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Humanistic Care Profiles among Medical Postgraduate Students: Associations with AI Risk Anxiety and Ethical Sensitivity

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Abstract

Background Humanistic care is an essential component of medical professionalism. This study aimed to identify distinct profiles of humanistic care among medical postgraduate students and examine their associations with AI risk anxiety and ethical sensitivity.

Methods A cross-sectional survey was conducted in August 2026 among 661 professional-degree master's and doctoral medical postgraduate students studying at three tertiary Grade-A general hospitals in Changsha, Hunan Province, China. Humanistic care was assessed across seven dimensions: altruism, honesty, courage, trust, patience, humility, and hope. Latent profile analysis (LPA) was used to identify distinct humanistic care profiles. Differences in demographic characteristics, AI-related experiences, AI risk anxiety, and ethical sensitivity across profiles were examined. Pearson correlation and pairwise binary logistic regression analyses were further performed.

Results The mean total humanistic care score was 3.67 ± 0.47. LPA identified three profiles: low (19.67%), moderate (63.54%), and high (16.79%). Age, weekly AI use frequency, AI-related training, and AI ethics education differed significantly across profiles (all $P < 0.05$). In multivariable analyses, older age, more frequent AI use, AI-related training, AI ethics education, and higher ethical sensitivity were associated with higher humanistic care profiles, whereas higher AI risk anxiety was associated with lower profiles. AI risk anxiety decreased progressively across profiles, whereas ethical sensitivity increased (both $P < 0.001$), and AI risk anxiety and ethical sensitivity were negatively and positively correlated with humanistic care, respectively (all $P < 0.001$).

Conclusions Medical postgraduate students showed heterogeneous patterns of humanistic care, with higher profiles associated with lower AI risk anxiety and higher ethical sensitivity. Postgraduate medical education should consider differentiated support according to students' humanistic care needs. AI education should be integrated with humanistic care, ethical reasoning, patient-centred communication, and professional responsibility, with greater emphasis on reflective practice, ethical case-based learning, and responsible AI use. This integrated approach may better prepare future physicians for technologically advanced yet human-centred healthcare.

Keywords Humanistic care; Medical postgraduate students; Latent profile analysis; AI risk anxiety; Ethical sensitivity

Introduction

Humanistic care is a core value of medicine and an essential component of professional practice. It encompasses the ability to attend to patients' needs and preferences, understand their emotions, communicate effectively, and recognize the value of the person within the therapeutic relationship. Rather than being a fixed personal disposition, humanistic care is increasingly understood as a professional competency that can develop through education and clinical experience [1]. In health professions education, humanistic approaches seek to prepare clinicians who integrate technical competence with affective, interpersonal, and ethical capabilities [2,3]. Evidence also suggests that empathy and related humanistic competencies can be strengthened through sustained educational interventions [3,4]. In China, national policy documents, including the Healthy China 2030 blueprint and the Guiding Opinions on Accelerating the Innovative Development of Medical Education, explicitly emphasize the cultivation of physicians who combine professional competence with humanistic values [5,6].

Despite this emphasis, humanistic care among health professions students remains an educational concern. Studies of Chinese nursing students have generally reported moderate levels of humanistic care ability, including among students in Changsha and emergency departments, with specific dimensions such as patience showing particular room for improvement [7–9]. Students have also reported dissatisfaction with the amount of humanities education in nursing curricula, suggesting a need to strengthen the integration of humanistic content into health professions education [10]. More broadly, as clinical practice and medical education become increasingly technology-mediated, concerns have been raised that technological efficiency may receive greater attention than the relational, ethical, and person-centred dimensions of care [11]. Medical postgraduate students warrant particular attention because they occupy a transitional educational position: they are both advanced learners and increasingly involved in direct clinical care. However, evidence describing the heterogeneity of their humanistic care ability remains limited, particularly in the context of rapid AI adoption.

The rapid integration of artificial intelligence (AI) into healthcare and medical education has added an important dimension to this educational challenge. AI is

increasingly used for diagnostic support, clinical decision-making, personalized learning, assessment, and content generation, while recent reviews have highlighted both its educational potential and continuing concerns about competencies, implementation, and ethics [12–15]. Generative AI tools such as ChatGPT may provide personalized learning support and simulated clinical scenarios [16], but their use also raises concerns about inaccurate or fabricated information, algorithmic bias, privacy, transparency, accountability, and overreliance on automated outputs [17–21]. These developments make it important for medical educators to consider not only whether students use AI, but also how AI-related psychological responses and ethical capacities coexist with their ability to provide humanistic care.

AI risk anxiety refers to negative emotional responses associated with learning about, using, or anticipating the consequences of AI [22,23]. In health professions education, concerns about AI have been linked to possible dehumanization, reduced empathy, and changes in the clinician–patient relationship [11]. Ethical issues surrounding AI—including privacy, bias, transparency, accountability, and informed consent—have likewise become increasingly relevant to medical education [17–21]. However, the relationship between AI risk anxiety and students' humanistic care ability remains insufficiently understood, especially among medical postgraduate students.

Ethical sensitivity refers to the capacity to recognize the ethical dimensions of a situation and identify the values, obligations, and potential consequences relevant to ethical decision-making [24,25]. It is considered important for translating ethical and humanistic values into clinical action [26,27]. The increasing use of AI may make this capacity particularly relevant because clinicians and trainees may need to identify and respond to dilemmas involving algorithmic bias, data privacy, informed consent, responsibility, and the appropriate balance between automated recommendations and professional judgment [17–21]. Nevertheless, evidence concerning ethical sensitivity among medical postgraduate students in relation to AI remains limited, and it is unclear how ethical sensitivity is distributed across students with different levels and patterns of humanistic care.

Existing evidence suggests that AI-related perceptions, ethical sensitivity, and humanistic care are interconnected but does not yet provide a clear picture of how these characteristics coexist within individual learners. Previous studies have reported positive associations between ethical sensitivity and humanistic care among undergraduate nursing students [26], and have linked ethical principles with ethical sensitivity and caring behaviours in nursing students [27]. Studies involving nursing, midwifery, and medical students have also reported heterogeneous perceptions of AI, person-centred care, and AI-related clinical or educational issues [11,28]. However, much of the existing literature has examined these constructs separately or through pairwise associations. Such variable-centred approaches describe average relationships between variables but may obscure meaningful subgroups of learners who show distinct combinations of humanistic care characteristics. Moreover, findings from nursing students cannot be assumed to generalize directly to medical

postgraduate students, whose clinical responsibilities, educational stage, and exposure to AI may differ.

Latent profile analysis (LPA) is a person-centred approach that identifies unobserved subgroups based on patterns across multiple continuous indicators and estimates the probability that individuals belong to each profile [29–33]. LPA has increasingly been used in nursing and medical education research to examine heterogeneity in learner characteristics and competencies [34].

Against this background, the primary educational question of this study is whether medical postgraduate students can be meaningfully differentiated into distinct profiles of humanistic care, and whether these profiles are associated with AI risk anxiety, ethical sensitivity, and selected AI-related educational experiences. We therefore aimed to: (1) identify latent profiles of humanistic care among medical postgraduate students using the seven dimensions of the humanistic care scale; (2) compare AI risk anxiety and ethical sensitivity across the identified profiles; and (3) examine demographic and AI-related educational characteristics associated with profile membership. By adopting a person-centred perspective, this study seeks to extend current evidence on humanistic care in medical postgraduate education and to provide empirically grounded information that may help educators consider differentiated approaches to AI literacy, ethics education, and humanistic care development.

Participants and methods

Study participants

In August 2026, a convenience sample of professional-degree master's and doctoral students in clinical medicine was recruited from three tertiary Grade-A general hospitals in Changsha, Hunan Province, China. Eligible participants were (1) enrolled in a professional-degree master's or doctoral programme in clinical medicine at one of the participating hospitals during the survey period and (2) willing to participate and provide online informed consent. Students enrolled in academic-degree programmes, those on leave of absence, suspension, or long-term exchange away from the participating hospitals, and respondents whose questionnaires were deemed invalid during data-quality screening were excluded.

Sample size Estimation

Previous simulation studies have shown that the statistical performance of LPA is influenced by sample size, the number of indicators, and the degree of separation between latent profiles, with larger samples generally supporting more stable profile identification [30,35]. The three instruments used in this study comprised 75 items, corresponding to an estimated sample size of 375 – 750 participants based on commonly used empirical guidance for questionnaire studies. Considering the stability of LPA estimation, the requirements of subsequent multivariable logistic regression analyses, and the possibility of invalid or incomplete responses, we planned to recruit 600 – 700 participants, allowing for 15 – 20% potentially invalid questionnaires. A total of 720 questionnaires were distributed, of which 661 were valid, yielding a valid response rate of 91.8%. The final sample size met the

prespecified target and provided an adequate basis for the LPA and subsequent multivariable logistic regression analyses.

Survey instruments

General information questionnaire

A self-designed questionnaire, developed on the basis of a literature review and research-team discussion, collected nine characteristics: age (≤24, 25–28, or ≥29 years), sex (male or female), academic level (master's or doctoral student), specialty (internal medicine, surgery, orthopaedics, gynaecology, paediatrics, otorhinolaryngology, acupuncture and moxibustion, integrated traditional Chinese and Western medicine, general practice, medical imaging and nuclear medicine, pharmacy, traditional Chinese pharmacy, clinical laboratory diagnostics, or stomatology), clinical internship experience (yes or no), weekly AI use frequency (1–3, 4–6, or ≥7 times), AI-related training experience (yes or no), AI clinical application experience (yes or no), and AI ethics education experience (yes or no).

Humanistic care scale

Humanistic care ability was assessed using a 42-item humanistic care scale [36]. The scale comprises seven dimensions: altruism (5 items), honesty (5 items), courage (5 items), trust (8 items), patience (7 items), humility (7 items), and hope (5 items). Items are rated on a 5-point Likert scale from 1 (completely inconsistent) to 5 (completely consistent); items 13, 14, and 33 are reverse-scored. Dimension and total scores were calculated as the mean of the corresponding items and ranged from 1 to 5, with higher scores indicating greater humanistic care ability. Cronbach's α for the total scale was 0.948 in the present study.

AI risk anxiety scale

AI risk anxiety was assessed using the Chinese version [22] of the Artificial Intelligence Anxiety Scale, originally developed by Wang and Wang [21]. The 20-item scale covers four dimensions: learning anxiety, job replacement anxiety, sociotechnical blindness anxiety, and AI configuration anxiety. Each item is rated from 1 (strongly disagree) to 5 (strongly agree), yielding a total score of 20–100, with higher scores indicating greater AI risk anxiety. Cronbach's α was 0.945 in the present study.

Ethical sensitivity questionnaire

Ethical sensitivity was assessed using the Chinese version [24] of the Ethical Sensitivity Questionnaire for Nursing Students (ESQ-NS), originally developed by Muramatsu et al. [23]. The 13-item questionnaire comprises four dimensions: respect for the individual, reasonable care, distributive justice, and privacy protection. Items are rated on a 4-point Likert scale from 1 (completely disagree) to 4 (completely agree), and all items are positively scored; total scores range from 13 to 52, with higher scores indicating greater ethical sensitivity.A total of 72 cases were included in this preliminary study. The scale demonstrated good internal consistency (Cronbach’s

α = 0.818). This article's Cronbach's α was 0.814 in the present study. As the ESQ-NS was originally developed for nursing students, its use in this sample was interpreted as an assessment of general ethical sensitivity rather than a discipline-specific measure for medical education; this cross-professional measurement limitation is considered in the Discussion.

Data collection

Data were collected anonymously using an online questionnaire administered through Wenjuanxing (https://www.wjx.cn), with assistance from teaching administrators at the three participating hospitals. The first page described the study purpose, questionnaire content, voluntary participation, anonymity, and intended use of the data. Participants were informed that data would be analysed only in aggregate and used for academic publication, with no individual or hospital identification in reporting. Participants proceeded after providing online informed consent and could withdraw before submission. All items were mandatory, preventing submission with missing responses, and each account was restricted to one submission to minimise duplicate responses.

Two researchers independently screened all returned questionnaires for data quality, considering completion time, response patterns, and logical consistency. Questionnaires were considered invalid when they showed (1) an unusually short completion time together with inadequate response quality; (2) identical or highly regular responses across most items; or (3) logical inconsistency among related responses. Disagreements were resolved through discussion and consensus. The completion-time criterion was therefore used in conjunction with response-pattern and logical-consistency checks rather than as a stand-alone exclusion criterion.

Statistical analysis

Analyses were conducted using SPSS version 28.0 (IBM Corp., Armonk, NY, USA) and Mplus version 8.3 (Muthén & Muthén, Los Angeles, CA, USA). Continuous variables were summarised as means and standard deviations when appropriate, and categorical variables as frequencies and percentages. Differences across latent profiles were examined using one-way analysis of variance followed by LSD post-hoc tests for continuous variables and the chi-square test or Fisher's exact test for categorical variables, as appropriate.

LPA was conducted in Mplus 8.3 using robust maximum likelihood estimation (MLR). The seven dimension scores of the humanistic care scale were entered as continuous indicators. One- through five-profile solutions were estimated sequentially and evaluated using the Akaike information criterion (AIC), Bayesian information criterion (BIC), sample-size-adjusted BIC (aBIC), entropy, the bootstrapped likelihood ratio test (BLRT), and the Vuong–Lo–Mendell–Rubin likelihood ratio test (VLMR) [28–30]. Lower AIC, BIC, and aBIC values indicated improved relative fit, whereas higher entropy indicated greater classification precision. Significant BLRT and VLMR results indicated that the k-profile solution provided a better fit than the corresponding (k−1)-profile solution. Average posterior probabilities (AvePP) were also examined, together with profile sizes, convergence, parsimony, and substantive interpretability [31,32]. The final solution was selected by considering these statistical

and substantive criteria jointly, with particular attention to avoiding trivially small classes and retaining profiles that represented interpretable patterns of humanistic care.

Pearson correlation analysis was used to examine associations between AI risk anxiety and ethical sensitivity and the total and dimension scores of humanistic care.

Pairwise differences in profile membership were examined using binary logistic regression, with separate models comparing moderate versus low, high versus moderate, and high versus low profiles. Variables previously reported to be associated with humanistic care [25], together with variables showing significant between-profile differences in univariate analyses ($P < 0.05$), were entered simultaneously using the enter method. Six variables were included: age (≤24, 25–28, or ≥29 years), weekly AI use frequency (≤3, 4–6, or ≥7 times), AI-related training experience (no or yes), AI ethics education experience (no or yes), AI risk anxiety score, and ethical sensitivity score. Age and AI-use frequency were entered as categorical variables, with ≤24 years and ≤3 times per week as the reference categories, respectively. Training and ethics-education experience were entered as binary variables, with "no" as the reference category; AI risk anxiety and ethical sensitivity were entered as continuous variables. Odds ratios (ORs) and 95% confidence intervals (CIs) were reported. All tests were two-sided, and $P < 0.05$ was considered statistically significant. In each pairwise model, profile membership was recoded as a binary outcome and the specified reference profile was used. These analyses were interpreted as associations with profile membership rather than causal or predictive effects.

Ethical approval

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the First Hospital of Hunan University of Chinese Medicine (approval no. 2026007043). All participants provided online informed consent before completing the questionnaire. Data were collected anonymously and used solely for research purposes.

Results

Characteristics of participants

After exclusion of 43 invalid questionnaires, 661 valid questionnaires were included in the analysis, yielding an effective response rate of 91.8%. The characteristics of the participants are presented in Table 1. The largest age group was ≤24 years (n = 259, 39.18%), followed by 25–28 years (n = 222, 33.59%) and ≥29 years (n = 180, 27.23%). Female participants accounted for 76.85% (n = 508). Most participants were master's students (n = 492, 74.43%) and had clinical internship experience (n = 645, 97.58%). Regarding AI-related characteristics, 255 participants (38.58%) reported using AI ≤3 times per week, 213 (32.22%) reported 4–6 times per week, and 193 (29.20%) reported ≥7 times per week. AI-related training experience was reported by 98 participants (14.83%), experience of applying AI in clinical practice by 317 (47.96%), and AI ethics education by 150 (22.69%). The mean total scores were 55.18

± 15.35 for AI risk anxiety, 35.93 ± 5.83 for ethical sensitivity, and 3.67 ± 0.47 for humanistic care.

Table 1 Participant characteristics ($N = 661$)

Characteristic	***n* (%)**
Age (years)	
≤24	259 (39.18)
25–28	222 (33.59)
≥29	180 (27.23)
Sex	
Male	153 (23.15)
Female	508 (76.85)
Grade	
Master's	492 (74.43)
Doctoral	169 (25.57)
Specialty	
Internal medicine	233 (35.25)
Surgery	87 (13.16)
Orthopaedics	58 (8.77)
Gynaecology	39 (5.90)
Paediatrics	55 (8.32)
Otorhinolaryngology	63 (9.53)
Acupuncture and moxibustion	44 (6.66)
Integrated traditional Chinese and Western medicine	35 (5.30)
General practice	5 (0.76)
Medical imaging and nuclear medicine	12 (1.82)
Pharmacy	3 (0.45)
Traditional Chinese pharmacy	6 (0.91)
Clinical laboratory diagnostics	2 (0.30)
Stomatology	19 (2.87)
Clinical internship experience	
Yes	645 (97.58)
No	16 (2.42)
Weekly AI use frequency	
≤3 times	255 (38.58)
4–6 times	213 (32.22)
≥7 times	193 (29.20)
AI-related training experience	
No	563 (85.17)
Yes	98 (14.83)
AI clinical application experience	
No	344 (52.04)
Yes	317 (47.96)

AI ethics education experience	
No	511 (77.31)
Yes	150 (22.69)
AI risk anxiety total score	55.18 ± 15.35
Ethical sensitivity total score	35.93 ± 5.83

Humanistic care scores among medical postgraduate students

Among the 661 participants, the mean total score for humanistic care was 3.67 ± 0.47. The mean scores across the seven dimensions were 3.31 ± 0.61 for altruism, 3.71 ± 0.59 for honesty, 3.39 ± 0.53 for courage, 3.65 ± 0.52 for trust, 3.81 ± 0.60 for patience, 3.82 ± 0.56 for humility, and 3.89 ± 0.69 for hope.

Latent profile analysis of humanistic care

Latent profile analysis was performed using the seven dimension scores of the humanistic care scale as indicators. Model fit indices for the one- to five-profile solutions are presented in Table 2. AIC, BIC, and aBIC decreased progressively as the number of profiles increased. For the two- to five-profile solutions, the BLRT (all $P < 0.001$) and VLMR-LRT (all $P < 0.05$) were statistically significant, indicating improved fit compared with the solution with one fewer profile. Because information criteria may continue to decrease with increasing model complexity, profile enumeration was based on the joint consideration of entropy, likelihood-ratio tests, profile size, parsimony, and substantive interpretability.

The two-profile solution showed relatively higher AIC, BIC, and aBIC values and mainly represented a broad low-versus-high distinction, with limited capacity to capture heterogeneity across the seven humanistic care dimensions. The three-profile solution yielded the highest entropy (0.935), with profile sizes of 130 (19.67%), 420 (63.54%), and 111 (16.79%) participants and AvePP values of 0.970, 0.973, and 0.959, respectively, indicating high classification certainty. Although the four- and five-profile solutions had lower AIC, BIC, and aBIC values and significant likelihood-ratio tests, each included a profile comprising only three participants (0.45%), raising concerns about profile stability and substantive interpretability. Considering model fit, classification certainty, profile size, parsimony, and interpretability, the three-profile solution was retained as the most appropriate solution. It provided a substantial improvement over the two-profile solution while maintaining adequate class sizes, high classification certainty, and interpretable patterns of humanistic care.

Table 2 Fit indices for latent profile models of humanistic care

Model	**AIC**	**BIC**	**aBIC**	**Entropy**	**VLMR-LRT (*P*)**	**BLRT (*P*)**	**Estimated profile proportions (%)**
1-class	8187.124	8250.036	8205.586	—	—	—	100

2-class	6848.986	6947.848	6877.997	0.819	0.004	<0.001	46.60 / 53.40
3-class	5889.971	6024.784	5929.533	0.935	0.005	<0.001	19.67 / 63.54 / 16.79
4-class	5500.108	5670.871	5550.220	0.948	0.048	<0.001	0.45 / 20.27 / 62.03 / 17.25
5-class	5209.591	5416.303	5270.252	0.898	0.031	<0.001	0.45 / 16.94 / 32.98 / 36.01 / 13.62

Characteristics and naming of humanistic care profiles

Profile labels were assigned according to the relative score patterns across the seven humanistic care dimensions (Fig. 1). Because dimension scores were calculated as item means, they are shown on the original 1–5 response scale. Profile 1 comprised 130 participants (19.67%) and showed the lowest scores across all seven dimensions, ranging from 2.85 (altruism) to 3.05 (honesty), with altruism relatively lower than the other dimensions; it was therefore labelled the Low Humanistic Care Ability profile. Profile 2 comprised 420 participants (63.54%) and showed intermediate scores across all seven dimensions (3.29–3.94); it was therefore labelled the Moderate Humanistic Care Ability profile. Profile 3 comprised 111 participants (16.79%) and showed consistently the highest scores (3.59–4.70), with courage relatively lower than the other dimensions, indicating a relatively balanced and advantageous pattern of humanistic care ability. It was therefore labelled the High Humanistic Care Ability profile. These labels are descriptive and reflect the observed score patterns rather than predefined clinical categories.

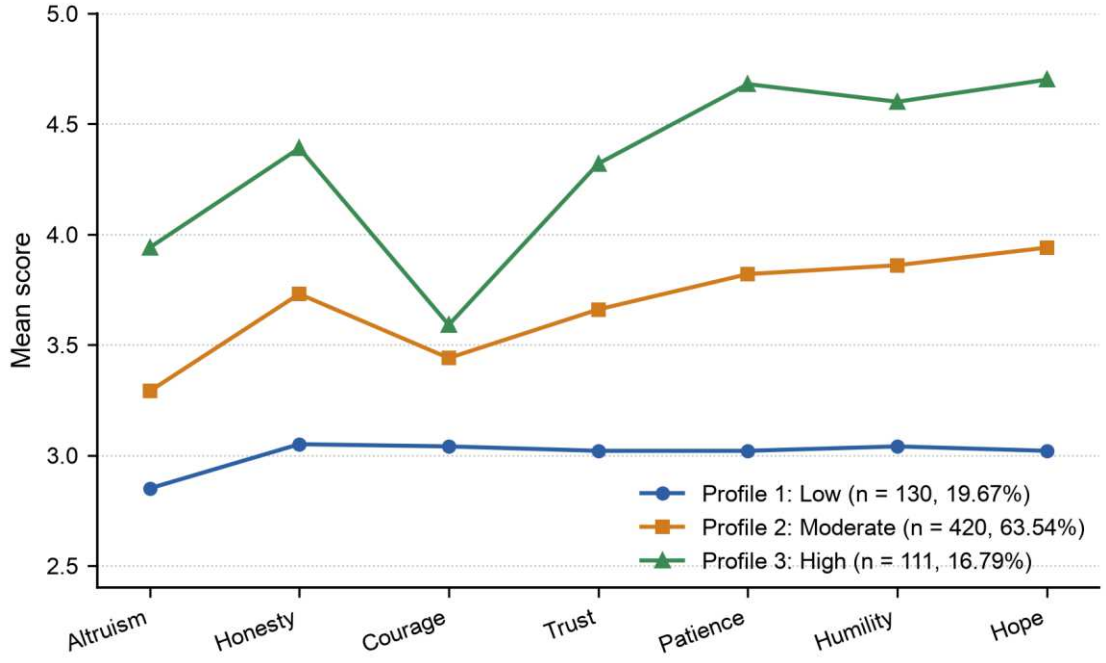


Fig. 1 Latent profiles of humanistic care among medical postgraduate students

Univariate analysis of factors associated with humanistic care profiles

Across the three profiles, no significant differences were observed in sex, academic level, clinical internship experience, or prior clinical use of AI (all $P > 0.05$). In contrast, age, weekly AI use frequency, AI-related training experience, AI ethics education experience, AI risk anxiety, and ethical sensitivity differed significantly across profiles (all $P < 0.05$). Post-hoc comparisons showed that AI risk anxiety was significantly lower in the moderate and high profiles than in the low profile and lower in the high profile than in the moderate profile. Conversely, ethical sensitivity was significantly higher in the moderate and high profiles than in the low profile and higher in the high profile than in the moderate profile (all $P < 0.05$). Full univariate results are presented in Table 3.

Table 3 Univariate analysis of factors associated with humanistic care profiles

Characteristic	**C1 (*n*=130)**	**C2 (*n*= 420)**	**C3 (*n*= 111)**	**Test statistic**	***P***
Age (years)				χ^2= 27.786	<0.001
≤24	69(53.08)	166 (39.52)	24 (21.62)		
25–28	37(28.46)	143 (34.05)	42 (37.84)		
≥29	24(18.46)	111 (26.43)	45 (40.54)		
Gender				χ^2 = 4.412	0.110
Male	38(29.23)	95 (22.62)	20 (18.02)		
Female	92(70.77)	325 (77.38)	91 (81.98)		
Academic level				χ^2 = 0.884	0.643
Master's	96(73.85)	317 (75.48)	79 (71.17)		
Doctoral	34(26.15)	103 (24.52)	32 (28.83)		
Clinical internship experience				χ^2 = 0.477	0.872
Yes	126(96.92)	410 (97.62)	109(98.20)		
No	4 (3.08)	10 (2.38)	2 (1.80)		
Weekly AI usage frequency				χ^2= 30.967	<0.001
≤3 times	67 (51.54)	168 (40.00)	20 (18.02)		
4–6 times	34 (26.15)	136 (32.38)	43 (38.74)		
≥7 times	29 (22.31)	116 (27.62)	48 (43.24)		
AI training experience				χ^2= 20.851	<0.001
No	120 (92.31)	363	80 (72.07)		

		(86.43)			
Yes	10 (7.69)	57 (13.57)	31 (27.93)		
Prior clinical use of AI				$\chi^2 = 2.334$	0.311
No	60 (46.15)	226 (53.81)	58 (52.25)		
Yes	70 (53.85)	194 (46.19)	53 (47.75)		
AI ethics education experience				$\chi^2 = 18.189$	<0.001
No	113(86.92)	327 (77.86)	71 (63.96)		
Yes	17 (13.08)	93 (22.14)	40 (36.04)		
AI risk anxiety score	60.12±13.28	55.94 ± 13.81[a]	46.51 ± 19.33[ab]	F = 26.890	<0.001
Ethical sensitivity score	33.42±5.58	35.80 ± 5.09[a]	39.39 ± 7.02[ab]	F = 34.929	<0.001

Note: Data are presented as *n* (%) for categorical variables and as mean ± SD for continuous variables. Categorical variables were compared using the χ^2 test, and continuous variables were compared using one-way ANOVA with LSD post hoc tests. C1 = low humanistic care profile; C2 = moderate humanistic care profile; C3 = high humanistic care profile. [a]$P < 0.05$ compared with C1; [b]$P < 0.05$ compared with C2.

Correlations between AI risk anxiety, ethical sensitivity and humanistic care

Pearson correlation analysis showed that AI risk anxiety was negatively correlated with the humanistic care total score and all seven dimensions ($r = -0.164$ to -0.329, all $P < 0.001$), with the strongest correlation observed for the total score ($r = -0.329$). Ethical sensitivity was positively correlated with the humanistic care total score and all seven dimensions ($r = 0.212$ to 0.340, all $P < 0.001$), with the strongest correlation likewise observed for the total score ($r = 0.340$). At the dimension level, trust showed the strongest correlation with AI risk anxiety ($r = -0.319$), while patience showed the strongest correlation with ethical sensitivity ($r = 0.303$); courage showed the weakest correlation with ethical sensitivity ($r = 0.212$). Overall, greater AI risk anxiety was associated with lower humanistic care scores, whereas greater ethical sensitivity was associated with higher humanistic care scores. The full correlation matrix is presented in Table 4.

Table 4 Correlations between AI risk anxiety, ethical sensitivity and humanistic care ($N = 661$)

Humanistic care dimension	**AI risk anxiety**		**Ethical sensitivity**	
	r	***P***	***r***	***P***
Altruism	−0.164	<0.001	0.281	<0.001
Honesty	−0.216	<0.001	0.279	<0.001
Courage	−0.257	<0.001	0.212	<0.001

Trust	−0.319	<0.001	0.287	<0.001
Patience	−0.283	<0.001	0.303	<0.001
Humility	−0.284	<0.001	0.279	<0.001
Hope	−0.302	<0.001	0.263	<0.001
Total score	−0.329	<0.001	0.340	<0.001

Note: Values are Pearson correlation coefficients (*r*). All correlations between the AI risk anxiety and ethical sensitivity total scores and the total and dimension scores of humanistic care were statistically significant at $P < 0.001$.

Binary logistic regression analysis of factors associated with humanistic care profiles

Binary logistic regression models were constructed with humanistic care profile membership as the dependent variable. Three pairwise models were fitted, comparing moderate versus low, high versus moderate, and high versus low profiles. Six variables were entered simultaneously using the enter method: age, weekly AI use frequency, AI-related training experience, AI ethics education experience, AI risk anxiety, and ethical sensitivity. The coding scheme is shown in Table 5, and the regression results are presented in Table 6.

Table 5 Coding scheme for the study variables

Variable	**Coding**
Humanistic care profile (dependent variable)	C1 (low) = 1; C2 (moderate) = 2; C3 (high) = 3
Age (years)	≤24 = 1; 25–28 = 2; ≥29 = 3
Weekly AI use frequency	≤3 times = 1; 4–6 times = 2; ≥7 times = 3
AI-related training experience	No = 0; Yes = 1
AI ethics education experience	No = 0; Yes = 1
AI risk anxiety total score	Original values
Ethical sensitivity total score	Original values

In the moderate versus low comparison, participants aged 25–28 years (OR = 1.656, 95% CI 1.029–2.665, $P = 0.038$) and ≥29 years (OR = 2.047, 95% CI 1.161–3.612, $P = 0.013$) had higher odds of membership in the moderate profile than those aged ≤24 years. AI ethics education experience was also associated with higher odds of moderate-profile membership (OR = 2.060, 95% CI 1.134–3.742, $P = 0.018$). Higher AI risk anxiety was associated with lower odds of moderate-profile membership (OR = 0.977, 95% CI 0.962–0.993, $P = 0.006$), whereas higher ethical sensitivity was associated with higher odds (OR = 1.106, 95% CI 1.059–1.155, $P < 0.001$). Weekly AI use frequency and AI-related training experience were not significantly associated with moderate-profile membership ($P > 0.05$).

In the high versus moderate comparison, participants aged 25–28 years (OR = 1.827, 95% CI 1.015–3.288, $P = 0.045$) and ≥29 years (OR = 1.974, 95% CI 1.079–3.610, $P = 0.027$) had higher odds of high-profile membership than those aged ≤24 years. Participants who used AI 4–6 times (OR = 2.003, 95% CI 1.082–3.710, $P = 0.027$) or

≥7 times per week (OR = 2.594, 95% CI 1.390–4.844, $P = 0.003$) also had higher odds than those using AI ≤3 times per week. Higher AI risk anxiety was associated with lower odds of high-profile membership (OR = 0.973, 95% CI 0.959–0.987, $P < 0.001$), whereas higher ethical sensitivity was associated with higher odds (OR = 1.102, 95% CI 1.059–1.146, $P < 0.001$). AI-related training experience and AI ethics education experience were not significantly associated with high-profile membership ($P > 0.05$).

In the high versus low comparison, participants aged 25–28 years (OR = 2.954, 95% CI 1.305–6.685, $P = 0.009$) and ≥29 years (OR = 4.734, 95% CI 1.906–11.756, $P = 0.001$) had higher odds of high-profile membership than those aged ≤24 years. Participants using AI 4–6 times (OR = 3.432, 95% CI 1.474–7.993, $P = 0.004$) or ≥7 times per week (OR = 2.444, 95% CI 1.028–5.814, $P = 0.043$) also had higher odds than those using AI ≤3 times per week. AI-related training experience (OR = 4.246, 95% CI 1.443–12.491, $P = 0.009$) and AI ethics education experience (OR = 3.087, 95% CI 1.265–7.532, $P = 0.013$) were also associated with high-profile membership. Higher AI risk anxiety was associated with lower odds of high-profile membership (OR = 0.951, 95% CI 0.928–0.975, $P < 0.001$), whereas higher ethical sensitivity was associated with higher odds (OR = 1.201, 95% CI 1.117–1.291, $P < 0.001$).

Overall, older age, more frequent AI use, AI-related training, AI ethics education, and higher ethical sensitivity were associated with higher humanistic care profile membership, whereas higher AI risk anxiety was associated with lower-profile membership. These findings describe associations with profile membership and should not be interpreted as causal effects.

Table 6 Binary logistic regression analysis of factors associated with humanistic care profiles

Group	Variable	β	SE	Wald χ^2	OR	95% CI	*P*
C2 versus C1[1])	Age (years)						
	25–28 vs. ≤24	0.505	0.243	4.320	1.656	1.029–2.665	0.038
	≥29 vs. ≤24	0.717	0.290	6.122	2.047	1.161–3.612	0.013
	Weekly AI use frequency						
	4–6 vs. ≤3	0.333	0.253	1.740	1.395	0.850–2.290	0.187
	≥7 vs. ≤3	0.434	0.266	2.667	1.543	0.917–2.597	0.102
	AI-related training experience (yes vs. no)	0.197	0.398	0.247	1.218	0.559–2.655	0.619
	AI ethics education experience (yes vs. no)	0.723	0.305	5.625	2.060	1.134–3.742	0.018
	AI risk anxiety total score	−0.023	0.008	7.596	0.977	0.962–0.993	0.006

	Ethical sensitivity total score	0.101	0.022	20.965	1.106	1.059–1.155	<0.001
	Age (years)						
	25–28 vs. ≤24	0.602	0.300	4.034	1.827	1.015–3.288	0.045
	≥29 vs. ≤24	0.680	0.308	4.872	1.974	1.079–3.610	0.027
	Weekly AI use frequency						
	4–6 vs. ≤3	0.695	0.314	4.885	2.003	1.082–3.710	0.027
	≥7 vs. ≤3	0.953	0.319	8.956	2.594	1.390–4.844	0.003
C3 versus C2[2])	AI-related training experience (yes vs. no)	0.552	0.299	3.410	1.736	0.967–3.118	0.065
	AI ethics education experience (yes vs. no)	0.480	0.268	3.193	1.616	0.955–2.734	0.074
	AI risk anxiety total score	−0.027	0.007	13.806	0.973	0.959–0.987	<0.001
	Ethical sensitivity total score	0.097	0.020	23.383	1.102	1.059–1.146	<0.001
	Age (years)						
	25–28 vs. ≤24	1.083	0.417	6.757	2.954	1.305–6.685	0.009
	≥29 vs. ≤24	1.555	0.464	11.221	4.734	1.906–11.756	0.001
	Weekly AI use frequency						
	4–6 vs. ≤3	1.233	0.431	8.177	3.432	1.474–7.993	0.004
	≥7 vs. ≤3	0.894	0.442	4.089	2.444	1.028–5.814	0.043
C3 versus C1[1])	AI-related training experience (yes vs. no)	1.446	0.551	6.899	4.246	1.443–12.491	0.009
	AI ethics education experience (yes vs. no)	1.127	0.455	6.133	3.087	1.265–7.532	0.013
	AI risk anxiety total score	−0.050	0.012	15.996	0.951	0.928–0.975	<0.001
	Ethical sensitivity total score	0.183	0.037	24.407	1.201	1.117–1.291	<0.001

Notes: C1 = low humanistic care profile; C2 = moderate humanistic care profile; C3 = high humanistic care profile. 1) Reference = C1; 2) Reference = C2. The dependent variable was humanistic care profile membership, and each model was restricted to the two profiles being compared. β = unstandardised regression coefficient; SE = standard error; OR = odds ratio; CI = confidence interval. Other reference categories were age ≤24 years, weekly AI use ≤3 times, no AI-related training experience, and no AI ethics education experience.

Discussion

Principal findings

Among the 661 medical postgraduate students, the mean total humanistic care score was 3.67 ± 0.47. Hope, humility, and patience showed relatively higher scores, whereas altruism and courage were relatively lower. Rather than indicating a uniform level of humanistic care, this pattern suggests that different components of humanistic care may develop unevenly during postgraduate medical training. Latent profile analysis further identified three distinct profiles: low (19.67%), moderate (63.54%), and high (16.79%) humanistic care. Importantly, AI risk anxiety decreased progressively across these profiles, whereas ethical sensitivity increased. AI risk anxiety was negatively correlated with all seven dimensions of humanistic care, while ethical sensitivity was positively correlated with all seven dimensions. In the adjusted pairwise analyses, higher AI risk anxiety was consistently associated with lower humanistic care profile membership, whereas higher ethical sensitivity was associated with higher-profile membership. These findings suggest that humanistic care among medical postgraduate students is heterogeneous and is closely associated with both their responses to AI-related uncertainty and their ethical sensitivity.

Heterogeneity and developmental patterns of humanistic care

The identification of three humanistic care profiles provides information that would be obscured by relying solely on the total score. The predominance of the moderate profile indicates that most postgraduate students had established a basic foundation of humanistic care but had not developed consistently high levels across all dimensions. This finding is consistent with the view that humanistic competence develops through the interaction of formal education, clinical experience, professional role modelling, and reflective learning rather than through knowledge acquisition alone [37,38]. Recent work has also proposed “humanistic practice” as a measurable educational outcome that integrates noticing humanistic needs, adapting interpersonal behaviour, reflection, and subsequent reorientation in clinical practice [37].

The relatively higher scores for hope, humility, and patience may indicate that students more readily develop interpersonal attitudes that are reinforced through routine clinical interactions. In contrast, the relatively lower scores for altruism and courage may reflect the greater complexity of translating humanistic values into action when clinical priorities, workload, hierarchy, or uncertainty are present. Courage is particularly relevant because recognizing a patient's needs or an ethical concern does not necessarily mean that a trainee will feel confident enough to question decisions, advocate for patients, or speak up in challenging situations. Therefore, humanistic education may need to move beyond the transmission of values

toward repeated opportunities for reflection, communication, patient advocacy, and professional action [38,39].

The three profiles should be interpreted as descriptive patterns rather than fixed developmental categories. The moderate profile represented the majority of participants, whereas the low and high profiles identified smaller but educationally relevant subgroups. Person-centred and longitudinal approaches may be particularly useful for understanding how these profiles evolve during postgraduate training. Previous research indicates that reflective and longitudinal approaches can support the development of empathy and professionalism, while clinical encounters can contribute to professional identity formation and patient-centred attitudes [40,41].

The role of age and AI-related educational experiences

Age was independently associated with humanistic care profile membership. Compared with students aged ≤24 years, older students had higher odds of belonging to the moderate or high humanistic care profiles in the pairwise models. One possible explanation is that older students may have accumulated greater clinical exposure, interpersonal experience, and professional socialization. However, age itself should not be interpreted as a causal determinant of humanistic care. Rather, age may act as a marker of differences in training stage, clinical experience, or professional development.

AI-related educational experiences also showed profile-specific associations. AI ethics education was associated with membership in the moderate rather than low profile and in the high rather than low profile, whereas AI-related training was significantly associated with the high rather than low profile. Interestingly, neither type of education significantly differentiated the high and moderate profiles. This pattern may suggest that exposure to AI-related education is more relevant to distinguishing students with relatively lower humanistic care from those with at least moderate or high levels, whereas progression from moderate to high humanistic care may require broader and more experiential forms of professional development.

This interpretation is consistent with recent evidence that medical students increasingly recognize the need for formal AI and AI ethics education, while existing curricular provision may not adequately address these needs [42]. A 2024 principle-based framework further argues that AI ethics education should extend beyond technical knowledge to include autonomy, beneficence, non-maleficence, justice, accountability, and other ethical considerations [21]. Therefore, AI education should not be viewed simply as technical skills training. Its educational value may be greater when AI-related content is embedded within clinical ethics, professionalism, patient communication, and reflection on the changing role of physicians.

Weekly AI use frequency was significantly associated with membership in the high

rather than moderate profile, with students reporting more frequent AI use showing higher odds of belonging to the high profile. This association should also be interpreted cautiously. More frequent AI use may reflect greater digital engagement, academic motivation, or familiarity with emerging technologies rather than an effect of AI use itself. Reverse or bidirectional associations are also possible. Longitudinal studies are needed to determine whether structured and responsible AI use is related to subsequent changes in humanistic care.

The association between humanistic care profiles and AI risk anxiety

A notable finding was the progressive decrease in AI risk anxiety from the low to the high humanistic care profile. AI risk anxiety was also negatively correlated with the total humanistic care score and each of its seven dimensions, with the strongest association observed for total humanistic care. These findings indicate that students with stronger humanistic care characteristics tended to report lower levels of concern about AI-related risks. Importantly, because this was a cross-sectional study, this association should not be interpreted as evidence that humanistic care reduces AI anxiety.

One possible explanation is that humanistic orientations may shape how students understand the role of AI in medicine. AI introduces concerns related to professional roles, accountability, privacy, algorithmic bias, misinformation, and possible changes in employment or clinical responsibilities [42,44,45]. Recent systematic evidence indicates substantial variation in medical students' perceptions of AI, including concerns about job security, clinical responsibility, and the implications of AI integration into medical practice [42]. Students who conceptualize medicine primarily as a technical activity may perceive AI as a potential substitute for components of professional work, whereas students with stronger humanistic orientations may place greater emphasis on communication, empathy, shared decision-making, and relational care—areas that remain closely connected to the physician–patient relationship [42,45].

This interpretation is also compatible with recent discussions of AI-era professionalism, which argue that technological competence should be integrated with enduring professional values such as empathy, integrity, accountability, and patient-centred care [46]. However, this explanation remains hypothetical and should be tested in longitudinal or qualitative studies. In particular, the relatively strong association between the trust dimension of humanistic care and AI risk anxiety should not be interpreted as indicating that students with greater interpersonal trust necessarily trust AI more. Rather, the finding may reflect broader differences in professional orientation and perceptions of technological change.

The association between humanistic care and ethical sensitivity

Ethical sensitivity showed a consistent positive association with humanistic care. Students in the high humanistic care profile had the highest ethical sensitivity scores, whereas those in the low profile had the lowest. Moreover, ethical sensitivity was positively correlated with the total humanistic care score and all seven dimensions. These findings support the conceptual relationship between recognizing ethically relevant aspects of patient care and maintaining a patient-centred, relational orientation.

Ethical sensitivity and humanistic care, however, should not be regarded as interchangeable constructs. Ethical sensitivity primarily concerns the recognition and interpretation of ethically relevant features of a situation, whereas humanistic care encompasses broader attitudes and interpersonal orientations toward patients. Recent research has similarly emphasized the importance of developing ethical awareness among medical and nursing students [46]. In addition, the concept of humanistic practice has been proposed as an outcome that links ethical sensitivity with concrete interpersonal and clinical behaviours [37]. The positive associations observed in the present study may therefore indicate that these two competencies are complementary components of professional development rather than manifestations of the same construct.

The relatively weaker correlation between courage and ethical sensitivity is also noteworthy. Ethical sensitivity may help students recognize that an ethical issue exists, but recognition alone does not necessarily translate into the willingness or confidence to act. This distinction may be particularly important in postgraduate clinical environments, where students work within established professional hierarchies. Educational strategies that incorporate case-based ethical reasoning, reflective discussion, communication training, and structured opportunities to practise speaking up may therefore help bridge the gap between ethical recognition and humanistic action [38,39].

Integrating technological adaptation, ethical sensitivity, and humanistic care in medical education

Taken together, the findings suggest that AI literacy, ethical sensitivity, and humanistic care should not be treated as independent educational domains. The increasing integration of AI into medical education and clinical practice creates a need for physicians who can understand technological capabilities while maintaining professional responsibility and patient-centred values [44,45]. Recent literature similarly emphasizes that AI may transform clinical workflows and decision-making while simultaneously raising questions about accountability, privacy, bias, misinformation, and the physician–patient relationship [21,42,45].

The present findings provide an empirical basis for considering these competencies together. Students with higher humanistic care profiles reported lower AI risk anxiety

and higher ethical sensitivity. This does not mean that anxiety is inherently undesirable or that students should simply become less concerned about AI. Appropriate concern may encourage critical evaluation of AI limitations and ethical risks. The educational goal should therefore be to transform unstructured AI-related anxiety into informed, reflective, and ethically grounded engagement with AI. Principle-based AI ethics education may provide one pathway for achieving this balance [21].

Accordingly, future postgraduate medical education could integrate AI literacy with patient-centred communication, ethical reasoning, professional identity formation, and reflective practice. Rather than establishing AI education as a separate technical module, institutions could use authentic clinical cases involving AI-assisted diagnosis, clinical decision support, informed consent, privacy, algorithmic bias, and responsibility for AI-assisted decisions. Such approaches may help students understand that technological competence and humanistic care are complementary rather than competing competencies.

Implications for differentiated postgraduate medical education

The three-profile solution has practical implications for differentiated education. Students in the low humanistic care profile may benefit from foundational interventions focusing on empathy, communication, patient perspective-taking, ethical awareness, and reflective practice. For students in the moderate profile, educational strategies could emphasize the integration of humanistic values into complex clinical situations, including shared decision-making, ethical dilemmas, and communication under time or resource constraints. Students in the high profile may benefit from advanced opportunities involving patient advocacy, ethical leadership, mentoring, and responsible AI implementation.

The findings also suggest that AI-related education should be differentiated according to students' developmental needs. For students with high AI risk anxiety, education should provide realistic information about AI capabilities and limitations while emphasizing professional accountability and the continuing importance of human judgement and patient relationships. For students with frequent AI use, training should focus on responsible use, critical appraisal of AI-generated information, privacy, bias, transparency, and appropriate boundaries of AI-assisted decision-making [21,45]. Such differentiated approaches may be more appropriate than a uniform curriculum because the present findings demonstrate meaningful heterogeneity in humanistic care.

Strengths and limitations

This study has several strengths. First, the use of latent profile analysis enabled identification of heterogeneous patterns of humanistic care that could not be

adequately captured by mean scores alone. Second, the study examined humanistic care in relation to both AI risk anxiety and ethical sensitivity, thereby addressing two increasingly important dimensions of postgraduate medical education in the context of rapid technological change. Third, the pairwise logistic regression analyses provided a more detailed examination of factors associated with differences between humanistic care profiles.

Several limitations should also be considered. First, the cross-sectional design prevents causal inference, and all associations should be interpreted as correlational. Second, convenience sampling was used to recruit professional-degree medical postgraduate students studying at three tertiary Grade-A general hospitals in Changsha, which may limit the generalizability of the findings to students from other regions, institutions, educational programmes, or cultural contexts. Third, the study relied on self-reported measures, which may be affected by social desirability and common-method bias. Fourts. Fourth, the latent profiles were derived from the seven humanistic care dimensions measured at a single time point; therefore, the temporal stability and developmental transitions of these profiles remain unknown. Fifth, although AI-related variables were included in the analysis, the study did not directly assess objective AI literacy or actual competency in responsible AI use. Future longitudinal and multicentre studies should examine whether educational interventions can alter profile membership and whether changes in AI literacy, ethical sensitivity, and humanistic care occur together over time.

Conclusions

This study identified three distinct profiles of humanistic care among medical postgraduate students, with most students belonging to a moderate profile. Humanistic care was positively associated with ethical sensitivity and negatively associated with AI risk anxiety across all seven dimensions. Older age, more frequent AI use, AI-related training, and AI ethics education were also associated with differences in humanistic care profile membership, although these relationships should not be interpreted causally. The findings highlight the heterogeneity of humanistic care during postgraduate medical training and support a more integrated educational approach combining humanistic development, ethical reasoning, and responsible AI literacy. In the context of rapidly evolving AI-enabled healthcare, medical education should aim not only to prepare students to use new technologies, but also to preserve and strengthen the professional values and patient-centred relationships that remain fundamental to medical practice.

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collection.

Authors' contributions

Ping Zhang conceived the study, participated in its design, and wrote the original draft. Jiawen Liu drafted the manuscript and provided critical revisions. Ying Zhang participated in data acquisition and conducted the statistical analysis. Huanwen Luo coordinated the research process. Yana He critically revised the manuscript for important intellectual content. Ping Zhang and Jiawen Liu contributed equally to this work. All authors approved the final version of the manuscript to be published and agree to be accountable for all aspects of the work.

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Availability of data and materials

The datasets generated and analysed during the current study are not publicly available because they contain information that could compromise the privacy of the participants; they are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the First Hospital of Hunan University of Chinese Medicine (approval no. 2026007043). All participants were informed of the purpose of the study, the voluntary nature of participation, anonymity and the intended use of the data, and provided online informed consent before completing the questionnaire.

Consent for publication

Not applicable.

Declaration of generative AI

During the preparation of this manuscript, the authors used ChatGPT for language polishing and translation assistance. The authors subsequently reviewed, revised, and verified the content and take full responsibility for the accuracy and integrity of the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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