

ORIGINAL RESEARCH ARTICLE

Educational inequality and reproductive autonomy among female students in China: The mediating role of educational attainment in the context of urban-rural disparities

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Abstract

Urban-rural educational inequality remains a major structural challenge in China, yet its implications for young women's reproductive autonomy remain underexplored. This study examined the relationships among educational resource accessibility, perceived educational opportunity equality, school support environment, educational attainment, and reproductive autonomy among female students in China, with educational attainment modeled as a mediator. A cross-sectional quantitative survey was conducted among female students aged 15–24 from selected secondary, vocational, and higher education institutions in Gansu, Henan, and Jiangsu provinces of China. A total of 674 valid responses were analyzed using Structural Equation Modeling. The results showed that educational resource accessibility, perceived educational opportunity equality, and school support environment all positively predicted educational attainment. Educational attainment, in turn, positively predicted reproductive autonomy. The three educational antecedents also had significant direct effects on reproductive autonomy. In addition, educational attainment significantly mediated the relationships between each educational antecedent and reproductive autonomy. These findings suggest that female students' reproductive autonomy is shaped not only by health-related factors but also by educational conditions and academic development. We conclude that, in the context of urban-rural disparities, promoting reproductive autonomy among young women therefore requires greater attention to educational equity, supportive school environments, and the strengthening of students' educational progress. (*Afr J Reprod Health* 2026; 30 [13]: 123-139).

Keywords: Urban-rural educational inequality, Reproductive autonomy, educational attainment, Female students, China, Structural equation modeling

Résumé

L'inégalité éducative entre les zones urbaines et rurales reste un défi structurel majeur en Chine, mais ses implications pour l'autonomie reproductive des jeunes femmes restent sous-explorées. Cette étude a examiné les relations entre l'accessibilité aux ressources éducatives, la perception de l'égalité des opportunités éducatives, l'environnement de soutien scolaire, le niveau d'éducation atteint et l'autonomie reproductive chez les étudiantes en Chine, le niveau d'éducation étant modélisé comme un médiateur. Une enquête quantitative transversale a été menée auprès d'étudiantes âgées de 15 à 24 ans provenant d'établissements d'enseignement secondaire, professionnel et supérieur. Un total de 674 réponses valides a été analysé à l'aide de la modélisation par équations structurelles. Les résultats ont montré que l'accessibilité aux ressources éducatives, la perception de l'égalité des opportunités éducatives et l'environnement de soutien scolaire prédisaient tous positivement le niveau d'éducation atteint. Le niveau d'éducation atteint, à son tour, prédisait positivement l'autonomie reproductive. Les trois antécédents éducatifs avaient également des effets directs significatifs sur l'autonomie reproductive. De plus, le niveau d'éducation atteint médiatisait significativement les relations entre chaque antécédent éducatif et l'autonomie reproductive. Ces résultats suggèrent que l'autonomie reproductive des étudiantes est façonnée non seulement par des facteurs liés à la santé, mais aussi par les conditions éducatives et le développement académique. Promouvoir l'autonomie reproductive chez les jeunes femmes nécessite donc une plus grande attention à l'équité éducative, aux environnements scolaires favorables et au renforcement des progrès éducatifs des étudiantes. (*Afr J Reprod Health* 2026; 30 [13]:123-139).

Mots-clés: Inégalité éducative urbain-rural, Autonomie reproductive, Niveau d'éducation atteint, Étudiantes, Chine, Modélisation par équations structurelles

Introduction

Urban–rural inequality remains one of the most persistent structural challenges in China’s social development, and education is among its most visible and consequential manifestations.¹ Although substantial progress has been made in expanding access to schooling, disparities between urban and rural settings continue to appear in the distribution of qualified teachers, learning materials, digital resources, academic guidance, and broader institutional support.² These differences do not merely shape students’ academic performance in the short term; they also influence how young people understand their future opportunities, evaluate their own capabilities, and imagine possible life trajectories.³ For female students in particular, educational inequality may carry implications that extend beyond schooling itself, because access to supportive and equitable educational environments can affect not only educational progress but also the development of agency, self-expression, and decision-making capacity in other domains of life.⁴

One important domain in which these broader consequences may emerge is reproductive autonomy. Reproductive autonomy refers to an individual’s ability to form, express, and act upon her own views regarding reproductive matters, including whether and when to have children, how to seek reproductive health information and support, and how to resist external pressure in matters related to her body and future family life.⁵ As a concept, reproductive autonomy is closely linked to reproductive health, gender equality, bodily integrity, and personal self-determination.⁶ It is therefore not only a health-related construct but also a social and developmental one. A lack of reproductive autonomy may constrain women’s future choices even when formal educational participation has been achieved, whereas greater autonomy may reflect a broader capacity to convert educational experiences and social resources into meaningful control over one’s life.⁷

Despite its importance, research on reproductive autonomy has focused predominantly on married women, women of reproductive age, contraceptive decision-making, and maternal or clinical populations.⁸ Comparatively less attention

has been paid to younger female students who are still in the process of educational and social development.⁹ This omission is important because reproductive autonomy is unlikely to emerge suddenly in adulthood or only after marriage or childbirth. Rather, it is likely to develop gradually through socialization, education, exposure to support systems, and the accumulation of personal competencies. Female students represent a particularly important population in this regard, because adolescence and early adulthood are periods in which educational trajectories remain active while attitudes toward gender, bodily rights, health, and future family formation are still taking shape.¹⁰ Studying reproductive autonomy among female students therefore allows the analytical focus to shift from reproductive outcomes alone to the developmental conditions under which reproductive agency is formed.¹¹

Within this broader context, urban–rural educational inequality should not be treated as a single undifferentiated condition. A simple rural–urban distinction may be useful descriptively, but it cannot fully capture the educational experiences through which inequality is actually lived and interpreted by students.¹¹ In this study, urban–rural educational inequality is therefore conceptualized through three specific and closely related dimensions. The first is Educational Resource Accessibility, which refers to students’ perceived access to essential learning resources such as qualified teachers, educational materials, digital learning tools, academic guidance, and information about educational advancement.¹² The second is Perceived Educational Opportunity Equality, which captures students’ perceptions of whether educational opportunities are distributed fairly and whether their background constrains their prospects for further study and advancement.¹³ The third is School Support Environment, which refers to the extent to which the school context provides academic encouragement, emotional support, developmental guidance, and health-related educational support.¹⁴ Together, these three dimensions offer a more concrete and analytically useful way of examining how educational inequality is experienced by female students across diverse institutional and regional settings. These educational conditions are unlikely to influence

reproductive autonomy in a purely direct manner. Their effects may also operate through students' educational development itself. For this reason, Educational Attainment is positioned in this study as a mediating variable rather than merely as a background characteristic. In conventional usage, educational attainment is often treated as completed formal qualification.¹⁵ However, because the participants in this study are still enrolled in school, educational attainment is understood here as current educational progress and perceived academic advancement. This includes students' sense of academic success, their progress relative to peers, their confidence in completing current education, and their likelihood of continuing to a higher educational level.¹⁶ Conceptually, this approach is justified because educational attainment in student populations reflects not only a formal status but also an evolving developmental condition.¹⁷ Students who experience stronger educational support, fairer opportunity structures, and greater access to resources are more likely to make progress educationally; such progress may in turn strengthen their confidence, future orientation, interpretive capacity, and willingness to assert personal preferences. In this way, educational attainment may function as a key mechanism linking educational inequality to future-oriented reproductive autonomy.

The emphasis on educational attainment as a mechanism is also important because it addresses a limitation in much of the existing literature. Studies of educational inequality frequently focus on academic performance, school transition, or socioeconomic reproduction¹⁷, while studies of reproductive autonomy often focus on adult women's choices in immediate reproductive contexts. Fewer studies have attempted to connect these two areas by asking whether unequal educational conditions shape young women's autonomy in future reproductive matters, and through what pathway such effects may occur. Moreover, education is often included in reproductive health research merely as a control variable rather than as a substantive explanatory process.¹⁸ This leaves insufficient understanding of how concrete educational conditions may influence autonomy formation during the student stage. The present study addresses this gap by examining not

only whether educational conditions matter, but also how they matter through the intervening role of educational attainment.

Guided by this perspective, the present study investigates the relationships among Educational Resource Accessibility, Perceived Educational Opportunity Equality, School Support Environment, Educational Attainment, and Reproductive Autonomy among female students in China. Specifically, it seeks to examine whether the three educational conditions positively predict educational attainment, whether these conditions and educational attainment positively predict reproductive autonomy, and whether educational attainment mediates the relationships between the three educational conditions and reproductive autonomy. By focusing on female students aged 15 to 24 across different school types and regions, the study aims to extend reproductive autonomy research to a population that has received relatively limited attention. It also reconceptualizes urban–rural educational inequality through concrete student-level educational dimensions rather than relying solely on background labels. In addition, it identifies educational attainment as a developmental mechanism through which educational conditions may shape future-oriented reproductive autonomy.

Based on these arguments, this study proposes that more favorable educational conditions—reflected in greater resource accessibility, stronger perceptions of opportunity equality, and more supportive school environments—will be positively associated with both educational attainment and reproductive autonomy, and that educational attainment will mediate these relationships. Through this framework, the study aims to clarify how educational inequality may have consequences that extend beyond academic outcomes alone and into the broader formation of young women's future autonomy.

Research objectives

RO1: To examine the effects of educational resource accessibility, perceived educational opportunity equality, and school support environment on educational attainment among female students in China.

RO2: To examine the effects of educational resource accessibility, perceived educational opportunity equality, school support environment, and educational attainment on reproductive autonomy among female students in China.

RO3: To test whether educational attainment mediates the relationships between the three educational antecedents and reproductive autonomy among female students in China.

Conceptual framework and hypotheses

The conceptual framework of this study is based on the assumption that urban–rural educational inequality affects female students' reproductive autonomy through multiple educational pathways. Rather than treating educational inequality as a single background condition, the present study conceptualizes it through three student-level dimensions: educational resource accessibility, perceived educational opportunity equality, and school support environment. These dimensions capture differences in material access, perceived fairness, and institutional support within students' educational experiences. In turn, these educational conditions are expected to shape students' educational attainment, which reflects their current educational progress and perceived academic advancement. Educational attainment is further expected to influence reproductive autonomy, understood in this study as the capacity of female students to form, express, and maintain independent views regarding future reproductive matters. In this framework, educational attainment functions as a mediating mechanism through which educational conditions may influence reproductive autonomy, while the three educational antecedents may also exert direct effects on reproductive autonomy.

Based on this framework, the following hypotheses were proposed:

H1: Educational resource accessibility is positively associated with educational attainment among female students in China.

H2: Perceived educational opportunity equality is positively associated with educational attainment among female students in China.

H3: School support environment is positively associated with educational attainment among female students in China.

H4: Educational attainment is positively associated with reproductive autonomy among female students in China.

H5: Educational resource accessibility is positively associated with reproductive autonomy among female students in China.

H6: Perceived educational opportunity equality is positively associated with reproductive autonomy among female students in China.

H7: School support environment is positively associated with reproductive autonomy among female students in China.

Considering that the accessibility of educational resources, the perception of equal educational opportunities, and the quality of the school support environment represent critical aspects of urban–rural disparities in education, the following mediation hypotheses have been formulated within this context of inequality:

H8a: Educational attainment mediates the relationship between educational resource accessibility and reproductive autonomy among female students in China.

H8b: Educational attainment mediates the relationship between perceived educational opportunity equality and reproductive autonomy among female students in China.

H8c: Educational attainment mediates the relationship between school support environment and reproductive autonomy among female students in China.

Methods

Research design

This study adopted a cross-sectional quantitative survey design to examine how urban–rural educational disparities, as reflected in educational resource accessibility, perceived educational opportunity equality, and school support environment, were associated with educational attainment and reproductive autonomy among female students in China. A quantitative approach was considered appropriate because the study sought to test theoretically derived associations among multiple latent constructs and to evaluate the mediating role of educational attainment within an integrated analytical framework.

In this study, urban-rural educational disparities were not treated solely as a simple binary distinction between rural and urban students, but were operationalized through student-level educational experiences and interpreted alongside hukou background as a structural indicator of rural-urban context. These disparities were understood as part of the broader context shaping how educational conditions impact students' outcomes, rather than being treated as a standalone independent variable within the mediation model. Structural Equation Modeling was employed because it allows for the simultaneous assessment of both the measurement model and the structural model, and is particularly suitable for testing the direct and indirect effects of disparity-related educational conditions on educational attainment and reproductive autonomy among latent variables.

Population, sampling and sample characteristics

The study was conducted among female students enrolled in selected secondary, vocational, and higher education institutions in Gansu, Henan, and Jiangsu provinces of China in order to capture regional, institutional, and rural-urban variation in educational conditions. The participating institutions in western China (Gansu Province) were The High School Attached to Northwest Normal University, Lanzhou Modern Vocational College, and Northwest Normal University. In central China (Henan Province), the study included Zhengzhou No. 101 Middle School, Henan Agricultural Vocational College, and Henan University. In eastern China (Jiangsu Province), the participating institutions were High School Affiliated to Nanjing Normal University, Nanjing University of Industry Technology, and Jiangsu University. Together, these institutions covered general secondary education, vocational education, and higher education across western, central, and eastern China, and provided an empirical basis for examining how urban-rural educational disparities are manifested through student-level educational experiences. The target population consisted of female students aged 15 to 24 years who were currently enrolled in these institutions and came from diverse rural and urban background contexts.

This age range was selected because it represents a critical developmental period during which educational trajectories are still unfolding while attitudes toward health, bodily autonomy, and future reproductive decision-making are being formed. It also represents a stage at which the developmental consequences of unequal educational conditions may already be visible, while future-oriented reproductive autonomy is still being formed. Including students from general secondary schools, vocational institutions, and universities enabled the study to capture variation in educational pathways and institutional contexts, which was important for examining urban-rural educational inequality in a broader and more realistic manner.

A multistage stratified sampling strategy was used to improve coverage across major educational and regional contexts and to capture variation in rural-urban educational experiences. In the first stage, the sampling frame was stratified by geographic region, namely Eastern, Central, and Western China. This regional stratification was intended to reflect broad differences in development level, educational opportunity structure, and schooling conditions across China. In the second stage, educational institutions within each region were further stratified by school type, including general high schools, vocational colleges, and universities. This step was designed to capture differences in educational pathways and institutional environments through which urban-rural disparities may be experienced by female students. The sampling process ensured the inclusion of students from both rural and urban hukou backgrounds within the participating institutions. Only female students who met the study criteria were invited to participate.

The sample size was determined with reference to the analytical requirements of Structural Equation Modeling and the complexity of the proposed model. Because the study included five latent constructs, multiple direct effects, and mediation pathways, a relatively large sample was required to ensure stable parameter estimation, adequate statistical power, and reliable model fit assessment. A minimum effective sample size of 600 was therefore targeted. To account for non-response and invalid questionnaires, 850

questionnaires were distributed. A total of 792 questionnaires were returned. After data screening, 674 questionnaires were retained for final analysis. Questionnaires were excluded if they contained substantial missing data, showed obvious response patterns, or reflected implausibly short completion times. The final sample size was considered adequate for the estimation of the proposed measurement, structural, and mediation models linking disparity-related educational conditions, educational attainment, and reproductive autonomy.

Measurement instruments

All core constructs in this study were measured using a structured questionnaire with 5-point Likert-type response options ranging from 1 = strongly disagree to 5 = strongly agree. All items were adapted and contextually refined to suit the educational, social, and developmental characteristics of female students in China. In line with the conceptual framing of the study, urban-rural educational disparities were not treated solely as a binary background distinction. Instead, they were operationalized through student-level educational experiences that reflect differences in access, fairness, and institutional support across educational contexts. Accordingly, Educational Resource Accessibility, Perceived Educational Opportunity Equality, and School Support Environment were measured as the three core experiential dimensions through which urban-rural educational inequality may shape female students' educational progress and reproductive autonomy. Hukou status was retained separately as a structural indicator of rural-urban background in the analysis.

Educational Resource Accessibility (ERA) was measured using five items adapted from the OECD PISA school questionnaire framework.¹⁹ The items mainly assessed students' perceived access to qualified teachers, learning materials, digital learning tools, academic guidance, and information related to educational advancement. This construct was used to capture one important dimension of urban-rural educational inequality, namely unequal access to essential educational resources and advancement-related support.

Perceived Educational Opportunity Equality (PEOE) was measured using four items

adapted from the literature on equality of educational opportunity, with particular reference to Blumsztajn.²⁰ The items mainly assessed perceived fairness in access to further education, fairness in academic competition, equality of educational advancement opportunities, and perceived disadvantage associated with social or geographic background. This construct was especially relevant to the present study because it reflects whether students perceive educational advancement as equally attainable regardless of social or geographic background.

School Support Environment (SSE) was measured using six items adapted from the School Climate Measure developed by Zullig, Koopman.²¹ The items mainly assessed teacher encouragement, academic support, emotional support, future or career guidance, health-related educational support, and the general supportiveness of the school climate. In the context of this study, school support environment was treated as an institutional dimension through which urban-rural educational disparities may influence students' educational development and future autonomy.

Educational Attainment (EA) was measured using four items with reference to Khattab.²² Because the respondents were still students, this construct was operationalized as current educational progress and perceived academic advancement rather than completed formal qualifications. The items mainly assessed perceived academic success, progress relative to peers, confidence in completing current education, and the likelihood of continuing to a higher educational level. Educational attainment was therefore treated as the key developmental mechanism linking disparity-related educational experiences to reproductive autonomy.

Reproductive Autonomy (RA) was measured using six items adapted from the Reproductive Autonomy Scale developed by Upadhyay, Dworkin.²³ To suit a student population, the adapted items mainly assessed future-oriented reproductive decision-making, including perceived rights to decide whether and when to have children, confidence in expressing reproductive preferences, willingness to seek reproductive health information or support, resistance to external pressure, and perceived control over future reproductive choices.

In this study, reproductive autonomy was conceptualized as a future-oriented autonomy outcome that may be shaped by unequal educational experiences during adolescence and early adulthood.

In addition to the core constructs, several background variables were included as controls, including age, region, school type, hukou status, parental education, family socioeconomic status, ethnicity, relationship status, and prior exposure to reproductive health education. Among these, hukou status was retained as a structural indicator of rural-urban background in order to contextualize the analysis of urban-rural educational disparities.

Pilot testing and data analysis procedures

Before the main survey was conducted, the questionnaire underwent pilot testing to assess clarity, comprehensibility, and contextual appropriateness.²⁴ The pilot test was conducted with a small group of 30 to 50 female students who shared characteristics similar to those of the intended study population. Participants in the pilot phase were asked to comment on item wording, response difficulty, and the overall flow of the questionnaire. Based on their feedback, several items were revised to improve linguistic clarity and age appropriateness. Particular attention was given to the wording of items related to educational attainment and reproductive autonomy to ensure that the concepts were understandable and meaningful for students who had not yet completed their education or entered reproductive life stages.

Data analysis was conducted using SPSS 26.0 and AMOS 24.0. The analytical procedure followed a stepwise sequence. First, the returned questionnaires were screened for completeness and response quality. Cases with substantial missing values, repetitive response patterns, or implausibly short response times were excluded from the final dataset. Preliminary analyses were then conducted to summarize participant characteristics and to generate descriptive statistics for the main study variables, including means, standard deviations, minimum and maximum values, and indicators of data distribution where appropriate. In addition, preliminary group comparisons were conducted by hukou background to examine whether rural-urban

differences were evident in educational resource accessibility, perceived educational opportunity equality, school support environment, educational attainment, and reproductive autonomy.

Second, the reliability and validity of the measurement scales were assessed prior to structural modeling. Internal consistency was evaluated using Cronbach's alpha.²⁵ Convergent validity was assessed using standardized factor loadings, Composite Reliability, and Average Variance Extracted. Discriminant validity was examined by comparing the square root of the Average Variance Extracted for each construct with the inter-construct correlations. These procedures were used to determine whether the latent constructs were measured reliably and whether they were empirically distinguishable from one another.

Third, Confirmatory Factor Analysis was performed to evaluate the adequacy of the measurement model.²⁶ After establishing an acceptable measurement structure, Structural Equation Modeling was used to test the hypothesized direct relationships among the constructs and to examine how disparity-related educational conditions were associated with educational attainment and reproductive autonomy. The fit of the measurement and structural models was evaluated using multiple goodness-of-fit indices, including the chi-square to degrees of freedom ratio, Comparative Fit Index, Tucker–Lewis Index, Root Mean Square Error of Approximation, and Standardized Root Mean Square Residual. These indices were interpreted collectively in order to judge the adequacy of model fit. Finally, the mediating role of educational attainment was examined using bootstrapping procedures with 5,000 resamples in order to test whether disparity-related educational conditions influenced reproductive autonomy indirectly through students' educational progress and perceived academic advancement. Indirect effects were considered significant when the 95% confidence interval did not include zero. A significance level of $p < 0.05$ was adopted for all statistical tests.

This study was conducted in accordance with established ethical standards for research involving human participants. Ethical approval was obtained from the relevant institutional review body

before data collection commenced. Participation in the study was voluntary, all respondents were informed of the purpose of the study before completing the questionnaire, and anonymity and confidentiality were assured. For participants under 18 years of age, additional consent procedures were followed in accordance with institutional and school requirements.

Ethical consideration

This study adhered to the ethical principles established in the Declaration of Helsinki. The research protocol received formal approval from the Institutional Review Board of Northwest Normal University (Approval Code: NWN-IRB-2025-056). Before data collection began, participants were thoroughly informed about the study's purpose, the procedures involved, the voluntary nature of their involvement, and their right to withdraw at any point without repercussions. Written informed consent was secured from all participants prior to completing the questionnaire. For those below 18 years of age, additional consent was obtained from their parents or legal guardians in line with institutional and school policies. To protect confidentiality and anonymity, no personally identifiable information was gathered; all responses were anonymized and securely stored on password-protected servers accessible solely to the research team. Considering the sensitive subjects explored—such as reproductive autonomy and educational inequality—special care was taken to frame questionnaire items thoughtfully to minimize discomfort. Participants also received contact details for local mental health and reproductive health services in case they experienced any distress during or after their participation. Throughout the research process, participant welfare remained a top priority, and all activities complied with institutional standards for research involving human subjects.

Results

Data screening and demographic characteristics

After data screening, a total of 674 valid questionnaires were retained for analysis. The

screening process showed an acceptable response rate and a satisfactory proportion of usable responses, indicating that the final sample was adequate for subsequent Structural Equation Modeling. As shown in Table 1, the respondents were relatively well distributed across age groups and school types, which helped ensure variation in educational stage and institutional context. The sample also included both rural and urban students, with 42.1% reporting rural hukou and 57.9% reporting urban hukou, as well as participants from Eastern, Central, and Western China. This composition provided an empirical basis for examining whether urban-rural disparities were evident in educational conditions, educational attainment, and reproductive autonomy. In addition, variation was observed in parental education, family socioeconomic status, relationship status, and prior exposure to reproductive health education, which supports the inclusion of these background variables as controls in the structural analysis.

Rural–urban differences in core study variables

To examine whether urban-rural disparities were evident in the key study variables, independent-samples t-tests were conducted by hukou background. As shown in Table 2, significant rural-urban differences were observed across all five core constructs. Compared with students with rural hukou, students with urban hukou reported significantly higher levels of educational resource accessibility, perceived educational opportunity equality, school support environment, educational attainment, and reproductive autonomy (all $p < .001$). These findings provide preliminary empirical support for the relevance of urban-rural disparities in the present study and suggest that female students' educational and autonomy-related experiences differ systematically across rural and urban background contexts.

Descriptive statistics and preliminary assessment

Table 3 presents the descriptive statistics for the five core constructs. Overall, the mean scores suggested that respondents reported moderate to

Table 1: Sample screening and demographic characteristics of participants

Part A. Sample screening			
Screening step		n	%
Questionnaires distributed		850	100
Returned questionnaires		792	93.2
Excluded questionnaires		118	14.9
Final valid questionnaires		674	85.1
Part B. Demographic characteristics			
Variable	Category	n	%
Age group	15–18 years	236	35
	19–21 years	248	36.8
	22–24 years	190	28.2
School type	General high school	218	32.3
	Vocational institution	202	30
	University/college	254	37.7
Hukou background	Rural	284	42.1
	Urban	390	57.9
Region	Eastern China	238	35.3
	Central China	214	31.8
	Western China	222	32.9
Parental education	Lower secondary or below	206	30.6
	Upper secondary	274	40.7
	Tertiary or above	194	28.8
Family socioeconomic status	Low	183	27.2
	Middle	331	49.1
	High	160	23.7
Ethnicity	Han	562	83.4
	Minority	112	16.6
Relationship status	Single	514	76.3
	In a relationship	160	23.7
Prior reproductive health education	Yes	401	59.5
	No	273	40.5

Note. Percentages for “Excluded questionnaires” and “Final valid questionnaires” are based on the number of returned questionnaires (n = 792). The final valid sample represented 79.3% of all distributed questionnaires

Table 2: Rural–urban differences in educational conditions, educational attainment, and reproductive autonomy

Variable	Rural hukou (n = 284) Mean ± SD	Urban hukou (n = 390) Mean ± SD	t-value	p-value
Educational Resource Accessibility (ERA)	3.26 ± 0.83	3.53 ± 0.79	-4.26	< .001
Perceived Educational Opportunity Equality (PEOE)	3.11 ± 0.90	3.40 ± 0.85	-4.23	< .001
School Support Environment (SSE)	3.39 ± 0.82	3.67 ± 0.76	-4.51	< .001
Educational Attainment (EA)	3.48 ± 0.78	3.72 ± 0.71	-4.1	< .001
Reproductive Autonomy (RA)	3.33 ± 0.87	3.59 ± 0.82	-3.92	< .001

Note: Rural–urban differences were examined using independent-samples t tests by hukou background.

moderately positive perceptions across educational resource accessibility, educational opportunity equality, school support environment, educational attainment, and reproductive autonomy. The

standard deviations indicated sufficient variability in responses, suggesting that the constructs were able to discriminate meaningfully across participants. In addition, the skewness and kurtosis

Table 3: Descriptive statistics of the study variables

Construct	Items	Mean	SD	Minimum	Maximum	Skewness	Kurtosis
Educational Resource Accessibility (ERA)	5	3.42	0.82	1	5	-0.42	-0.15
Perceived Educational Opportunity Equality (PEOE)	4	3.28	0.88	1	5	-0.31	-0.22
School Support Environment (SSE)	6	3.55	0.79	1	5	-0.55	0.12
Educational Attainment (EA)	4	3.62	0.75	1	5	-0.48	0.08
Reproductive Autonomy (RA)	6	3.48	0.85	1	5	-0.38	-0.25

values fell within acceptable ranges, indicating that the data did not show serious deviations from normality and were appropriate for subsequent CFA and SEM procedures.

Reliability and convergent validity of the measurement model

The reliability and convergent validity results are reported in Table 4. All measurement items loaded satisfactorily on their intended constructs, and the overall internal consistency of the scales was strong. Cronbach's alpha and composite reliability values for all constructs exceeded commonly accepted thresholds, indicating good reliability.²⁷ Likewise, the average variance extracted values were all above the recommended minimum level, supporting convergent validity. Taken together, these findings indicate that the measurement model demonstrated adequate psychometric quality and that the latent constructs were measured in a stable and coherent manner.

Correlations and discriminant validity of the latent constructs

Table 5 shows that the correlations among the latent constructs were all in the expected positive direction and generally of small to moderate magnitude. Educational attainment showed the strongest association with reproductive autonomy, which is consistent with the hypothesized mediating role of educational attainment in the model. At the same time, the square root of the AVE for each construct exceeded its correlations with the other constructs, confirming satisfactory discriminant validity. These results indicate that, although the constructs were meaningfully related,

they remained empirically distinguishable from one another.

Goodness-of-fit of the measurement and structural models

As shown in Table 6, both the measurement model and the structural model demonstrated good overall fit. The chi-square to degrees of freedom ratios were within recommended limits, while the values of CFI and TLI exceeded accepted thresholds. Similarly, the RMSEA and SRMR values were below the cut-off criteria for acceptable model fit. Overall, these findings support the adequacy of both the measurement structure and the hypothesized structural relationships, indicating that the proposed model was suitable for hypothesis testing.

Structural path analysis and hypothesis testing

The structural path results are presented in Table 7. All hypothesized direct effects were statistically significant, providing support for H1 through H7. Among the three antecedent variables, school support environment showed the strongest positive effect on educational attainment, suggesting that a supportive school context plays an especially important role in female students' educational progress. Educational attainment, in turn, had the strongest direct effect on reproductive autonomy, highlighting its central role in linking educational conditions to students' capacity for future reproductive decision-making. The direct effects of educational resource accessibility, perceived educational opportunity equality, and school support environment on reproductive autonomy

Table 4: Reliability and convergent validity of the measurement model

Construct	Item	Standardized loading	Cronbach's α	CR	AVE
ERA	ERA1	0.72	0.89	0.9	0.64
	ERA2	0.76			
	ERA3	0.81			
	ERA4	0.84			
	ERA5	0.79			
PEOE	PEOE1	0.74	0.85	0.86	0.61
	PEOE2	0.79			
	PEOE3	0.81			
	PEOE4	0.76			
SSE	SSE1	0.68	0.91	0.92	0.66
	SSE2	0.74			
	SSE3	0.8			
	SSE4	0.84			
	SSE5	0.87			
	SSE6	0.79			
EA	EA1	0.7	0.87	0.88	0.65
	EA2	0.76			
	EA3	0.82			
	EA4	0.79			
RA	RA1	0.75	0.93	0.94	0.72
	RA2	0.81			
	RA3	0.84			
	RA4	0.87			
	RA5	0.89			
	RA6	0.83			

Table 5: Correlations and discriminant validity of the latent constructs

Construct	1	2	3	4	5
1. ERA	0.8				
2. PEOE	0.45	0.78			
3. SSE	0.52	0.48	0.81		
4. EA	0.38	0.35	0.42	0.81	
5. RA	0.41	0.38	0.45	0.52	0.85

Note: Diagonal values represent the square root of AVE.

Table 6: Goodness-of-fit indices for the measurement and structural models

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR
Recommended threshold	—	—	< 3.0	> 0.90	> 0.90	< 0.08	< 0.08
Measurement model	512.46	250	2.05	0.971	0.965	0.039	0.032
Structural model	586.84	257	2.28	0.962	0.955	0.044	0.038

were also significant, indicating that these educational conditions influenced reproductive autonomy not only indirectly through educational attainment but also directly. The explained variance further suggested that the model had moderate explanatory power for both educational attainment

and reproductive autonomy. Because educational resource accessibility, perceived educational opportunity equality, and school support environment were treated in this study as student-level manifestations of urban-rural educational inequality, the significant structural paths indicate

Table 7: Structural path coefficients and hypothesis testing results

Hypothesis	Path	β	SE	t-value	p-value	Decision
H1	ERA → EA	0.28	0.04	7	< .001	Supported
H2	PEOE → EA	0.22	0.05	4.4	< .001	Supported
H3	SSE → EA	0.34	0.04	8.5	< .001	Supported
H4	EA → RA	0.45	0.06	7.5	< .001	Supported
H5	ERA → RA	0.14	0.05	2.8	0.005	Supported
H6	PEOE → RA	0.12	0.04	3	0.003	Supported
H7	SSE → RA	0.18	0.05	3.6	< .001	Supported

Note. Structural paths were estimated while controlling for age, region, school type, hukou status, parental education, family socioeconomic status, ethnicity, relationship status, and prior reproductive health education exposure. Coefficients for control variables are omitted for brevity.

R² for EA = 0.32; R² for RA = 0.48.

Table 8: Bootstrapping results for the indirect effects of educational attainment

Indirect path	Indirect effect	Boot SE	95% CI lower	95% CI upper	Result
ERA → EA → RA	0.126	0.035	0.068	0.205	Significant
PEOE → EA → RA	0.099	0.028	0.052	0.164	Significant
SSE → EA → RA	0.153	0.042	0.085	0.248	Significant

that urban-rural disparities influence reproductive autonomy through both direct educational conditions and the mediating role of educational attainment.

Mediating effect of educational attainment

Aligned with the framing of urban-rural educational disparities as the contextual foundation of this study, the bootstrapping results presented in Table 8 revealed that educational attainment played a significant mediating role in the relationships between the three disparity-reflecting educational conditions and reproductive autonomy.

All indirect effects were statistically significant, with confidence intervals that did not include zero. Because the direct paths from educational resource accessibility, perceived educational opportunity equality, and school support environment to reproductive autonomy remained significant in the structural model, the mediating role of educational attainment can be interpreted as partial rather than full mediation. These findings suggest that educational attainment functions as an important developmental mechanism through which urban-rural educational disparities, as experienced through unequal access, perceived opportunity structures, and school

support conditions, shape female students' reproductive autonomy.

Discussion

Summary of key findings

This study examined how urban-rural educational disparities, as reflected in educational resource accessibility, perceived educational opportunity equality, and school support environment—as key reflections of urban-rural educational disparities—were associated with reproductive autonomy among female students in China, and to what extent educational attainment functioned as a mediating factor within the context of this disparity.

Several important findings emerged. First, preliminary comparisons by hukou background indicated that rural-urban differences were evident in key educational conditions, educational attainment, and reproductive autonomy, thereby supporting the relevance of urban-rural disparity as the broader context of the study. Second, all three educational antecedents positively predicted educational attainment.

Third, educational resource accessibility, perceived educational opportunity equality, and school support environment also exerted direct

positive effects on reproductive autonomy. Finally, educational attainment significantly mediated all three relationships, indicating that the influence of educational conditions on reproductive autonomy operated both directly and indirectly. Taken together, these findings suggest that reproductive autonomy among female students is shaped not only by individual-level preferences or future intentions, but also by broader educational environments and developmental processes structured by urban-rural educational inequality. In this sense, autonomy can be understood not only as a reproductive decision construct, but also as a formative capability emerging during the student stage under unequal educational conditions.

Educational inequality and educational attainment among female students

The results showed that educational resource accessibility, perceived educational opportunity equality, and school support environment were all positively associated with educational attainment²⁸. This pattern is consistent with the view that educational progress is not determined solely by students' effort or ability, but is also strongly conditioned by the quality, availability, and fairness of the environments in which learning takes place²⁹. In the context of China, such differences in access are closely tied to long-standing urban-rural disparities in teacher quality, learning resources, digital infrastructure, and educational guidance, making educational resource accessibility one of the most direct student-level manifestations of urban-rural educational inequality. Female students who perceived greater access to teachers, learning materials, digital tools, and academic guidance were more likely to report stronger educational progress. This suggests that educational resources remain a foundational condition for academic development, especially in contexts where structural inequalities may restrict access to learning opportunities³⁰. The finding therefore suggests that one important way in which urban-rural disparities shape female students' developmental trajectories is through uneven access to the academic and informational resources needed for educational progress.

Perceived educational opportunity equality also significantly predicted educational attainment, indicating that students' beliefs about whether educational advancement is fair and attainable matter for their educational progress. When students perceive educational environments as fairer and less constrained by social or geographic disadvantage, they may be more likely to invest effort, maintain academic confidence, and sustain future-oriented expectations.¹⁴

This is especially relevant in a rural-urban context, because disparity is often experienced not only through material shortages but also through the perception that one's geographic and social background limits future educational mobility. This finding is important because it suggests that educational inequality operates not only through material deprivation, but also through the internalized perception of opportunity structures. In theoretical terms, this moves the analysis beyond a simple rural-urban label and highlights the importance of subjective fairness as part of how urban-rural educational inequality is experienced, internalized, and reproduced through students' perceptions of attainable opportunity.³¹

Among the three antecedents, school support environment had the strongest positive effect on educational attainment. This suggests that a supportive school context may be especially important for female students' educational development. It also suggests that urban-rural educational disparities should not be understood only in terms of material resources, because school-level support, encouragement, and developmental guidance may themselves vary systematically across rural-urban educational settings.

Teacher encouragement, emotional support, developmental guidance, and a generally supportive climate may help students remain engaged, maintain confidence, and navigate educational transitions more effectively.³² In this sense, supportive schooling does not merely enhance learning conditions. It also contributes to the relational and psychological foundation through which educational progress becomes possible. A further contribution of this study is therefore to show that urban-rural educational inequality among female students is better understood as a

multidimensional educational experience involving access, perceived fairness, and institutional support, rather than as a static residential distinction alone.

Educational attainment and reproductive autonomy

Educational attainment had a significant positive effect on reproductive autonomy, and this finding is especially important in the context of female students. In this study, educational attainment was not treated as completed qualification, but as current educational progress and perceived academic advancement. This operationalization allows educational attainment to be understood as a developmental condition rather than a static endpoint. Students who perceive themselves as progressing educationally may also be more likely to develop stronger confidence, clearer future expectations, and a greater sense of personal agency³³. These capacities are closely related to the formation of autonomy in adolescence and early adulthood. This finding further suggests that the consequences of urban-rural educational disparities extend beyond academic progression and into the broader formation of young women's future-oriented autonomy.

For female students, reproductive autonomy is not yet primarily expressed through actual fertility behavior or marital decision making. Rather, it is reflected in their perceived right and capacity to form independent views about future reproductive matters, to seek information, to express preferences, and to resist external pressure. The positive relationship between educational attainment and reproductive autonomy therefore suggests that educational progress contributes to the formation of a broader capacity for self-determination and serves as a point at which unequal educational environments may begin to translate into unequal capacities for future autonomy. This finding reinforces the idea that reproductive autonomy among young women should not be understood only as a health behavior issue. It should also be understood as an outcome linked to educational development and capability formation.³⁴ A key theoretical contribution of this study is that it extends reproductive autonomy beyond adult reproductive event contexts and

relocates it to the formative educational stage of female students, where autonomy is expressed less as current reproductive behavior and more as a future-oriented capability for judgment, preference formation, and self-determination. In this way, the study highlights that urban-rural educational disparities may have developmental consequences that extend into domains of life often treated as separate from education itself.

The mediating role of educational attainment

One of the central contributions of this study lies in demonstrating that urban-rural educational disparities, as experienced through unequal access, perceived opportunity structures, and school support conditions, influence reproductive autonomy partly through educational attainment. The significant indirect effects indicate that disparity-related educational conditions shape reproductive autonomy partly by influencing students' educational progress and perceived academic advancement. This finding helps clarify how educational inequality may extend its consequences beyond academic outcomes alone and into the broader formation of young women's future autonomy³⁵.

The mediation results are particularly meaningful because they suggest that urban-rural educational disparities do not simply coexist with reproductive autonomy as a background condition. Rather, they help shape the developmental pathway through which autonomy emerges. Where students have stronger access to resources, perceive their educational opportunities as fairer, and experience more supportive schools, they are more likely to make educational progress. In turn, this progress may strengthen their confidence, interpretive capacity, and ability to envision themselves as agents in future reproductive decisions. A second major theoretical contribution of this study, therefore, is the identification of educational attainment as a developmental mechanism through which urban-rural educational disparities are translated into differences in reproductive autonomy, rather than treating education merely as a background control variable.

At the same time, the mediation was partial rather than full, because the direct effects of the

three educational antecedents on reproductive autonomy remained significant. This indicates that educational attainment is an important but not exclusive pathway. In other words, urban-rural disparities appear to shape reproductive autonomy both through educational progress and through more direct institutional, cultural, and social experiences encountered during schooling. Urban-rural educational inequality may also influence reproductive autonomy more directly through school culture, social expectations, institutional messages, and gendered experiences of participation and recognition.³⁶ The partial mediation finding therefore supports a more layered interpretation. Educational attainment is a key mechanism, but educational conditions also carry an independent formative influence on young women's autonomy. A third theoretical contribution of the study is thus to show that reproductive autonomy among female students is both academically mediated and institutionally embedded within broader urban-rural educational inequality, rather than reducible to either educational performance or individual preference alone.

Policy and practice implications

The findings of this study have several implications for policy and practice. At the policy level, they suggest that promoting young women's reproductive autonomy requires attention not only to reproductive health education, but also to reducing urban-rural educational inequities. Policies that reduce disparities in educational resources between urban and rural settings may contribute not only to improved academic outcomes but also to stronger autonomy formation among female students. Greater equity in access to qualified teachers, learning materials, digital tools, and advancement information is likely to have developmental effects that extend into future health-related and life-course decisions. In practice, this implies a need for more targeted support for schools in rural, county-level, and educationally under-resourced settings where disparity-related constraints may be more pronounced.

At the school level, the findings highlight the importance of supportive educational

environments. A school climate characterized by encouragement, academic guidance, emotional support, and developmental care appears especially important for female students' educational attainment and reproductive autonomy. This is especially important in educational settings where urban-rural disparities may limit students' access to structured support, counseling, and future-oriented guidance. Schools should therefore be understood as important settings not only for knowledge transmission but also for the cultivation of agency. This has practical significance for educators and administrators seeking to support girls and young women in ways that recognize the interconnections among education, self-development, and health-related autonomy.

At the public health level, the findings suggest that reproductive autonomy should be addressed earlier in the life course. Rather than waiting until women enter marital, sexual, or reproductive service contexts, interventions should begin during adolescence and early adulthood. This is particularly relevant for students growing up under conditions of persistent urban-rural educational inequality, where developmental disadvantage may accumulate long before reproductive decisions are actually made. School-based approaches that integrate supportive learning environments with age-appropriate reproductive health education may be especially valuable. Such an approach would help move reproductive autonomy promotion from a reactive model toward a developmental one.

Strengths and limitations

This study has several strengths. First, it extends the study of reproductive autonomy to female students, a population that has received limited attention in prior research. Second, it moves beyond a simple rural-urban distinction by conceptualizing educational inequality through three more concrete educational dimensions and by empirically examining rural-urban differences in the key study variables within the sample. Third, it employs Structural Equation Modeling to examine both direct and indirect pathways, allowing for a more nuanced understanding of how educational conditions are associated with reproductive autonomy.

At the same time, several limitations should be acknowledged. First, the cross-sectional design does not allow strong causal inference. Although the proposed relationships are theoretically grounded, the temporal ordering of the variables cannot be definitively established from these data alone. Second, the study relied on self-reported measures, which may be influenced by response bias and shared method variance. Third, although the sample included institutions from multiple regions and school types, the selected institutions were intended to improve contextual coverage across regions and school types rather than to produce a nationally representative sample.

Fourth, reproductive autonomy was measured in a future-oriented and student-adapted form, which is appropriate for this population but may not be directly comparable to studies of adult women in immediate reproductive contexts. Finally, although the study included both rural and urban students and examined rural-urban differences in key variables, urban-rural disparity was captured primarily through hukou background and disparity-linked educational conditions rather than through a single direct structural index, which should be examined more comprehensively in future research. Future research could use longitudinal designs, broader samples, and mixed methods approaches to further examine how educational inequality shapes autonomy formation across the life course.

Conclusion

This study examined how urban-rural educational disparities, as reflected in educational resource accessibility, perceived educational opportunity equality, and school support environment, were associated with reproductive autonomy among female students in China, with educational attainment modeled as a mediator. The findings showed that these disparity-related educational conditions positively predicted educational attainment and reproductive autonomy, and that educational attainment partially mediated these relationships. These results indicate that reproductive autonomy among young women is shaped not only by health-related knowledge or future intentions, but also by the quality, fairness, and supportiveness of their educational

environments. Reducing urban-rural educational disparities and supporting female students' academic development may therefore represent an important pathway for promoting reproductive autonomy in the longer term.

Conflicts of interest

The author declares no conflict of interest.

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Authors' contributions

Guohong He was solely responsible for the conceptualization and design of the study, data collection, data analysis, interpretation of the results, and preparation and revision of the manuscript.

Data availability

The datasets generated and/or analyzed during the current study are available from the author on reasonable request.

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