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Discrete choice experiment on the preferences for continuing medical education training programs among primary health care physicians in China

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Abstract

Background Improving primary health care (PHC) physician's capacity has been identified as an important area in the healthcare reform. The continuing medical education (CME) training programs are conducive to enhancing competence of PHC physicians. But few studies have explored PHC physicians' needs and preferences for CME training programs. This study aimed to explore the preferences for CME training programs from the perspective of PHC physicians, and to understand the willingness, tendency, and needs in CME.

Methods A Discrete Choice Experiment (DCE) was developed based on literature review and semi-structured interviews with 4 general practitioners to identify key attributes of CME programs. The DCE survey was administered to 360 PHC physicians in Jiangsu Province, China, in August 2023, to elicit preferences for: training frequency, training time, training duration, training location, training content of basic medical services, and training content of basic public health services. A total of 281 valid responses were included after the quality control test, which involved checking completion time and consistency in repeated choice tasks. DCE data were analyzed using Mixed Logit, and Latent Class Models to explore preference heterogeneity and class membership.

Results PHC physicians showed strong preference for CME training programs that were conducted during working hours on weekdays, once a year, at a local meeting place and training on health management of patients with multiple chronic diseases. Latent class analysis identified 2 preference classes, with half (51.2%) of the respondents focused only on training frequency and time while the rest considered training logistic arrangement as well as training content. These preferences could be explained by some observed characteristics of PHC physicians such as age and professional level.

Conclusions Overall, PHC physicians valued the convenience of participation in CME training programs and training on health management of patients with multiple chronic disease. Our findings can be used to inform the design of CME training programs for PHC physicians in China.

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Keywords Continuing medical education, Primary health care physician, Training program preference, Discrete choice experiment, China

Introduction

Primary health care (PHC) has been considered as an important part of achieving both the Universal Health Coverage as well as Sustainable Development Goals by 2030 [1]. Since the launch of the new round of China's health care reform in 2009, the importance of PHC services has been fully highlighted [2]. "Strengthening the Primary Health Care (*qiang ji ceng*)" proposed by China's former Ministry of Health has also put the PHC system as a reform priority. Studies have found positive associations between strong PHC system and improved health outcomes [3]. As providers of PHC, PHC physicians are expected to provide quality health services to maintain and improve health of both patients and the general population in the community [4]. The medical service capacity of PHC physicians directly affect individual patient's health outcome, patient satisfaction and population health [5].

In China, the primary method for rapidly training PHC physicians is the post-transfer program, which spans one year. This program consists of 10 months of hospital-based training, one month of community service, and one month of theoretical instruction. However, this training model highlights significant shortcomings, such as limited training duration and suboptimal quality. As a result, many PHC physicians lacked sufficient diagnostic and treatment capabilities in practice [6]. Improving PHC physician's capacity has been identified as an important area in the healthcare reform. Due to insufficient investment in the early training of PHC physicians, continuing medical education (CME) after graduation plays a crucial role in addressing the gaps in the current training model.

CME is defined as educational activities designed to enhance the knowledge, skills, and professional performance of health workforce [7]. As a key component of CME, professional training programs focused on capacity enhancement are carried out to strengthen the development of PHC teams [8, 9]. CME is a mandatory requirement for PHC physicians in China [10], and various policies and training programs have been introduced to improve the workforce and capabilities of PHC physicians across the country [11, 12]. However, CME resources remain inadequate, especially in rural and urban communities [13]. Existing studies on CME training programs for PHC physicians primarily focus on specific programs and their impact on physicians' performance, though findings are mixed [14–16]. Some studies found a positive effect on physicians' knowledge, competence, and performance [17–22], while others reported limited effects [23–25]. Additionally, some research highlighted that the efficiency, quality, and satisfaction levels of CME training were low [26–28].

Researchers have also examined the facilitators and barriers to CME programs, identifying factors such as lack of funding, long travel time/distance, time constraints, inadequate infrastructure, and high workload as contributors to low participation rates among PHC physicians [29, 30]. Consequently, it is important to consider trainees' needs and preferences when designing CME programs [31]. Literature suggests that training programs tailored to physicians' needs are more likely to induce positive changes in trainee behavior [32, 33]. However, few studies have investigated the needs and preferences for training programs from the perspective of PHC physicians. There is limited information on the specific competencies PHC physicians require and their preferences for training program design. Furthermore, it remains unclear whether PHC physicians' preferences are linked to their individual characteristics.

Discrete choice experiment (DCE) measures the strength of individual preferences by modeling the impact of their mental states and key attributes during decision-making [34]. DCE has been widely used in research on clinical treatment technologies, vaccination programs, disease screening, and PHC services [35–37]. In health workforce management, DCE has been used to study retention and incentive mechanisms [1, 38–40]. However, its application to exploring PHC physicians' preferences for CME training programs remains limited. Traditional studies on the training needs of village doctors have predominantly relied on questionnaire-based surveys, which often exhibit moderate or lower levels of reliability and validity in measuring outcomes [41]. In contrast, DCE offers a more scientifically robust approach for capturing and analyzing the preferences of healthcare workers, making it a more effective tool for understanding PHC physicians' preferences for CME training programs.

This current study aimed to explore the preferences of PHC physicians in China for CME training programs and examine their associations with individual characteristics, providing evidence to guide the design of CME programs that better meet PHC physicians' needs and enhance their participation and capacity development.

Methods

Identification of attributes and levels

Attributes and attribute levels were derived from literature review, a nationwide survey among PHC physicians [5] and semi-structured interviews with PHC physicians. Firstly, we conducted a comprehensive literature review to identify the critical aspects relevant to CME training programs for PHC physicians that may influence their willingness to participation and training effectiveness. We then compiled a list of potential attributes and level. Altogether 10 aspects from studies in the United States, Portugal, Denmark, Jordan, Auckland and North Island were identified: lack of time, duration, blurred distinction between work and non-work time, geographical constraints, lack of interest in the content, unpractical topics, low quality of the programs, lack of digital competence, lack of digital infrastructure, lack of financial support [29, 42–47]. Secondly, we conducted semi-structured interviews with 4 general practitioners individually in July 2023. Using typical sampling, we consulted staff from Jiangsu Provincial Center for Disease Control and Prevention to recommend two community health centers, one in urban and the other in rural areas in Nanjing, which performed well in primary health care competence. Then director of each sampled community health center recommended two general practitioners, respectively. The sampled community health centers and general practitioners did not participate in the DCE survey later. In the interviews, general practitioners were asked what specific type of competence they were in urgent need to enhance and what they cared most in a CME training program, relevant but not limited to training content, frequency, format, etc. The interview results indicated that training frequency (how often the training was conducted), training schedule (whether it was held on a workday and during working hours), training duration (how many days it lasted), and training location (local or non-local) were aspects repeatedly emphasized by PHC physicians during the interviews. Thirdly, an index system for evaluating the health service capacity that PHC physicians are required to master was developed through literature review, Delphi expert consultation and a verification survey. Using this index system, the research team conducted a nationwide survey in August 2020, collecting self-reported data from PHC physicians regarding their competence levels and the degree to which these competencies were needed in their daily work [5]. Competencies that were identified as needed in practice but self-reported as having low or very low proficiency were selected as potential attributes and levels for the training content in this study. Based on these findings, attributes and levels related to training content in basic medical service and basic public health service competencies were established. After brainstorming and discussion, the research team finalized the following attributes and levels in Table 1.

Table 1 Attributes and associated levels identified for discrete choice experiment

Attribute	Level	Level for short
Training frequency	Once a month [Reference]	Month
	Once a quarter	Quarter
	Once half a year	Half a year
	Once a year	Year
Training time	Non-workdays [Reference]	Non-workdays
	Non-working hours on weekdays	Non-working hours
	Working hours on weekdays	Working hours
Training duration	Three days or more [Reference]	3 days ~
	Two days	2 days
	One day	1 day
Training location	Non-local meeting place [Reference]	Non-local
	Local meeting place	Local
Training content of basic medical services	Traditional Chinese medicine services [Reference]	Chinese medicine
	Emergency response for critical and severe cases	Emergency response
	Community rehabilitation services	Rehabilitation
Training content of basic public health services	Infants and child health care guidance and child health management [Reference]	Childcare
	Elderly care and hospice care	Elderly care
	Health management of patients with multiple chronic disease	Patients with multiple chronic disease

Choice tasks and experimental design

An orthogonal experimental design was performed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, N.Y., USA), and 25 profiles were generated. We selected the one profile that possessed the intermediate level of each attribute as the reference, and set it in pairs with each one of the remaining 24 profiles, respectively. As a result, we obtained 24 choice tasks. To mitigate respondents' cognitive burden, the 24 tasks were divided into 6 blocks of 4 tasks each. We included a duplicate choice task in each block to examine the internal consistency. Respondents randomized into 1 of the 6 blocks and each respondent was provided with five choice tasks [1, 48, 49]. We used unlabeled DCE design with two alternatives as "Profile 1" and "Profile 2" and forced choice design (i.e., without an opt-out option). The formal questionnaire consisted of three parts: (1) consent form; (2) general characteristics; (3) DCE choice tasks. For each choice task, participants were asked to choose which program they would prefer for CME training. A choice task example in DCE was showed in Table S1 in the supplementary materials. A pilot study was carried out in one community health center where we conducted interviews. According to the pilot study results, small modifications were made to improve the comprehensibility and feasibility of the questionnaire.

Data collection

Data were collected in August 2023 through an online survey. Based on the rule of thumb proposed by Johnson and Orme, the sample size for the DCE was calculated using the formula $N > 500c?\,(t \times a)$, where c represents the maximum number of levels for any attribute, t represents the number of choice sets in each questionnaire, and a represents the number of options per choice set. For this current study, the minimum sample size was calculated to be 250 [50, 51]. The potential respondents were general practitioners, public health doctors and village doctors, excluding nurses and other staff members in PHC facilities.

Multi-stage stratified sampling method was employed to ensure the representativeness of the data. Jiangsu Province is divided into three areas – the south, center and north – based on levels of economic and social development. In the first step, sample cities were selected considering primary healthcare service characteristics and socioeconomic factors. Specifically, cities with substantial strategies to enhance PHC service capacity, strong PHC service performance, and moderate levels of economic development and population size were chosen according to the recommendation of staff from Jiangsu Provincial CDC. In the second step, two districts (one in urban and one in rural) in each sampled city demonstrated medium-to-high-level PHC capacity and could cooperate well with the research group were selected. In the third step, four PHC facilities were chosen, which possessed medium-to-high-level primary health care capacity and were of almost the same scale. As a result, a total of 24 PHC facilities were selected. In the last step, based on the sample size aforementioned, 15 PHC physicians were randomly selected from each sampled facility. Altogether 360 PHC physicians participated in the online survey. Ethical approval was obtained from the Medical Ethics Committee of Nanjing Medical University (NMU Ethical Review (2023) No. 556).

Two quality control methods were used to examine data quality. We checked the time of completion of DCE tasks to identify speeders, 5% of the samples with the shortest completion time were removed. Respondents who gave different responses to the repeated choice tasks were excluded [34].

Statistical analysis

Descriptive analyses were reported on sample characteristics. Mixed Logit Model (MIXL) was used to account for preference heterogeneity across respondents. All attributes were included as categorical variables and levels were dummy coded, with the first level being determined as reference. We assumed all attributes followed a normal distribution. The coefficients from the MIXL were estimated using maximum simulated likelihood. The relative attribute importance was calculated by the ratio of the maximum utility of each attribute to the total utility [52].

We further explored preferences among PHC physicians through Latent Class Model (LCM), which split the sample into a finite number of groups (classes) with distinct preferences. Preferences within groups are assumed to be homogeneous. The optimal number of classes was selected based on conditional Akaike information criterion (CAIC), Bayesian information criterion (BIC) and log-likelihood ratio (LLR) test [53–55]. Using latent clustering analysis, we predicted the probability of each individual assigned to a latent category. Chi-square test was used to identify differences in characteristics between classes.

Descriptive analyses were performed in IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, N.Y., USA) [56]. All other data analyses were carried out in Stata Statistical Software 15.0 (Stata Corp., T.X.,USA) [57]. A two-tailed *P*-value below 0.05 was considered statistically significant.

Results

Of 360 PHC physicians included in the survey, 18 were identified as speeders and 61 failed repeated choice tasks thus excluded from the analysis. Ultimately, 281 valid questionnaires were retained and the effective rate was 78.1%, which was slightly higher than that in a relevant study (73.4%) and met the lowest sample size requirement for this current study [34].

Characteristics of participants

Sample characteristics of 281 PHC physicians were presented in Table S2 in the supplementary materials. Among them, 52.7% worked in urban areas, and 60.5% were female. The mean year of age and year of providing PHC services were 42.1 (standard deviation [SD] = 10.4) and 20.4 (SD = 17.0), respectively. About 77.6% held bachelor's degree or above, 71.5% had general practitioner license, and 72.6% worked in clinical post. About 71.5% participants had intermediate (e.g. physician-in-charge) or higher professional level (e.g. associate chief physician or chief physician).

Model estimates

Mixed logit model estimates

Table 2 presented MIXL results. Differences in preferences for levels of training frequency, training time, training location and training content for basic public health services were of statistical significance to PHC physicians and influenced their choices of training programs. Respondents showed strong preference for CME training programs that were held less frequently (once a year or half a year), during working hours on weekdays,

Table 2 Mixed logit model estimates for primary health care physicians' preferences for continuing medical education training programs in Jiangsu, 2023

Attribute & level	β	95% CI		SD	95% CI	
		Lower	Upper		Lower	Upper
Training Frequency (Ref: month)						
Quarter	0.573	-2.594	3.739	**5.033**	0.183	9.883
Half a year	**4.028**	0.765	7.290	**7.392**	2.026	12.758
Year	**4.860**	0.374	9.345	**3.705**	0.218	7.191
Training Time (Ref: non-workdays)						
Non-working hours on weekdays	**2.812**	0.069	5.556	2.381	-1.001	5.763
Working hours	**7.462**	1.652	13.271	**6.388**	1.510	11.266
Training Duration (Ref:3 days)						
2 days	0.570	-0.997	2.137	-0.348	-1.470	0.773
1 day	1.508	-0.223	3.239	1.130	-1.068	3.329
Training Location (Ref: non-local)						
Local	**4.375**	0.927	7.823	**5.338**	0.026	10.650
Training content of basic medical services (Ref: Chinese medicine)						
Emergency response	0.022	-1.657	1.700	**5.628**	1.091	10.166
Rehabilitation	-0.645	-2.553	1.262	4.265	-1.072	9.603
Training content of basic public health services (Ref: childcare)						
Elderly care	0.523	-0.817	1.864	**2.855**	0.250	5.460
Patients with multiple chronic diseases	**2.035**	0.129	3.942	1.176	-0.965	3.317
Log-likelihood	-578.843					
AIC	1205.686					
BIC	1342.913					

Note: SD: standard deviation. 95% CI: confidence interval. Levels that were statistically significant at 5% level were shown in bold

Table 3 Relative importance derived from mixed logit model estimates for primary health care physicians' preferences for continuing medical education training programs in Jiangsu, 2023

Attribute	RI(%)	SE	*P* value	95% CI	
				Lower	Upper
Training frequency	**23.2**	0.058	**0.000**	0.119	0.346
Training time	**35.7**	0.047	**0.000**	0.265	0.449
Training duration	7.2	0.038	0.061	-0.003	0.148
Training location	**20.9**	0.039	**0.000**	0.132	0.286
Training content of basic medical services	3.2	0.033	0.328	-0.032	0.096
Training content of basic public health services	**9.7**	0.033	**0.003**	0.032	0.163

Note: RI: relative importance SE: standard error. 95% CI: confidence interval. Levels that were statistically significant at 5% level were shown in bold

and at local meeting place. The results from MIXL also suggested that there was heterogeneity, as the standard deviations for most levels that were statistically significant were also of statistical significance at 5% level. There were two exceptions -- we did not observe substantial heterogeneity in respondents' preferences for the training program held at non-working hours on weekdays and providing training for health management of patients with multiple chronic diseases.

Table 3 showed the relative importance that was calculated from MIXL estimates. Training time of CME training programs was considered as the most important attribute (35.7%), followed by training frequency (23.2%), and training location (20.9%). There was a large gap between the relative importance of training content of basic public health services (9.7%) and that of the three attributes aforementioned. The relative importance of training duration and training content of basic public health services did not show statistical significance.

Latent class model estimates

We estimated that a latent class model with 2 classes exhibited the lowest CAIC and BIC (Supplementary Table S3). Table 4 presents the results of LCM. Looking at within-class model structure, class 1 constituted 48.8% of the respondents. They showed strong preferences for training programs that contained the training content of health management of patients with multiple chronic diseases ($\beta = 2.165$), could be conducted at local meeting place ($\beta = 1.940$), would be held once a year ($\beta = 1.681$) or half a year ($\beta = 1.336$), covered the training content of emergency response for critical and severe cases ($\beta = 1.177$), and with a duration of one day ($\beta = 1.072$). In comparison, class 2 accounted for 51.2% of the respondents, who preferred training programs that would be held at working hours ($\beta = 1.948$), and with the frequency of every six months ($\beta = 1.292$).

Figure 1 presented the relative importance from the two classes. It showed that PHC physicians in class 1 had strong preferences for the training content of basic public health services, training location, and the training

Table 4 Latent class Logit Model estimates for primary health care physicians' preferences for continuing medical education training programs in Jiangsu, 2023

Attribute & level	Class 1				Class 2			
	β	*P* value	95% CI		β	*P* value	95% CI	
			Lower	Upper			Lower	Upper
Training Frequency (Ref: month)								
Quarter	0.268	0.431	-0.399	0.935	-0.166	0.794	-1.414	1.081
Half a year	**1.336**	0.005	0.399	2.273	**1.292**	0.001	0.528	2.055
Year	**1.681**	0.002	0.604	2.757	0.728	0.074	-0.072	1.528
Training Time (Ref: non-workdays)								
Non-working hours on weekdays	0.295	0.420	-0.423	1.014	0.395	0.510	-0.780	1.570
Working hours	0.635	0.124	-0.173	1.443	**1.948**	0.000	0.867	3.029
Training Duration (Ref:3 days)								
2 days	0.469	0.172	-0.203	1.141	0.425	0.363	-0.491	1.341
1 day	**1.072**	0.004	0.340	1.804	0.921	0.061	-0.043	1.884
Training Location (Ref: non-local)								
Local	**1.940**	0.000	1.324	2.557	0.154	0.649	-0.508	0.816
Training content of basic medical services (Ref: Chinese medicine)								
Emergency response	**1.177**	0.008	0.306	2.048	-0.349	0.431	-1.217	0.519
Rehabilitation	-0.329	0.332	-0.993	0.336	0.006	0.989	-0.793	0.804
Training content of basic public health services (Ref: childcare)								
Elderly care	0.531	0.038	0.030	1.031	-0.312	0.383	-1.012	0.389
Patients with multiple chronic disease	**2.165**	0.000	0.966	3.364	-0.460	0.373	-1.470	0.551
Class share	48.8%				51.2%			

Note: 95% CI: confidence interval. Levels that were statistically significant at 5% level were shown in bold

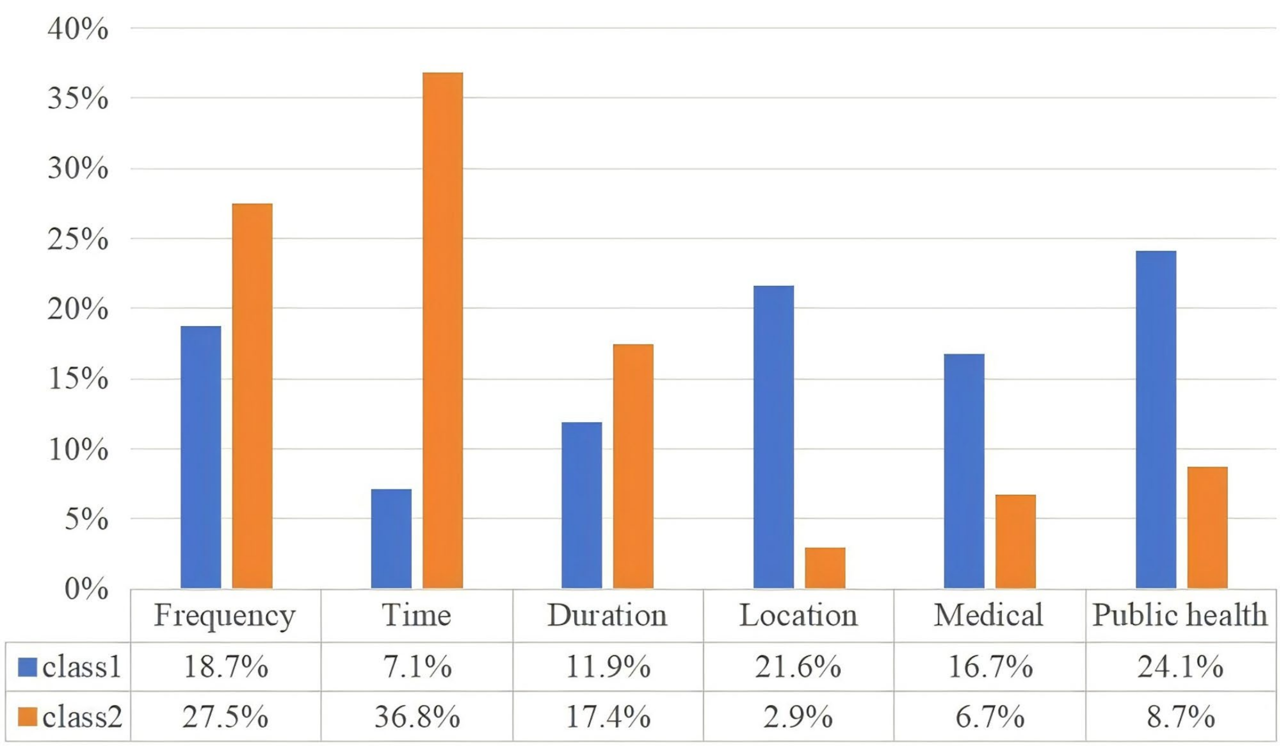

Fig. 1 Relative importance of class 1 and class 2 derived from Latent Class Logit Model estimates for primary health care physicians' preferences for continuing medical education training programs in Jiangsu, 2023

Table 5 Association between latent class membership and participants' general characteristics in primary health care physicians in Jiangsu, 2023

Variable	Class 1 (*N* = 137)		Class 2 (*N* = 144)		Chi-square value	*P* value
	N	**%**	***N***	**%**		
Urban/rural					0.987	0.320
Urban	68	49.6	80	55.6		
Rural	69	50.4	64	44.4		
Gender					1.421	0.233
Male	59	43.1	52	36.1		
Female	78	56.9	92	63.9		
Age group (yrs)					**10.108**	**0.018**
≤ 30	25	18.2	26	18.1		
31–40	21	15.3	41	28.5		
41–50	49	35.8	51	35.4		
≥ 51	42	30.7	26	18.1		
Education level					5.139	0.077
High school / technical secondary school or below	6	4.4	13	9.0		
Professional training college	27	19.7	17	11.8		
Bachelor degree or above	104	75.9	114	79.2		
Working years					7.175	0.067
≤ 10	36	26.3	47	32.6		
11–20	20	14.6	34	23.6		
21–30	47	34.3	37	25.7		
≥ 31	34	24.8	26	18.1		
Professional level					**18.513**	**0.001**
No title	12	8.8	17	11.8		
Junior	21	15.3	29	20.1		
Intermediate	25	18.2	46	31.9		
Associate senior	55	40.1	45	31.3		
Senior	24	17.5	7	4.9		
General practitioner license					1.751	0.186
Yes	103	75.2	98	68.1		
No	34	24.8	46	31.9		
Post					2.782	0.249
Clinical	104	75.9	100	69.4		
Chinese medicine	10	7.3	19	13.2		
Others	23	16.8	25	17.4		

Note: 95% CI: confidence interval. Levels that were statistically significant at 5% level were shown in bold

content of basic medical services. For PHC physicians in class 2, they had strong preferences for training time, training frequency and training duration. More detailed relative importance calculation results were shown in Supplementary Table S4 and Table S5.

As demonstrated in Table 5, PHC physicians of 51 years or above and with associate senior or higher professional levels were more likely to be assigned to class 1. In class 2, the proportion of PHC physicians under 40 years old and having the intermediate or lower professional levels was significantly larger than that of class 1.

Discussion

To the best of our knowledge, this current study might be the first one that used the DCE study design to elicit preferences for CME training programs among primary health care physicians in China. We found that PHC physicians considered training time, training frequency, training location, and the training content of basic public health services as the most important attributes of CME training programs.

PHC physicians inclined to choose CME training programs that held during working hours on weekdays, once a year and conducted locally. Previous research revealed that it was difficult for PHC physicians to balance their work with CME [58, 59]. CME scheduled after work or during holidays would interfered with personal life such as family obligations [60]. Inadequate time and feeling that the work was overloaded were major barriers to the implementation of CME in primary health care settings [17, 29]. In particular, one study showed that being too occupied was the main barrier to CME for general practitioners [61]. In order to reduce the contradiction between work and CME, the convenience for PHC physicians of arrangement should be emphasized in the design of CME activities to ensure it.

PHC services in China contain basic medical services and basic public health services. Our findings highlighted that PHC physicians valued training on public health services more than the medical services, especially the competence enhancement of health management of patients with multiple chronic disease, and we did not find preference heterogeneity for that level in the total sample. This may reflect on the increasing prevalence of multiple chronic diseases in China and the growing demand for managing multiple chronic diseases at the PHC level. With the aging of the population and the transformation of the disease spectrum, the prevalence of multiple chronic diseases increased from 34 to 43% in China between 2011 and 2015 [62, 63]. The Chinese Central Government launched the National Basic Public Health Services Project in 2009, which is funded by various levels of finance, contains services of health management for patients with hypertension and type II diabetes, with PHC physicians together with other health professionals in PHC facilities as the main provider. Compared with the single disease management mode, health management of patients with chronic comorbidities and the older adults in particular puts higher demands for the competence of prescribing and instructing on multiple medications on PHC physicians [64]. They do need to improve competence of multiple chronic diseases health management services. We did not find statistically significant evidence on the preference for the training content of basic medical services. It may indicate that providing public health services has becoming the principals task of PHC physicians.

Our latent class analysis confirmed the heterogeneity observed in the mixed logit model. Specifically, we identified that PHC physicians who were older and had higher professional levels showed preferences for CME training programs involving emergency response for critical & severe cases and health management of patients with multiple chronic diseases, and training held locally once a year. It may be that patients with multiple chronic diseases inclined to choose senior doctors for diagnosis and treatment [65]. The older PHC physicians are usually the backbone doctors of PHC facilities. Accordingly, they have heavier workload, which is also linked to their income. Frequent long-distance travels are bound to affect performance and income. The younger physicians with lower professional levels usually have wide range of contact with residents in the community and also shoulder heavy work burden [66]. They not only undertake health management of key populations such as chronic disease patients, pregnant women, and children under 7 years old, but attend outpatient clinics, instruct and supervise village doctors, and carry out health promotion for the general population as well. As a result, we found insignificantly differentiated preferences for CME training content among younger PHC physicians, and they were more concerned about whether the CME training programs take up the spare time.

CME is a mandatory requirement for professional title revalidation and successive registration in China, requiring health workers to participate in CME activities annually and earn at least 25 credits, equivalent to 90 h [10]. However, this incentive mechanism has led to challenges, as health professionals may focus on fulfilling credit requirements rather than actively engaging in learning knowledge and skills [67]. The findings of this current study confirmed this issue. Although the training content was aligned with the practical needs of PHC physicians, they placed greater importance on the efficiency of the training process over its content. Moreover, existing evaluations of CME training programs have largely concentrated on immediate improvements in knowledge and skills, with limited attention to their long-term impact on patient and community health outcomes [21]. In essence, the incentive mechanism may have fallen short of leveraging CME training programs to enhance population health outcomes. Instead, it might have added to the burden on PHC physicians, who to a certain degree value the ease of attending training over the programs' practical utility. Therefore, beyond simply mandating credit requirements for CME, revalidation criteria should be optimized to design CME training programs that align with the needs and preferences of PHC physicians, shifting the focus from credit quantity to service outcomes. Although the expenses for CME training programs are reimbursed by the facilities, participation in such programs may prevent PHC physicians from carrying out their routine work, which is a key component of performance evaluations tied to their income [42, 46, 47]. This misalignment between the incentive mechanisms and CME training policies creates a barrier to participation. To address this issue, performance evaluation metrics should include the immediate achievements of CME participation, outcomes in a longer time such as the mastery of training-related skills at the end of the year, and the impact on the health outcomes of served populations. More importantly, these metrics should compensate for the workload lost due to training participation. Future research and program development should focus on achieving tangible, long-term improvements in patient health, thereby aligning CME training programs with practical, outcome-oriented objectives.

Our findings have some implication on the design of CME training programs. With regards to the logistic arrangement of CME training, shortening duration of training sessions may motivate PHC physicians to attend the training programs. The convenience for PHC physicians to join in training programs should be emphasized. Training programs should be ensured with appropriate frequency, reasonable time, opportune duration, and convenient location. In addition, training programs should be tailored to different needs of PHC physicians with different age and professional levels, to motivate their participation in CME.

Limitations

This study had some limitations. First, we elicited the preferences for PHC physicians for CME training programs to inform the design of future training programs. However, given the hypothetical nature of DCEs, there may be disparities between revealed and stated preference [68]. Additionally, the inherent constraints DCE methodology meant that only a limited number of training content attributes and levels could be included in this current study. Further research should expand the range of CME training content considered and adopt complementary methods to analyze preferences for more diverse and specific training needs. Second, we used a DCE design without an 'opt-out' alternative, which indicated that we considered every PHC physicians as a 'demander' for the CME training programs. By using forced choices, we were not able to explore preferences and reasons for choosing the opt-out alternative. Third, when designing the DCE attributes and levels, we did not include "online training" in the training place attribute. In the interviews, the sampled general practitioners opted to register for offline programs. Such preference was attributed to the fact that most training programs were held online during the COVID-19 pandemic, but training on health management and rehabilitation services included practical operations. Therefore, the online format was dropped in this current study. Fourth, this study employed a multi-stage stratified sampling method to ensure data representativeness and implemented quality control measures, such as monitoring DCE task completion time and including repeated choice tasks, to verify the authenticity of responses. However, limitations remain regarding the randomness of online sampling. Future research will expand the survey scope and incorporate offline questionnaires to enhance sampling randomness. Besides, according to current policies, funding for CME is provided by the state, collectives, society, and individuals. However, in Jiangsu Province, most of the CME expenses incurred by PHC physicians are reimbursed by their facilities, meaning that individual physicians bear relatively little financial burden. Additionally, the cost of CME training programs varies significantly depending on their design and is influenced by multiple factors, making it difficult to accurately define a consistent monetary range. Considering these factors, the monetary value was not included as an attribute in this current study. Finally, the survey was conducted in Jiangsu Province – a relatively more developed region in China, thus our results may not be generalizable to other regions. Future research at the national level is needed.

Conclusions

This current study analyzed the preferences for CME training programs by investigating 360 PHC physicians in Jiangsu China. PHC physicians showed strong preference for training programs conducted less frequently (once a year or half a year), during working hours, at a local meeting place, and training on health management of patients with multiple chronic diseases. Our findings can be used to inform the design of CME training programs for PHC physicians.

Abbreviations

CME	Continue medical education
DCE	Discrete choice experiment
MIXL	Mixed logit model
LCM	Latent class model
RI	Relative importance
BIC	Bayesian information criterion
CAIC	Conditional akaike information criterion
LLR	Log-likelihood ratio

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-06828-1.

Supplementary Material 1

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Author contributions

SC led the data analysis, interpreted the results and drafted the manuscript. XJ and YH conducted data collection and contributed to data analysis. DQ contributed to results interpretation and commented on previous versions of the manuscript. XW conceived the study and commented on previous versions of the manuscript. TP contributed to analysis framework design and commented on previous versions of the manuscript. All authors have revised the manuscript and approved the final version.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
This study was reviewed and approved by the Medical Ethics Committee of Nanjing Medical University (NMU Ethical Review (2023) No. 556), and followed the ethical principles of the Declaration of Helsinki. The informed consent from each participant were obtained before the survey began.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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