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Systematic Review

Conducting educational intervention research in general practice: From design to publication

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ABSTRACT

With the ongoing development of primary care in China, nearly 400,000 general practitioners (GPs) are expected to be trained over the next decade. The training of competent GPs is of vital importance, which requires GP educators to explore evidence-based educational concepts, methods, and curricula tailored to the Chinese context. At present in China, the quality of GP educational intervention studies in general practice is relatively poor. and most faculty and researchers in GP lack relevant training in this area. The aim of this paper is to outline the process of conducting educational intervention research in general practice from design to publication, comprising four stages with 13 steps:constructing research questions (generating research inspiration, literature review, incorporating a theoretical/conceptual framework, refining research questions), research design (trial design, intervention, outcome evaluation) , research implementation (establishing a research team, obtaining research resources, applying for ethical approval, program execution), and publication and evaluation (article writing, reflection and evaluation). This paper provides research methods and ideas for educational researchers and practitioners in GP to conduct educational intervention studies, which will contribute to the generation of high-quality educational research "evidence", further improvement of the quality of GP educational, and the training of competent general practitioners.

Primary care system and tiered diagnosis and treatment model are key priorities for health care reform and development in China. In this context, training competent general practitioners (GPs) is of critical importance. In 2018, the General Office of the State Council issued the "Opinions on Reforming and Improving the Training and Incentive Mechanisms for General Practitioners", which set a goal of achieving five qualified GPs per 10,000 urban and rural residents by 2030, meaning that an additional 400,000 GPs will be trained over the next decade in China[1]. Medical education and training are culturally sensitive. However,due to the short development history of general practice in China, its education and training systems, concepts, and methods have been largely adapted from other countries. Giving unique health service system and cultural traditions, the effectiveness and suitability of such training remain uncertain.

With the shift from theory-based teaching to evidence-based teaching, educational practice should consider evidence level of training methods to ensure "best evidence" of medical education[2]. Educational intervention research provides reliable guidance for teaching practice, which refers to purposeful, planned, and targeted implementation of new training programs, curricular models, or instructional strategies aimed at reforming outdated educational systems or practices and enhancing teaching effectiveness[3]. The development of GP education and training highlights the urgent need to draw on international training experience and conduct high-quality educational intervention research

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in China to generate more robust evidence for practice. However, many researchers still regard medical educational research as a "soft science", leading to insufficient rigor and methodological robustness in study design. A systematic review reported that many studies were of low quality, characterized by unclear methodology, absence of control groups, and lack of ethics approval[4]. Similarly, a scoping review of GP education research revealed widespread methodological deficiency: 23 % of quantitative studies used pre- and post-test designs, nearly half relied mainly on questionnaires for data collection, and only 10 % employed randomized controlled trials (RCTs)[5]. Such design limitations undermine research validity and hinder the broader dissemination of educational innovations.

Drawing on methodological literature from educational intervention research[6–10] and practical experience in GP education and training, this paper outlines the process of conducting educational intervention research from design to publication, which consists of four stages with 13 steps, aims to provide GP educators and researchers with methodological guidance and practical strategies to support the development of high-quality educational intervention studies.

Stage 1: constructing research questions

Step 1: Generating research inspiration

Generating research inspiration is the first step in formulating research questions.

Researchers in GP education often draw inspiration from literature and academic conferences[6], whereas for educators, the most important source is practical experiences[7, 11]. GP educators frequently face clinical challenges and teaching dilemmas, and may adopt new concepts and methods– such as narrative medicine, shared decision-making, and scenario-based learning – all of which can inform research directions.

Step 2: Literature review

After generating inspiration, a literature review helps researchers develop a comprehensive and clear understanding of research of the field, identify evidence gaps, and avoid unnecessary duplication of prior work. In addition, researchers can learn from the experiences of other scholars in study design, intervention methods, evaluation tools, and data analysis strategies[8] thereby informing the development of their own research plan based on review and comparison.

Step 3: Incorporating a theoretical/conceptual framework

A theoretical or conceptual framework can be described as “a way of thinking about or studying a problem, or a method for representing complex relationships among phenomena”, including educational theories (e.g., deliberate practice), models (e.g., Kolb’s learning cycle), or practice principles developed through observation or empirical research[12].

Such a framework highlights a specific aspect of the research question and offers a partial representation of reality. For example, in a study aiming to improve GP’ communication skills, cognitive-behavioral theory focuses on psychological strategies and performance evaluation, constructivism emphasizes the processes through which knowledge and skills are acquired, social learning theory highlights interactions between teachers and learners or among learners themselves[13]. Incorporating a theoretical or conceptual framework helps clarify the problem, guide the development of solutions or interventions, and enables readers to quickly grasp the study’s foundation and assumptions, thereby facilitating application of findings[9]. Unfortunately, many prior studies are limited in rigor and generalizability due to the absence of a theoretical or conceptual framework[14].

A Theoretical or conceptual framework can be used alone or in combination, with the latter often resulting in more effective interventions. This paper highlights three examples of theoretical/conceptual frameworks commonly used in GP educational research, providing illustrative examples for researchers[15–17] (see Table 1).

Researchers should conduct a systematic review of the literature before selecting an appropriate theoretical or conceptual framework. Additionally, the textbook Introduction to Medical Education Research[18] offers a detailed discussion of commonly used theories and models, and is highly recommended for further reading.

Step 4: Refining research questions

Transforming research inspiration into a clear and focused research question can be challenging. One useful strategy is to apply the PICOT framework, commonly used in evidence-based medicine, to help GP researchers formulate more precise questions. PICOT stands for population, intervention group, control group, outcomes and time[19]. Additionally, the FINER criteria are often used to assess research question, emphasizing that they should be feasible, interesting, novel, ethical and relevant[20].

Stage 2: Research design

Step 5: Study design

Once the research question is established, it is essential to select an appropriate study design to evaluate the effectiveness of the educational intervention. Common study designs in GP education include single-group post-test, single-group pre-test/post-test, non-randomized controlled pre-test/post-test, randomized controlled post-test and randomized controlled pre-test/post-test. Educational research should adhere to the same rigorous scientific standards as clinical research, while also considering the strengths and limitations of each design within the educational context. The choice of design should align with the research question, study population, and available resources(Table 2)[21–25].

Step 6: Intervention

For example, in studies focusing on communication training for health professionals managing hypertension, variations in the content, teaching strategies, and duration have contributed to the heterogeneity in the effectiveness of such educational interventions on blood pressure outcomes[26]. An educational intervention should specify multiple educational related factors, including learning objectives, teacher qualifications, number and baseline knowledge of participants, teaching strategies, training schedule, course materials, training environment, incentives for participation and evaluation methods. The GREET checklist(Guideline for Reporting Evidence-based Educational Interventions and Teaching),includes 3 sections and 17 criteria, providing a comprehensive framework for describing interventions in medical education[27].

Step 7: Outcome evaluation

Researchers should select appropriate outcome measures to assess the effectiveness of intervention. Compared to other educational evaluation models, Kirkpatrick’s four-level model is most widely used frameword in educational research and has been adopted by the Best Evidence Medical Education (BEME) Collaboration as the standard for grading evidence for different educational approaches[28–29]. Kirkpatrick’s model not only evaluates learner satisfaction, knowledge acquisition, and skills improvement, but also examines how training influences workplace behavior and patient health outcomes. The four levels[30] are: Reaction(learner satisfaction), Learning(changes in attitudes, knowledge, and skills), Behavior(changes in workplace behaviors) and Results(impact on patient outcomes). A review found that 24 % of studies reported outcomes at level 1, 64 % at level 2, and only 12 % at levels 3 or 4[28]. However, the design of an educational study should not simply pursue higher-level outcomes, but should balance research aims with and available resources.

Selecting the appropriate evaluation level requires identifying suitable assessment methods and instruments. For example, questionnaires can assess learner satisfaction, knowledge tests measure acquisition, standardized patients evaluate skill, and medical record audits assess behavior change (Table 3). Each outcome level requires specific methods, even same method may requires different instruments. For instance, changes in GPs’ communication behaviors can be assessed using self-report, direct observation, video recording, or anonymous standardized. Direct observation may employ instruments such as custom checklists or standardized tools like the SEGUE Framework[31]. Professor Cook recommends first determining the evaluation level, then selecting the method and instrument[32]. Every evaluation method has its own strengths and

Table 1
Examples of theoretical/conceptual frameworks of educational intervention studies in general practice.

Theoretical/Conceptual framework	Theory description	Application in general practice
Reflective learning	Reflective learning enhances learning outcomes by encouraging learners to reflect on their learning activities. Reflection involves a process of re-examining one's own thinking processes and outcomes to gain deeper understanding.	Shaughnessy et al.[15] integrated an ongoing reflective exercise into the curriculum of a family medicine residency program. Residents engaged in reflective writing on their clinical practice three times a week. Qualitative research was conducted via focus groups to enhance the residents' self-development capabilities.
Community of practice	A community of practice consists knowledge, community, and practice. Members share common beliefs and understandings, communicate and collaborate, and through mutual engagement, exchange resources, help each other, and apply acquired knowledge in practice.	Malaty et al.[16] formed clinical practice teams among family medicine residents to help them learn clinical management and use patient data to improve care quality. Researchers provided regular practice management data to the teams and conducted quarterly educational seminars. These seminars, led by medical directors and resident supervisors, taught ways to improve clinical indicators through institutional processes. Learners' knowledge and competencies were comprehensively evaluated.
Adult learning	Adult learning posits that adults are self-directed, draw on prior experience, prefer problem-centered tasks with immediate applicability, and are intrinsically motivated.	Guided by adult learning theory, the University of Alberta in Canada developed a two-year family medicine residency program. The rotation curriculum covered 23 core family medicine topics. Learning activities included problem-based learning modules, journal clubs, and exam preparation sessions. The entire training program was assessed using multi-source evaluation methods[17].

Table 2
Advantages and disadvantages and application examples of five types of design in educational intervention research in general practice.

Design type	Diagram	Advantages	Disadvantages	Example research question	Example study design
Single-group post-test	X—O_1	Simple, cost-effective, and easy to implement; facilitates rapid formative feedback	No baseline; susceptible to maturation/history effects; cannot attribute change to the intervention	Does workshop-based teaching improve GPs' overall competence?[21]	Participants: GPs in transition training. Intervention: Workshop-based teaching including outpatient practice, case discussions, and bedside teaching. Evaluation: post-training survey measuring perceived effectiveness.
Single-group pre-test/post-test	O_1—X—O_2	Moderately complex and economical; no control group needed; shows pre- and post-intervention changes	Effects may stem from external factors or natural maturation; participants may learn from repeated testing	Is training at community-based evaluation centers effective for GPs?[22]	Participants: 30 GPs from community health centers. Intervention: Training at community-based evaluation centers covering theory, skills, physical exams, and communication. Evaluation: Comparison of GP competencies before and after intervention.
Post-test control group	E:O_1—X—O_2 C:O_1——O_2	Controls for measurement-related confounding factors; reduces learning from pre-tests; more feasible than RCTs	Complex, requires significant resources; baseline differences between the two groups are difficult to align	Does dementia training improve attitudes and confidence of GP residents? [23]	Participants: 332 GP residents. Intervention: A 3-hour face-to-face workshop on dementia. Evaluation: post-intervention scales of confidence and attitudes.
Randomized post-test control group	R E: X—O_1 C: —O_1	Control for confounding variables; requires fewer resources and allows for randomization	Cannot estimate within-person change; may requires a large sample size, and baseline differences between the two groups are difficult to align	Can brief non-verbal communication training for GPs improve patient satisfaction?[24]	Participants: 16 GPs randomly assigned to the intervention group and the control group. Intervention: Brief non-verbal communication training, followed by watching and reflecting on their own consultation videos. Evaluation: Patients complete a medical interview satisfaction scale after the intervention.
Randomized pre-test/post-test control group	R E: O_1—X—O_2 C: O_1——O_2	High external validity; minimize baseline differences; control for confounding variables	Complex and costly; often requires large sample and multi-center implementation	Is learner-centered communication training more effective than traditional methods? [25]	Participants: 100 Dutch GPs randomly assigned to groups. Intervention: Video feedback on communication deficiencies. Evaluation: pre/post assessment of consultation communication skills via video review

Notes: E represents the experimental group, C represents the control group, R represents the randomized trial design, X represents the intervention, O1 represents the first measurement, and O2 represents the second measurement.

limitations, instruments differ in their reliability and validity[33]. Researchers should prioritize validated instruments with high reliability; if unavailable, existing tools may be adapted or new ones developed. In either case, a pilot study is recommended to validate instuments and identify potential issues in the data collection[32].

Table 4

Stage 3: Research implementation

Step 8: Establishing a research team

A well-structured research team should ideally consist of two main categories of members:

Project implementers, responsible for conducting educational evaluations, delivering interventions, and collecting data, may include colleagues at a similar career stage, as well as junior physicians, residents, or students. (2)Expert advisors, such as senior educational researchers, statistical experts, or experienced educators. They may not be familiar with the clinical research context, their extensive knowledge of educa-

Table 3
The four levels of evaluation with corresponding application examples in Kirkpatrick's Model.

Level	Evaluation Type	Description	Common evaluation methods	Example: GP training on colorectal cancer (CRC) screening
Level 1	Reaction	Learners' reactions to the training: engagement, satisfaction, acceptability, and perceived usefulness	-Learner questionnaires -semi-structured interviews	GPs' satisfaction and perceived usefulness of the course on "Implementing CRC screening in general practice",assessed via post-course questionnaires.
Level 2	Learning	Learners' gains:: knowledge, skills, attitudes, confidence, and willingness	-Knowledge tests -Standardized patients -validated scales/questionnaires	1. Knowledge test: Assesses GPs'CRC knowledge 2. Standardized patient: evaluate communication and shared decision-making 3. Scales: Measures attitudes and willingness to screen.
Level 3	Behavior	Behavior changes in clinical practice following training	- Direct observation or video review -Anonymous standardized patient - Medical record audits	1.Video review of consultations to assess CRC screening behaviors 2.Medical record audits: Checks whether eligible patients received CRC screening
Level 4	Result	Organizational impact or patient outcomes attributable to training	-Patient surveys -clinical indicators -Institutional reports	1.Clinic CRC screenings one month post-training 2.NCRC diagnoses within one year; 3.Community CRC mortality within one year post-training

Table 4
Summary of reporting Guidelines for educational intervention studies.

Name	Publication year	Author(s)	Study type	Summary of reporting content
BMJ Guidelines	1999	Luisa et al[39].	educational intervention study	Comprises four sections (overview, theoretical considerations, training description and design, discussion) and 18 items.
Cook Key Elements of Reporting	2007	Cook et al[4].	educational intervention study	Specifies key reporting elements:literature review, conceptual framework, study intent, research design, intervention/control groups, and ethics.
GREET	2014	Phillips et al[40].	educational intervention study	Identifies 39 items for describing educational interventions for evidence-based practice; provides detailed information solely for describing the intervention; to be used in conjunction with design-specific reporting guidelines.
Recommendations for Reporting Mastery Education Research in Medicine	2015	Cohen et al[49].	Mastery learning research	Includes 22 categories and 38 core items, organized into six sections: Title & Abstract, Introduction, Methods, Results, Discussion, and Other Information.
the Improvement of the GREET	2019	Meinema et al[22].	educational intervention study	Identifies additional items beyond GREET, adding learning needs, intervention development process, context/environment, participants, evaluation, and satisfaction.

tional theory and research methodology enables them to provide invaluable guidance for educational research project[7].

Step 9: Securing research resources

The research team must assess and securing necessary resources to support the educational intervention. First, engage institutional stakeholders to understand the potential value of project and secure access for researchers to essential resources, such as participants, facilities, and equipment needed for the intervention. Second, ensure that research is embedded within existing GP courses educational or training programs to minimize additional resource demands. Third, leverage institutional resources for pilot studies, and use the findings to strengthen applications for external funding. Currently, many municipal or provincial health commissions and GP associations provide funding opportunities, including national-level initiatives jointly launched by the National Medical Education Steering Committee and the Chinese Medical Doctor Association[34].

Step 10: Applying for ethical approval

Medical education research requires protecting participants' autonomy, minimizing risk, and promoting justice while ensuring authenticity and validity. Ethical approval from an institutional review board (IRB) or ethics committee is essential before a study begins. Some studies may qualify for ethics review exemption, but this determination must made by the ethics committee rather than the researcher. Most leading journals require formal ethics approval prior to publication, reflecting stricter standards[35]. Researchers can take various steps during study design to minimize ethical risks, such as informed consent from, anonymous or coded data, crossover study designs. Twelve practical tips and common pitfallspublished in prior work provide useful guidance for researchers[36-37].

Step 11: Program execution

High-quality educational research requires both rigorous design and pragmatic execution. At the start of implementation, the investigator must shift roles–from researcher to project manager. Project manager should develop a detailed timeline(a Gantt chart is recommended) that specifies task start, end dates and realistic milestone. In addition, a regular schedule of team meeting (e.g., weekly) is essential to address challenges through brainstorming and discussions. For novice researchers, it is advisable to gain basic knowledge of project management beforehand to ensure successful implementation[38].

Stage 4: Publication and Evaluation

Step 12: Manuscript writing

Successfully publishing an educational intervention study not only advances the a researcher's academic career and scholarly influence, but also facilitates the translation and promotion of interventions, providing guidance for others. However, the reporting quality of medical education intervention studies remains suboptimal, often lacking essential methodological elements[4].

A systematic review involving 105 studies reported that 52.4 % failed to report a theoretical framework, and 43.8 % did not specify training objectives, with the average reporting quality score of 15.9/32 . These findings underscore the importance of adhering to internationally recognized reporting guidelines.

Current guidelines include the BMJ guideline for reporting educational interventions[39], Cook's list of key reporting elements[4], The

Table 5
Major Chinese and English journals for publishing educational studies in general practice.

Rank	Chinese Journal	Proportion (%)	Category	English Journal	Proportion (%)	Category
1	Chinese General Practice	8.11	General Practice	Education for primary care	17.89	General Practice
2	Continuing Medical Education	3.95	Education	BMC medical education	5.99	Education
3	Chinese Journal of General Practice	3.17	General Practice	The British journal of general practice	5.99	General Practice
4	Health Vocational Education	2.77	Education	Australian family physician	5.17	General Practice
5	China Higher Medical Education	2.56	Education	The medical journal of Austrilia	2.89	Comprehensive

Notes: The retrieval period is from January 1, 2010, to June 30, 2022. The databases searched include CNKI (Chinese) and PubMed (English). The Chinese search strategy is: (标题=全科) OR (标
题=社区医生) OR (标题=全科规范化)OR (标题=家庭医生)OR (标题=乡村医生)和(标题=教育) OR (标题=培训) OR (标题=课程)OR (标题=教学)
The English search strategy is: (((((education [Title])) OR (curriculum [Title])) OR (teaching [Title])) OR (training [Title])) OR (course [Title]) AND ((((((family physician [Title])) OR (general practitioner [Title])) OR (family practice [Title])) OR (general practice [Title])) OR (primary care physician [Title])) OR (GP residents [Title]).

Table 6
Quality evaluation tools for educational intervention research.

Quality assessment tool	Author(s) & publication year	Publication Year	Assessment content	Suitable study types
Medical Education Research Study Quality Instrument (MERSQI)	REED et al[50].	2007	Study design, sample, data types, validity of assessment instrument, data analysis, outcomes	Experimental, quasi-experimental, observational studies
Best Evidence in Medical Education (BEME)	LITTLEWOOD[51]	2005	Evaluates results and conclusions using Kirkpatrick-based outcomes,categorized evidence into 6 levels	educational studies in clinical or community settings
Newcastle-Ottawa Scale for Education Literature (NOS-E)	COOK[52]	2008	Assesses sample selections/ representativeness, comparability, study design, and outcome assessment.	Non-randomized controlled trials, cohort studies, internet-based intervention studies
Academic Emergency Medicine Education Research Score (AEM)	FARRELL[53]	2011	Introduction, measurement, data collection, data analysis, discussion, limitations, innovation, generalizability, clarity of writing	Quantitative research emphasizing hypothesis testing and measurement in emergency medicine educational interventions

GREET framework[27, 40]. These guidelines provide structured instructions, helping GP researchers save time, avoid common pitfalls, and improve reporting quality. When selecting a journal, authors may consider general practice or medical education journals. in either Chinese or English. We provide a list of the top five Chinese and English journals that pubilish GP education research based on CNKI and PubMed (Table 5).

Step 13: Reflection and Evaluation

Despite careful design, practical constraints and limited resources often pose challenges in implementation. For example, limited sample representativeness, incomplete reporting, and inadequate data can reduce study quality, introduce bias, and limit scientific value[41], This highlights the necessity of critical reflection to guide future research. Systematic evaluation criteria includes sample representativeness, clariity of intervention descriptions, bias control, outcome assessment and reporting method[42]. Many published appraisal tools are available and applicable to medical education research. These tools differ in focus depending on their specific criteria and intended application (Table 6). These tools vary in focus but provide a framework for planning, implementing, analyzing, and reporting educational research. They also offer standardized criteria for journal reviewers, peer reviewers, and readers[43].

Discussion

In the context of China's health care system and broader social environment, GP training faces emerging challenges that require rigorous and effective approaches. We provide GP educators a comprehensive, step-by-step guide aimed at informing educational practice, enhancing research rigor, and encouraging publication of innovative practices in academic journals, enabling wider dissemination of findings.

For GP educators conducting research, it is essential to understand the curricula design, including needs assessment, learning objectives, teaching content, instructional strategies, implementation and evaluation. For further guidance, educators may refer to the work of Schneiderhan et al.[44] and the textbook Curriculum Development for Medical Education: A Six-Step Approach[45]. Integrating these steps can transform teaching projects into educational research initiatives[46]. Novice researchers are advised to collaborate with experienced GP educators and researchers, both within and outside their institutions, to accumulate experience and ensures innovative and rigorous research. When resources are limited, it is advisable to conduct research within existing GP training programs to enhance feasibility.

Due to space limitations, this paper does not provide an in-depth discussion of all procedures, such as sample size estimation, data collection, and statistical analysis[8]. Readers are encouraged to consult the cited references for each step in this paper for further study, as well as recommended textbooks such as Introduction to Medical Education Research[18] and Educational Research: Quantitative, Qualitative, and Mixed Approaches[47] . Additionally, open-access online courses are available through Chinese University MOOC platforms, including Educational Research Methods offered by Southwest University and Zhejiang University[48]. Although methods, textbooks, and courses provide a solid foundation for educational intervention research, the most effective strategy for mastering educational intervention research is through continuous practice and reflection. It is also important to recognize that educational intervention research has limitations and cannot address all types of research questions. For example, surveys are more appropriate for descriptive questions, while qualitative research is better suited for exploratory questions. Researchers should therefore select methods aligned with their specific research question[10]. Furthermore, well-designed educational intervention research may achieves high internal validity, but the generalizability is often constrained by contextual factors such as characteristics of learner, educato, and cultural characteristics. This highlights the importance of integrating a theoretical framework to enhance applicability of findings.

GP educators bear a dual responsibility: (1)Ensuring GP trainees' satisfaction and skills development; (2)Improving the effectiveness of education and training to enhance patient outcomes, which is the fundamental purpose of GP education and training. We hope that the meth-

ods and steps presented in this paper—including constructing research questions, designing experimental methods and outcome evaluations, and utilizing reporting guidelines and quality appraisal tools for educational research—will enable GP educators to conduct educational intervention research in a scientific, standardized, and effective manner. In doing so, they can play a critical role in bridging the gap between theory and practice in GP education and training.

Competing interest

Competing interests:Z.C. is the editorial member of Chinese General Practice Journal, he is not envolved in the editorial review or the decision to publish this article. All authors declare that there are no competing interests.

Declarations

Not applicable.

Authors' contributions

Conceptualization, Z.C., Z.X. and L.K.; Data curation, not applicable; Methodology, O.JM and Z.X.; Data curation, not applicable; Formal analysis, not applicable; Funding acquisition, Z.C., Z.X. and L.K.; Project administration, Z.X., P. T, T.HX.and X.CY; Resources, not applicable; Supervision, Z.C. C.QQ. and L.K.; Validation, Z.C. C.QQ. and L.K.; Writing—original draft, O.J., P.T., Z.Y., X.CY. and T.HX.; Writing—review and editing, Z.C. and L.K. All authors have read and agreed to the published version of the manuscript.

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