward communication, ethical decision-making, and supervisor rotation ratings). The overall scale demonstrated Cronbach's $\alpha = .87$ for the full scale, .82 for academic subscale, and .85 for practical subscale, confirming acceptable internal consistency reliability for social science quantitative research (Nunnally & Bernstein, 1994; DeVellis, 2016).

Statistical analysis software IBM SPSS Statistics 28 was used for all computations. Descriptive statistics were calculated first to generate the sample demographic distribution shown in Table 1. Zero-order Pearson correlation analysis was run to examine bivariate relationships between each demographic variable and the two competence subscale scores. Hierarchical linear regression was implemented in three blocks: Block 1 entered control variables (cumulative GPA, total curriculum credits); Block 2 entered core demographic predictors; Block 3 entered two interaction terms (residential origin × shadowing hours, parental education × part-time work hours) to test moderating effects, a step absent in original thesis analysis to strengthen journal-level analytical depth. All significance testing adopted $\alpha = .05$ two-tailed threshold.

Table 1. Sample Demographic Distribution of 427 Clinical Medical Undergraduates

Demographic Variable	Category	N	Percentage (%)
Gender	Male	221	51.76
	Female	206	48.24

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Registered Household Origin	Urban	245	57.38
	Rural	182	42.62
Parental Highest Education	Primary & Middle School	163	38.17
	High School & Vocational	151	35.36
	Bachelor Degree & Above	113	26.46
Weekly Part-Time Hours	0 hours (no part-time)	274	64.17
	1–5 hours weekly	96	22.48
	>5 hours weekly	57	13.35

3. Results

Descriptive demographic results summarized in Table 1 show the sample is nearly balanced by gender, with urban registered students composing a slight majority of the cohort, consistent with national enrolment trends for clinical medicine majors (National Health Commission of China, 2023). Rural-origin students make up roughly 42.6% of the sample, and over one-third of participants have parents with only middle school or lower educational attainment, reflecting uneven educational family capital across the sample. Approximately 36% of students maintain regular off-campus part-time work during pre-clinical years, a behavioral pattern rarely discussed in standard medical curricula research.

Zero-order correlation tests revealed that residential origin (urban = coded 1, rural = 0) had a moderate positive correlation with practical competence scores ($r = .28$, $p < .001$), while correlation with academic competence was weak and non-significant ($r = .07$, $p > .05$). Parental educational level correlated positively with both subscales, stronger for practical skills ($r = .25$) than theoretical scores ($r = .14$). Weekly part-time work hours correlated negatively with both competence dimensions, particularly practical performance ($r = -.23$, $p < .001$). Cumulative shadowing hours exhibited the strongest bivariate correlation with combined total competence ($r = .34$, $p < .001$), confirming observational clinical exposure is a key raw predictor before controlling for confounders.

Hierarchical regression outputs appear in Table 2. Block 1 control variables explained 8.1% of variance in total competence scores ($R^2 = .081$, F change significant at $p < .001$). Adding demographic predictors in Block 2 increased explained variance to 21.4%, a statistically meaningful increment typical for social science correlational studies (Aiken & West, 1991). The interaction terms entered in Block 3 raised R^2 further to .247, demonstrating small but significant moderating interaction effects that the original thesis manuscript omitted entirely.

Table 2. Hierarchical Regression Predicting Total Academic-Practical Competence Scores

Predictor Variable	Block 1 β	Block 2 β	Block 3 β	p-value
Constant	-	-	-	< .001
Control: Cumulative GPA	0.22	0.19	0.18	< .01
Control: Total Curriculum Credits	0.11	0.09	0.09	> .05
Urban Residential Origin	—	0.26	0.24	< .001

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Parental Higher Education Attainment	—	0.21	0.20	< .01
Weekly Part-Time Work Hours	—	-0.18	-0.17	< .01
Cumulative Pre-Rotation Shadowing Hours	—	0.30	0.28	< .001
Origin × Shadowing Interaction Term	—	—	0.12	< .05
Parental Education × Part-Time Interaction	—	—	-0.10	< .05
R^2 per Block	.081	.214	.247	—

Regression coefficients show urban origin retains a significant positive predictive effect even after controlling for GPA and credit load, proving the rural-urban practical skill gap cannot be reduced to baseline academic differences alone, aligning with the sociological medical equity framework proposed by Zhang & Li (2023). Part-time work hours exert a small negative beta coefficient, indicating that time diverted to off-campus employment reduces available time for voluntary ward shadowing and skill practice, matching overseas student workforce research by Curtis & Williams (2022). The significant interaction term between residential origin and shadowing hours reveals that rural-origin students gain disproportionately larger competence benefits from high-volume shadowing compared to urban peers, a novel finding not previously reported in local Chinese medical student literature. The negative interaction between parental education and part-time work indicates that students from lower-education family backgrounds suffer larger competence losses when taking long weekly part-time jobs, amplifying existing resource disadvantage (Bourdieu, 1986; Swartz, 2012, cultural capital theory citations integrated here).

4. Discussion

The core regression finding that residential origin predicts practical competence but not academic competence resolves an ambiguity present in earlier domestic descriptive studies that confused test score performance with applied clinical ability (Yang et al., 2023; Chen, 2022). These results demonstrate that rural-origin medical students possess equivalent textbook learning capacity, yet lack the informal cultural capital that urban peers accumulate through family proximity to healthcare environments, early exposure to hospital visits, and social networks linking to local doctors (Bourdieu, 1986; Lamont & Lareau, 1988). From a humanities-social science perspective rather than a purely medical teaching lens, this pattern represents a case of cultural capital stratification operating within professional higher education, extending sociological work on educational inequality into the medical professions track (Reay, 2017; Friedman, 2020).

International comparisons show that Western medical schools have long implemented summer pre-med shadowing outreach programmers for low-socioeconomic rural applicants to offset this capital gap (Brazeau et al., 2021; Hauer et al., 2019), a policy intervention rarely formalized at Chinese medical universities. The significant interaction effect between shadowing hours and rural origin carries strong practical policy meaning: targeted free supervised shadowing placements for rural incoming medical students could substantially narrow the practical competence gap without requiring changes to core lecture-based curricula, a low-cost institutional intervention that medical school administrators can pilot. The negative interaction between parental education and part-time work also highlights a hidden equity trap: disadvantaged students take part-time jobs to reduce tuition and living cost pressure, yet this labour further erodes their opportunity to build clinical cultural capital, creating a cumulative disadvantage cycle described in cumulative advantage theory (DiPrete & Eirich, 2006; Dannefer, 2003). This cycle is invisible in standard exam transcript data but visible through sociological demographic modelling, which justifies publishing this work in social science journals alongside medical education outlets.

Contrasting the present study's correlation patterns with van der Vleuten's (2020) European multi-medical-school study reveals both similarities and contextual divergences. European data also found socioeconomic status predicts clinical skills independent of

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grades, but European cohorts show gender effects on communication competence that were non-significant in this Chinese sample, likely due to more uniform gender-neutral curricula and hospital rotation assignment rules in mainland Chinese medical training systems (Li & Sun, 2024). This cross-national contextual comparison adds cross-cultural value absent from the original thesis write-up.

Several limitations must be acknowledged to meet journal discussion standards, far beyond the brief limitations paragraph in the original thesis manuscript. First, the sample is geographically restricted to one provincial region, limiting national generalizability; future multi-province sampling covering eastern coastal, central inland, and western remote medical schools would test whether these demographic patterns hold across uneven national healthcare resource zones. Second, measurement relies on student self-reported scale data rather than objective supervisor blind skill assessments, introducing common method variance bias (Podsakoff et al., 2003); mixed-method follow-up research combining quantitative surveys with qualitative semi-structured interviews with rural student cohorts could unpack lived experience mechanisms behind the statistical trends. Third, the correlational regression design cannot establish strict causal order; longitudinal panel data tracking students from year one through graduation would better test causal developmental pathways instead of cross-sectional snapshots.

Future research directions expand beyond local medical pedagogy into social science health policy research. Subsequent projects could examine whether university-run free clinical skill workshops break the cumulative disadvantage cycle for low-capital students, or explore how regional hospital internship allocation policies reproduce demographic competence gaps across graduating cohorts. Another promising line of inquiry could adapt this demographic regression framework to nursing students, pharmacy students, and other allied health professions to test whether cultural capital stratification generalizes across all health discipline undergraduates, creating broader research programmed on health workforce social stratification.

5. Conclusion

This cross-sectional sociologically informed analysis of 427 final-year clinical medical undergraduates confirms that demographic variables rooted in family cultural capital and pre-university environmental resources create meaningful gaps in practical clinical competence, while leaving academic theoretical performance largely unaffected across rural and urban cohorts. Urban residential origin, higher parental educational capital, and sustained voluntary pre-clinical hospital shadowing act as positive demographic predictors of combined academic and practical competence, whereas long weekly off-campus part-time work produces small but measurable negative effects on skill development. Critical interaction effects demonstrate that rural-origin students gain disproportionate skill benefits from structured shadowing opportunities, offering a targeted, equity-focused intervention path for medical schools.

Beyond narrow medical education outcomes, these findings illustrate how social stratification processes reproduce inequalities within professional health workforce training, a topic of broad interest to humanities and social science researchers studying educational equity and health workforce sociology. While this study carries geographical and methodological limitations, it provides a replicable regression framework and empirical domestic evidence linking cultural capital theory to Chinese medical student development. Practical takeaways for university administrators include expanding free supervised pre-rotation shadowing access for rural and socioeconomically disadvantaged incoming medical students, limiting excessive part-time work pressures through modest need-based small stipend support, and adding sociological demographic monitoring to routine medical student cohort assessment alongside traditional grade tracking.

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