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Research on continuing education for general practitioners in China over the past decade: a systematic review☆

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ABSTRACT

Background: With shifts in disease patterns and the implementation of tiered healthcare, general practitioners (GPs) play a vital role in disease diagnosis and management. The rapid advancement of medical knowledge and evolving health service demands necessitate continuing education for GPs to provide optimal clinical decision-making and disease management.

Objective: This study analyzes the development trends, training quality, and research quality of continuing medical education (CME) for GPs in China over the past decade (2013–2022).

Methods: In January 2023, eight databases (PubMed, Cochrane Library, Embase, CINAHL, ERIC, CNKI, Wanfang Data, and CBM) were searched for studies on CME for Chinese GPs, covering publications from January 2013 to December 2022. The Medical Education Research Study Quality Instrument (MERSQI) was used to systematically evaluate study quality.

Results: A total of 49 studies were analyzed, including 11 in English and 38 in Chinese. Training themes focused primarily on cardiovascular diseases (22.4 %), emergency care (6.1 %), and mental health (6.1 %). Most training was lecture-based (69.3 %), with only 6.1 % using skill-based formats and 4.0 % employing problem-based (PBL) or team-based (TBL) learning. Rigorous evaluation was lacking in most studies: 63.2 % (n = 31) used surveys to assess outcomes, with 19 lacking reliability and validity considerations. Study designs were predominantly single-group pre- and post-tests (53.1 %), with 26.5 % using randomized controls and only 4.1 % incorporating controlled pre- and post-test designs. Only 18.3 % (n = 9) reported ethical considerations; most studies (81.7 %) did not mention it. Assessment largely focused on knowledge and skill gains (85.7 %) with limited evaluation of behavioral changes (14.2 %) or benefits to patients and healthcare institutions (22.4 %).

Conclusion: Research on general practice CME in China over the past decade has been limited in scope but shows significant growth potential. Future CME efforts should broaden topic coverage, diversify instructional methods, use validated assessment tools, and prioritize training-induced behavioral changes and patient outcomes to improve the multidimensional quality of general practice education programs.

General practitioners (GPs) in China are central providers of community health services, covering a broad scope of prevention, primary care, rehabilitation, health education, and family planning. This comprehensive approach—known as the "six-in-one" model—positions GPs as vital gatekeepers of public health[1]. However, studies indicate that general practice training is still at an imperfect and exploratory stage in China, with the number of GPs unable to meet the healthcare needs of the population. Additionally, the challenges of limited primary healthcare resources remain unresolved[2]. Strengthening continuing medical education (CME) for GPs is essential for improving the quality of the primary care workforce and is a crucial component in advancing healthcare reform efforts across China.

In China, general practice education comprises three main forms[3]: (1)academic education, which includes undergraduate general practice stream (such as undergraduate general practice stream), as well as master's and doctoral programs; (2)postgraduate education, also known as standardized residency training and general practice vocational training; (3)CME, encompassing on-the-job (or retraining) programs and on-

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going CME courses. The China Education Modernization 2035 initiative underscores the importance of developing a cohesive, progressive training system across these three phases for qualified medical professionals[4]. Expanding CME in general practice is thus crucial for developing a skilled, competent general practice workforce capable of meeting the increased demands of primary care[5].

To provide optimal healthcare services, qualified GPs must continually update and expand their knowledge and skills, staying informed about the latest medical research and treatment practices. While academic and postgraduate education are fundamental, CME is equally essential to a general practice career development, serving as both a foundational support and a sustained motivation for professional growth[6]. Currently, research on CME for GPs in China is limited. This study aims to review the current status of CME training and research for Chinese GPs by reviewing relevant literature from both Chinese and international databases (2013–2022). The study also evaluates the quality of CME training and research to provide a valuable reference for future general practice educators and researchers in advancing training and research efforts.

Materials and Methods

Protocol Registration

The protocol for this systematic review was registered on April 13, 2023, with the International Platform of Registered Systematic Review and Meta-analysis Protocols (INPLASY), registration number INPLASY202340043.

Literature Search

Eight English and Chinese databases were used as data sources: PubMed, Cochrane Library, Embase, CINAHL, ERIC, CNKI, Wanfang Data, and CBM. Relevant studies on CME for GPs in China were retrieved, covering the period from January 2013 to December 2022. The search strategy incorporated both subject headings and free-text terms to ensure comprehensive results.

The English search terms included keywords and subject headings related to the following: (1) General Practice and Family Medicine: Terms such as "General Practice" and "Family Practice."; (2)GPs and family Doctors: Terms like "General Practitioner," "family doctor," "primary care physician," "health care providers," and "village doctor."; (3)Education: Terms including "education," "training," "curriculum," and "learning."(4)China: Terms such as "Chinese" and "China".

For the Chinese language article search, keywords and subject headings included: 全科医生+教育 (general practitioner + education), 全科医生+培训 (general practitioner + training), 全科医生+课程 (general practitioner + curriculum), 全科医生+教学 (general practitioner + teaching), 乡村医生+教育 (village doctor + education), 乡村医生+培训 (village doctor + training), 乡村医生+课程 (village doctor + curriculum), 乡村医生+教学 (village doctor + teaching), and 社区医生+教育 (community doctor + education), among others.

Inclusion and Exclusion Criteria

Inclusion criteria: (1)Studies focused specifically on GPs, family doctors, and/or primary care physicians; (2)Research using quantitative or mixed-methods designs for study or evaluation purposes; (3)Studies conducted within China; (4)Research focused on CME.

Exclusion Criteria: (1)Studies limited to other medical professionals (e.g., internal medicine physicians, pediatricians), general practice trainees, interns, medical students, pharmacists, nurses, or patients; (2)Articles or reviews that focus solely on describing course or program development without evaluation; (3)Systematic reviews, meta-analyses, descriptive reviews, letters, popular science articles, and publications with abstract-only availability.

Literature screening, data extraction, and quality assessment

EndNote X9 was used for literature screening. The process was conducted in two stages: initial screening and secondary screening.

During the initial screening, duplicate articles—defined as those with identical titles, authors, journals, and publication dates—were identified, retaining only one copy for the study. In this stage, two researchers independently reviewed the titles and abstracts to exclude studies that were clearly irrelevant to the research topic or met exclusion criteria. The researchers then cross-checked initial screening results, and any articles with disagreements were provisionally included. In the secondary screening stage, the two researchers read the full texts based on inclusion and exclusion criteria to determine final eligibility. If any disagreements arose at this stage, a third senior researcher was consulted for discussion and resolution.

Data were extracted from each included study covering the following categories: (1)Study details: Including the first author's name, publication year, study location, and journal; (2)Training information: Comprising the training topics, duration, number of participants, and format; (3)Research attributes: Including study type, methodology, and evaluation level.

Quality assessment of included studies

To achieve a precise evaluation of study quality, the Medical Education Research Study Quality Instrument (MERSQI) was used.

Developed in 2007, MERSQI assesses the methodological quality of experimental, quasi-experimental, and observational studies in medical education. This tool evaluates 10 items across six key domains, with a maximum score of 18 points. According to MERSQI standards, scores of 13–18 represent high quality, 7–12 indicate moderate quality, and scores ≤6 are classified as low quality. Research by Cook et al.[7] demonstrates that MERSQI provides strong inter-rater reliability, establishing it as a robust tool for evaluating the quality of research in medical education studies.

Statistical Analysis

Data from the included studies were entered and organized using Excel. Descriptive statistical analysis was conducted on the studies' thematic focus, literature sources, training content, research characteristics, and quality assessment. This analysis provided a comprehensive overview of the current research status on CME for GPs in China, highlighted prevalent research themes, and facilitated a quality evaluation of the literature.

Results

The initial search in January 2023 yielded 16,387 articles. After removing duplicates, 10,054 articles remained. Screening titles and abstracts according to inclusion and exclusion criteria resulted in 81 full-text articles published between 2013 and 2022. Following further review, 5 articles were identified as research proposals, 26 did not meet inclusion criteria, and 1 lacked specific data. Consequently, 49 articles were included in this study. The search process is detailed in Figure 1.

Sources and geographic distribution of included studies

All studies included in this review were conducted in China. 36.7 % of the studies were conducted in the east region of China (18 studies), primarily in Shanghai (7 studies) and Hangzhou (3 studies). Studies in the north region of China contributed 14.3 % of the included studies (7 studies), mostly concentrated in Beijing (6 studies), while the studies in south region of China represented another 14.3 % (7 studies). Studies in both the central and southwest regions of China accounted for 12.2 % each (6 studies), with one study spanning in the north, East, and Southwest regions. Additionally, studies from the northwest of China

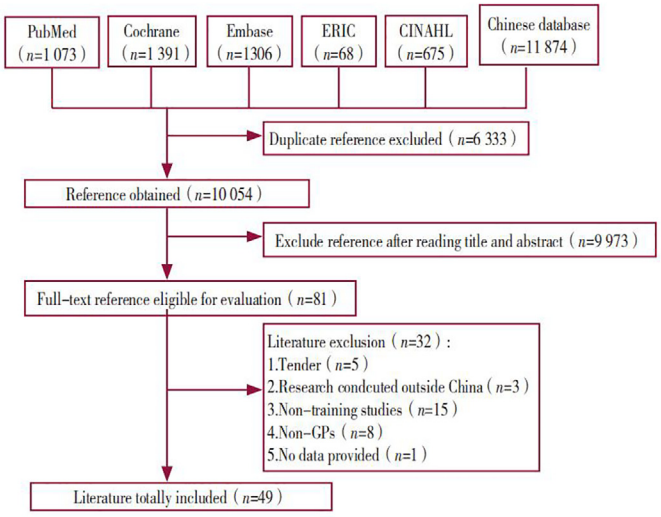

Fig. 1. Literature screening flowchart

Table 1
Continued education training topics of general practitioner

Research theme	Number of studies	Percentage (%)
Hypertension	5	10.0
Other cardiovascular diseases	4	8.0
Common chronic diseases in community	3	6.0
Mental health disorders	3	6.0
Emergency skills	3	6.0
Diabetes	3	6.0
Cerebrovascular diseases	2	4.0
Electronic health records	2	4.0
Evidence-based medicine	2	4.0
Vertigo	2	4.0
Faculty training	2	4.0
Medical consortiums-related	2	4.0
Other	16	33.0

constituted 8.1 % (4 studies), and the studies in northeast of China represented 4.1 % (2 studies). One study (2.0 %) did not specify its research location.

Of the 49 studies included, 11 were published in English, while 38 were in Chinese language. These studies were distributed across 42 journals, with 32 journals in Chinese. Among the Chinese journals, the highest publication frequencies were observed in the Community Health Management (6.1 %, 3/49), the Chinese General Practice (6.1 %, 3/49), the Health Vocational Education (4.1 %, 2/49), and the China Continuing Medical Education (4.1 %, 2/49).

Training-related results

(1)Training topics

Most studies (22.4 %) focused on cardiovascular and cerebrovascular health, with specific areas including cerebrovascular diseases (2 studies), hypertension (5 studies, 10.2 %), and other cardiovascular conditions (4 studies, 8.2 %). Additional training topics addressed chronic diseases commonly encountered in community health (3 studies, 6.1 %), mental health (3 studies, 6.1 %), skills of emergency medicine (3 studies, 6.1 %), and diabetes management (3 studies, 6.1 %). A detailed distribution of these topics is presented in Table 1.

(2)Duration of CME programs

Among the 49 studies, 59.2 % (29 studies) provided only general information on training duration. Calculating each training day as 8 hours, 20.4 % of studies (10 studies) reported training sessions lasting 3 days or less, 16.3 % (8 studies) described sessions lasting between 3 and 7 days, and 4.1 % (2 studies) included sessions extending beyond 7 days.

(3)Participants of CME programs

Of the 49 studies, 65.3 % (32 studies) involved GPs who working in community health centers, while 26.5 % (13 studies) were those practicing in rural primary health care facilities. In 14.3 % of the studies (7 studies), the participants' practice setting was not clearly specified.

(4)Strategies of CME programs

In 69.4 % of studies (34 studies), the main training method was expert-led lecture presentations. Other formats included clinical case studies (16.3 %, 8 studies), video presentations and workshops (12.2 %, 6 studies each), simulated patient interactions (10.2 %, 5 studies), expert advising (6.1 %, 3 studies), procedural skills training (6.1 %, 3 studies), and problem-based or team-based learning (PBL/TBL) methods (4.1 %, 2 studies).

As technology advanced, online training methods also emerged, accelerating due to the COVID-19 pandemic. Specifically, 8.2 % of studies (4 studies) were conducted fully online, while 26.5 % (13 studies) adopted a blended model (online and offline), with most of these studies conducted after 2019. Conversely, 22.4 % (11 studies) lacked specific information on training formats. In terms of instructional materials, only 30.6 % of studies (15 studies) explicitly mentioned preparing and using these, while the remaining 69.4 % (34 studies) did not specify their inclusion.

Quality of research on CME for GPs

(1)Study design

Among the 49 studies analyzed, the most frequent design was the single-group pre- and post-test, appearing in 26 studies (53.1 %). Randomized controlled trials (RCTs) with pre- and post-testing followed, used in 13 studies (26.5 %). Less common designs included RCTs with post-testing only (3 studies, 6.1 %), single-group post-tests (3 studies, 6.1 %), and controlled pre- and post-tests (2 studies, 4.1 %). Two studies (4.1 %) employed non-randomized controlled trials, while another two did not specify a research methodology.

(2)Evaluation levels

To categorize training assessment levels in the included studies, the Kirkpatrick Four-Level Modelwas applied, which is commonly used to evaluate training programs and consists of four levels: Reaction, Learning, Behavior, and Results[8]. Among the 49 studies, 11 (22.4 %) evaluated the reaction level of the training, 42 (85.7 %) assessed the learning level, only 7 (14.3 %) evaluated the behavior level, and 11 (22.4 %) assessed the results level.

(3)Evaluation methods and reporting on reliability/validity

Evaluation methods varied across the studies, with questionnaire surveys being the most commonly used approach (63.3 %, 31 studies), followed by written tests (34.7 %, 17 studies). Other assessment methods included skills exams (16.3 %, 8 studies), role-playing or scenario simulations (4.1 %, 2 studies), and oral exams (4.1 %, 2 studies). Direct observation, interviews or focus groups, and patient management were each employed in one study (2.0 %). Two studies (4.1 %) did not clearly specify their evaluation methods.

Among the 31 survey studies, only 2 (6.4 %) provided descriptions of both the reliability and validity of the questionnaires. Of these, one study reported content validity and internal consistency reliability, while the other utilized a standardized scale with previously validated reliability and validity; both studies were sourced from English-language databases. Four studies (12.9 %) reported reliability only, using Cronbach's α to reflect internal consistency reliability. Six studies (19.4 %) described validity alone, using expert evaluation or internationally recognized scales to establish content validity.

Ethical approval

Only 9 studies (18.4 %) among the included literature reported obtaining ethical approval, with 7 of these studies originating from

English-language databases and 2 from Chinese-language databases. The remainder did not mention ethical consideration.

Quality assessment

This study applied the Medical Education Research Study Quality Instrument (MERSQI) to calculate individual scores for each item, yielding an overall MERSQI score of 12.6 ± 1.5. Out of the total studies, 30 (58.8 %) were classified as having moderate quality scores, while 21 (41.1 %) were rated as high quality. No studies were found to have low quality scores.

Discussion

Developing CME is a critical component of the national medical education system, designed to train highly skilled medical professionals and improve the overall quality of healthcare. For GPs in China, substantial improvement is needed in both foundational medical knowledge and clinical expertise. According to the China Health Statistics Yearbook 2019, the educational level of personnel in primary care facilities remains low.

In 2017, only 30.8 % of healthcare staff in community health centers and 12.4 % in township health centers completed tertiary education, i.e., held a bachelor or higher degrees. By 2021, these percentages increased modestly to 33.8 % and 15.0 %, respectively, while personnel who hold higher degree consistently accounted for less than 2.0 % in these settings from 2017 to 2018[9]. Given the critical role GPs play—providing comprehensive, high-volume primary care across diverse communities—CME has become essential for enhancing the skills and knowledge base of the general practice workforce, which, in turn, strengthens primary care and improves public health outcomes. This study reviewed research from the past decade on CME for GPs in China. Findings reveal that this field is developing and that such continuing education programs can lead to moderate improvements in GPs' knowledge, skills, and clinical practices in specialized areas. However, the current scope of research remains limited, especially in comparison to more extensively studied areas such as 'standardized general practice training'. Additionally, evaluations of training effectiveness are typically restricted to basic knowledge and skill acquisition, with limited assessment of more comprehensive outcomes such as enhanced teamwork or broader improvements in healthcare delivery. As a result, CME's contribution to advancing the general practice workforce and strengthening primary care remains constrained.

Limited and uneven distribution of research on CME for GPs

In the past decade (2013–2022), only 49 studies on CME for GPs in China were identified. A 2020 review on standardized general practice training in China reported 86 publications between 2013 and 2018 alone, indicating a greater focus on this area following the State Council's 2011 "Guiding Opinions on Establishing a General Practitioner System"[10]. Consequently, studies on standardized general practice training have generated substantial findings, whereas CME research remains less developed. In their analysis, Jin Hua et al.[11] observed that general practice education has not yet become a widely researched topic within the field. They pointed to a limited number of publications and insufficient impact, calling for further exploration and synthesis in this area.

In a systematic review of family medicine education from 2002 to 2012, Webster et al.[12] included 624 studies, 259 of which (41.5 %) focused specifically on CME, reflecting its significance as a global priority in family medicine. This contrast with the limited research on CME for GPs in China underscores the development gap and the potential for growth in this field within the country. In China, CME research is geographically concentrated, primarily in eastern regions such as Shanghai and Hangzhou, followed by Beijing and the southern provinces. By 2020, the total number of GPs in eastern cities—including Beijing, Shanghai, and Hangzhou—accounted for 50.84 % of China's general practice workforce, a proportion significantly higher than in central and western regions[13]. This regional concentration of both research and general practice training initiatives suggests that areas with more active CME development also demonstrate stronger workforce support.

Limited topics and methods in CME for GPs and need for improved training outcomes in China

This study reveals that chronic disease management, particularly hypertension, diabetes, and cardiovascular disease, is a primary focus in CME for GPs in China. These conditions significantly impact the health of older adults in China[14], and improving GPs' competencies in these areas is essential for enhancing primary care quality. Enhancing general practice proficiency in chronic disease management could thus improve primary care quality. However, CME in Australia, as reviewed by Bernardes et al.[15], presents a more diverse training range, covering mental health, dementia, adolescent health, and pediatric asthma, suggesting a broader thematic approach than is observed in China. Moreover, qualitative studies by You Conglei[6] and Shi Dandan[16] indicate a notable mismatch between CME content and the practical needs of GPs in China. These studies identify challenges such as community-based GPs lacking access to the patient cases or resources required to apply training content, which limits the practical relevance and applicability of training in real-world settings.

This study finds that CME programs in China primarily target GPs in urban primary care facilities, with limited access for township and village doctors. This discrepancy may stem from several challenges commonly faced in rural primary care facilities, including geographical isolation, resource limitations, lower income, and weaker motivation and incentives for professional development. Additionally, expert-led lectures constitute the dominant training format in CME (69.4 %), with other methods—such as case discussions, video learning, workshops, and patient simulations—used relatively less frequently. These findings align with the results reported by Yang Huimin et al.[17] who also noted that nearly two-thirds of CME programs do not mention providing or utilizing training materials.

The 'Cone of Learning', proposed by Edgar Dale in 1946[18], suggests that knowledge retention rates vary significantly with different learning methods, with teaching others and practical applications proving most effective, while lectures and reading yield the lowest retention. This indicates that lecture-based training alone may not effectively enhance skills and knowledge retention. Consistent with this, Bernardes et al.[15] found in their review of CME for GPs in Australia that integrating training materials with interactive workshops achieved better outcomes.

In China, however, CME research often emphasizes improvements in general practice knowledge, skills, and attitudes without exploring deeper impacts on practice behaviors, organizational benefits, or patient outcomes. Of the studies examined, only 14.3 % assessed behavior changes post-training, and 22.4 % evaluated outcome-level impacts, findings that align with Yardley et al.'s review of similar trends in medical education interventions[8]. Effective CME, akin to undergraduate and standardized general practice training, should emphasize outcomes that reach higher levels in Kirkpatrick's Four-Level Evaluation Model—particularly behavior and results[8]. Attaining these levels demands specialized expertise and resources that often surpass the capabilities of most CME providers[19]. Consequently, it is advisable for researchers to evaluate CME effectiveness in terms of clinical practice outcomes and patient benefits. This approach would better support the advancement of medical education for GPs.

General low quality in CME for GPs research

This review reveals that most studies on continuing education (CME) for GPs in China predominantly utilize single-group pre-post designs without control groups. This trend aligns with findings from broader reviews of medical education research[12]. Single-group pre-post designs

are often favored for their simplicity, low cost, and ease of execution, which allow for straightforward assessments of post-training effects. However, such designs carry inherent limitations, as outcomes can be influenced by external factors like natural maturation or non-training-related influences[20]. RCTs, which incorporate pre-assessment to minimize confounding variables and baseline discrepancies, are widely regarded as the "gold standard" for intervention studies. However, due to the complexity, expense, and logistical challenges associated with RCTs—such as high dropout rates, low compliance, and quality control issues—this method remains underutilized in educational research[21].

In terms of evaluation tools, questionnaires were the most widely used method in 63.3 % of the studies. However, more objective assessments, such as skill tests or role-playing exercises, were far less common, and most studies relied on self-developed questionnaires with minimal reliability or validity testing—only 6.1 % of the studies (2 total) included any description of these aspects. As surveys are inherently subjective, they are susceptible to biases, including the Hawthorne effect, where participants alter their behavior due to being observed. Reliability and validity testing of survey instruments is crucial as it directly impacts the credibility of findings in educational research[22]. Future research should prioritize validated survey instruments or objective assessments to enhance the accuracy, validity, and scientific rigor of study outcomes[23].

In the field of medical education research, specific ethical considerations—such as informed consent, regulatory oversight, data quality, and the dual-purpose nature of education and research—necessitate careful ethical considerations[24]. However, only 18.4 % of the included studies had obtained ethical approval, indicating insufficient attention to ethics in Chinese educational research. This is an area that has similarly been overlooked in international general practice and educational research, underlining the need for greater ethical oversight in future studies[25]. The quality assessment conducted using the MERSQI revealed significant areas for improvement, particularly in research design rigor, the reliability and validity of evaluation tools, and the levels of outcome assessment beyond immediate knowledge or skill gains[26]. These three aspects are crucial for ensuring scientific rigor in educational research and underscore the importance of strengthening methodological quality in future CME for GPs.

Conclusion

While the past decade has seen increased attention to general practice education in China, CME for GPs remains a secondary research focus. CME development and advancement face multiple challenges, including limited thematic coverage, reliance on traditional lecture-based formats, inadequate evaluation methods and tools, low assessment levels, and overall poor research quality. To better support the specific needs of healthcare system in China, general practice educators are encouraged to further explore training methods and frameworks tailored to national requirements. It is essential to clearly identify learners' needs, broaden CME topics, and ensure a balanced development across different regions. Enhancing general practice interactions nationwide and utilizing scientifically validated evaluation tools along with diverse training formats could improve CME outcomes. This approach would facilitate more substantial behavior change among GPs and enhance patient outcomes, advancing the overall quality of CME for GPs in multiple dimensions.

Limitations

Due to resource and personnel constraints, this study focused only on research from the past decade on CME for GPs in China. Grey literature was not included, nor were earlier research trends analyzed. Nonetheless, this review provides a meaningful snapshot of recent trends and the current state of GP CME. The quality assessment of the included studies also serves as a solid foundation for future research in this area, which can build upon these findings to conduct more extensive and comprehensive investigations.

Declarations

Not applicable.

Authors' contributions

Conceptualization, L.X. and Z.C.; Methodology, L.X. and Z.C.; Data curation, H.S., W.T., L.Y. and W.F.; Formal analysis, H.S., W.T., L.Y. and W.F.; Funding acquisition, not applicable; Project administration, not applicable; Resources, not applicable; Supervision, Z.X. and L.X.; Validation, Z.X. and L.X.; Writing—original draft, H.S.; Writing—review and editing, M.B., L.X. and Z.C. All authors have read and agreed to the published version of the manuscript.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

Not applicable.

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Competing interests

All authors declare that there are no competing interests.

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