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Review

Identifying Meaningful Research Gaps in Health Care: A Narrative Review and Practical Framework

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A B S T R A C T

Background: Identifying meaningful research gaps is essential for producing studies that advance knowledge, inform clinical and educational decisions and avoid unnecessary duplication. However, early-career investigators may equate a research gap with an entirely unstudied topic rather than with consequential uncertainty within an existing evidence base.

Purpose: To synthesize practical and conceptual approaches to identifying, evaluating and prioritizing research gaps in clinical research and health professions education.

Methods: This narrative review synthesizes the literature on evidence synthesis, research prioritization, critical appraisal, research design and health professions education. The review outlines a practical process for moving from a broad topic to a focused research question.

Results: Important research gaps may stem from absent, inconsistent, low-certainty, indirectly applicableor poorly implemented evidence. A defensible gap should be supported by the literature, useful to patients, learners, clinicians, health systems or policy and sufficiently important and feasible to investigate. We propose a practical framework that incorporates focused literature searching, evidence mapping, critical appraisal, assessment of applicability and priority and translation into an answerable research question. Digital tools and artificial intelligence (AI) may facilitate literature discovery and organization, but their outputs require verification against primary sources and independent judgment of importance and feasibility.

Conclusions: Research-gap identification is a transparent process for recognizing and prioritizing consequential residual uncertainties, not merely locating unstudied topics. Explicit instruction and mentorship may help clinicians, educators and trainees develop stronger research questions and design studies more likely to generate useful knowledge.

Keywords: Research gaps; research prioritization; evidence synthesis; research methodology; medical education; health professions education; clinical research; artificial intelligence

Introduction

Research questions should address uncertainties that are useful, evidence-based and capable of informing clinical, educationalor health-system decisions[1]. Yet many investigators, especially those early in their research careers, equate a research gap with a topic that has received little or no prior study. Although the absence of literature can signal an important uncertainty, it alone does not establish that a new study is needed[2]. A worthwhile research gap is more accurately understood as a clearly defined limitation in the available evidence that constrains understanding, decision-making, implementationor outcomes[3].

Identifying such gaps is increasingly important amid finite research resources and an expanding scientific literature. Studies that replicate established findings without a compelling rationale, examine outcomes of limited relevanceor address questions that matter only locally can contribute to research waste[3]. Conversely, carefully justified questions can direct effort toward areas where evidence is absent, conflicting, methodologically limited, insufficiently applicable to a population or settingor inadequately translated into practice. Determining whether an uncertainty merits investigation requires more than identifying what has not been studied. Investigators must appraise what is known, assess the quality and applicability of existing evidence and consider the value of resolving the remaining uncertainty[4].

The same challenge arises across clinical research, health services research and health professions education. Clinicians and investigators must routinely move from broad interests-such as diagnostic testing, implementation of evidence-based care, learner assessmentor health inequities-to focused questions they can address with available methods and resources. For students, residents, fellows and other early-career investigators, this transition can be especially challenging. Trainees often learn to identify research gaps implicitly through mentorship and repeated exposure to literature rather than explicit instruction[5]. As a result, trainees may begin projects before determining whether the proposed question is novel, consequential, feasible and sufficiently supported by the evidence base.

Rigorous gap identification integrates focused searching, evidence mapping, critical appraisal, assessment of applicability, consideration of stakeholder priorities and translation of uncertainty into an answerable question[4]. Frameworks such as Population, Intervention, Comparison, Outcome (PICO) and Feasible, Interesting, Novel, Ethical, Relevant (FINER) can assist with question formulation, but they are most useful once the underlying gap has been clearly articulated. In particular, novelty should not be treated as synonymous with priority. A question may be new but unimportant, whereas a familiar topic may contain a highly consequential unresolved uncertainty for a specific patient population, setting, outcomeor implementation context[6].

Digital tools, citation-network platforms and AI systems have transformed how researchers find and organize literature[7]. These technologies can help users identify related studies, visualize evidence clusters and summarize large bodies of work. However, they cannot independently determine whether a proposed gap is clinically meaningful, supported by reliable evidence, important to those affectedor appropriately addressed by a particular study design. Their outputs require verification against primary sources and interpretation within the clinical, educational and methodological context of the proposed research[7].

In this narrative review, we describe how to identify, evaluate and prioritize key research gaps in health care and health professions education. We outline key forms of residual uncertainty, present a practical framework for moving from a broad topic to a focused, defensible research question, discuss common pitfalls and consider the appropriate role of digital and AI-enabled tools. The goal is to help clinicians, educators, trainees and early-career investigators develop evidence-grounded questions worth pursuing.

Methods

Design and scope

We conducted a narrative review to synthesize conceptual, methodological and educational literature relevant to identifying, evaluating and prioritizing research gaps in health care and health professions education. A narrative review was appropriate because the topic spans several forms of scholarship, including evidence-synthesis methods, research prioritization, clinical and health services research, implementation science and medical education[8]. The goal was not to estimate an intervention effect or catalog every publication on the topic. Instead, it was to develop a practical approach to identifying important uncertainties and translating them into feasible research questions.

Literature identification

We searched MEDLINE/PubMed, Embase, Scopus, ERIC and the Cochrane Library for literature addressing research gaps, evidence gaps, research prioritization, evidence mapping, research question development, critical appraisal, research waste and health professions education[2]. Search terms combined controlled vocabulary with keywords for research gap, evidence gap, research priorities, priority setting, evidence synthesis, systematic review, research question, PICO, FINER, critical appraisal, medical education and health professions education. We also examined reference lists of relevant systematic reviews, scoping reviews, methodological articles and key guidance documents to identify additional sources.

The search focused on English-language publications relevant to clinical research, health services research, implementation science and health professions education. Literature was reviewed through July 2026. Given the rapid evolution of digital literature-discovery platforms and generative AI, we also considered recent peer-reviewed literature on their use for evidence discovery, synthesis and research-gap identification.

Source selection and synthesis

Sources were selected for their relevance to the proposed framework. Key domains included residual uncertainty, limitations in the evidence base, evidence quality and applicability, research priority, question formulation and the responsible use of digital and AI-enabled tools. We prioritized systematic reviews, scoping reviews, methodological studies, consensus statements, reporting guidance and seminal conceptual papers. Educational studies and practical guidance were included when they addressed the teaching or application of research-gap identification among health professions learners[9].

The authors iteratively reviewed the literature and grouped the findings into recurring themes. These themes were synthesized

into a practical framework to guide investigators from a broad topic of interest to a focused, evidence-based, consequential and feasible research question[9,10]. The authors refined the framework by comparing it with existing approaches to evidence synthesis, question formulation and research prioritization.

Author perspectives

The authors bring experience in clinical practice, health professions education, research mentorship and scholarly project development. These perspectives informed the interpretation of the literature and the development of the practical framework[8]. We sought to minimize reliance on anecdotal experience by grounding recommendations in published methodological and educational literature. Nevertheless, as with all narrative reviews, author judgment may have influenced source selection and interpretation.

Results

Defining decision-relevant research gaps

A research gap is not merely the absence of published studies. In health care, it is more appropriately defined as an area where available evidence is insufficient to support a conclusion or decision on a specific question[6]. The key task is to specify where the uncertainty lies, for example, in a population, intervention, comparator, outcomeor setting and why the existing evidence falls short[11]. A framework developed for systematic reviews characterizes gaps using the elements of population, intervention, comparison, outcome and setting and identifies four common reasons evidence falls short: insufficient or imprecise information, biased information, inconsistent informationor information that does not answer the relevant question[9,10].

This distinction prevents researchers from treating novelty as a proxy for importance. A topic may have received little study because it is uncommon, difficult to investigateor of limited consequence. Conversely, an extensively studied topic may still contain a consequential gap if prior studies excluded a high-risk population, measured non–patient-important outcomes, used weak methodsor were conducted in settings unlike the one in which a decision must be made[12]. A defensible gap statement identifies what is established, defines what remains uncertain and explains why that uncertainty matters.

Sources of uncertainty

Research gaps commonly stem from limitations in the quantity, quality, consistency, applicabilityor implementation of available evidence[2]. These categories often overlap. For example, a treatment may have been evaluated in several trials yet remain poorly understood among older adults, in rural settings, in resource-constrained health systemsor in populations historically excluded from research **(Table 1)**.

Table 1: Common Sources of Residual Uncertainty in Health Care Research and Illustrative Gap Statements[2,13].

Source of uncertainty	Description	Illustrative gap statement
Insufficient or imprecise evidence	Too few studies, inadequate sample sizesor wide confidence intervals prevent reliable conclusions	"Evidence is insufficient to determine whether the intervention reduces clinically important deterioration among low-risk emergency department patients."
Biased or methodologically limited evidence	Available studies have important risks of bias, weak comparators, incomplete outcome assessmentor outdated methods	"Existing observational studies suggest benefit, but residual confounding and inconsistent outcome measurement limit causal inference."
Inconsistent evidence	Study findings differ in direction or magnitude and the reasons for heterogeneity are unclear	"Prior studies report conflicting associations and differences in populations, exposure definitions and follow-up periods have not been adequately examined."
Indirect or inapplicable evidence	Evidence does not apply to the population, setting, intervention, comparatoror outcome relevant to the decision	"Most evidence derives from tertiary academic centers, with limited applicability to community emergency departments."
Outcome gap	Studies emphasize surrogate, processor short-term outcomes while omitting patient-, learner-or system-important outcomes	"The intervention has been evaluated primarily using knowledge scores; its association with clinical performance and patient-centered outcomes remains uncertain."
Implementation gap	Efficacy is established, but the conditions, strategies, equity effects, costsor sustainability of real-world implementation remain unclear	"Although the intervention is effective under controlled conditions, optimal implementation strategies in routine practice are unknown."

A useful gap statement is specific enough to guide the next research step. Statements such as "few studies exist," "the literature is limited," or "further research is needed" do not specify what evidence is missing, why its absence mattersor what type of study could reduce uncertainty. In contrast, a well-developed statement links a defined evidentiary limitation to a decision that clinicians, patients, educators, health systemsor policymakers cannot yet make with confidence[2].

Gap versus priority

Identifying a gap and establishing a research priority are related yet distinct tasks. Reviews of methods for health research prioritization show that gap identification often relies on knowledge synthesis, whereas priority setting more commonly incorporates stakeholder engagement, consensus processes, quantitative methods and feasibility considerations[6]. A research question should go beyond noting that evidence is incomplete. Investigators should ask whether resolving the uncertainty matters to those affected could influence a decision and can be studied ethically and feasibly[9,10].

This distinction matters especially for trainee-led projects. A feasible local study can be educationally valuable, but convenience alone does not confer broad scientific importance. Investigators should aim to identify questions that align the magnitude and consequences of uncertainty with the needs of relevant stakeholders and with a study design capable of generating useful new evidence[6].

Assessing the evidence base

Once a potentially important uncertainty has been identified, the next step is to determine whether it reflects a genuine limitation in the evidence base rather than incomplete searching, narrow framingor misreading of existing studies[9]. This process begins with a focused, transparent literature search and proceeds through evidence mapping and critical appraisal. Evidence and gap maps can provide a structured visual overview of studies and reviews across prespecified populations, interventions and outcomes, helping researchers identify both areas of evidence concentration and domains where rigorous evidence is sparse[11]. **(Table 2)** outlines a structured, iterative process for moving from a broad topic of interest to a prioritized, answerable research question.

Table 2: Structured Process for Identifying and Evaluating Research Gaps.

Step	Core question	Recommended activity	Output
1. Define the topic and decision context	What clinical, educational, health-systemor policy decisions are uncertain?	Describe the topic, intended population, setting, decision-maker and potential use of new evidence	Brief topic statement and decision context
2. Conduct a focused literature search	What evidence already exists?	Search relevant databases; prioritize recent systematic reviews, guidelines and pivotal primary studies; document databases, search terms and search dates	Search record and preliminary article set
3. Map the evidence	Where does evidence cluster and where is it sparse?	Extract study design, population, setting, intervention or exposure, comparator, outcomes, findings and limitations into an evidence table	Evidence map
4. Appraise evidence quality	How trustworthy are the available findings?	Assess risk of bias, precision, consistency, completeness, reporting quality and relevance of measured outcomes	Summary of key limitations
5. Assess applicability	Does the evidence apply to the intended population and setting?	Compare the existing evidence with the population, context, resources and outcomes relevant to the proposed decision	Applicability assessment
6. Define the residual uncertainty	What is specifically unknown, uncertainor inadequately addressed?	Identify whether uncertainty reflects insufficient, biased, inconsistent, indirect, outcome-limitedor implementation-limited evidence	Draft gap statement
7. Establish priority	Why should this uncertainty be addressed?	Consider patient, learner, clinician, health-system and policy relevance; disease burden; practice variation; equity; stakeholder priorities; and potential impact	Priority rationale
8. Assess feasibility	Can a proposed study meaningfully reduce the uncertainty?	Evaluate access to participants or data, time, expertise, funding, ethical requirements and institutional support	Feasibility assessment
9. Formulate the research question	What focused question can address the identified gap?	Use an appropriate question framework, such as PICO/PICOT for intervention questions or a framework tailored to diagnostic, prognostic, qualitativeor implementation questions	Final research question
10. Align the design	What design is most likely to reduce the specified uncertainty?	Select a design, outcomes, comparison group, sample and analytic approach that match the research question and reason evidence is insufficient	Preliminary study concept or protocol

Note: The process is iterative rather than strictly linear. New evidence, stakeholder feedback, feasibility constraintsor critical appraisal may require investigators to revisit and refine earlier steps. Evidence and gap maps can help organize heterogeneous evidence and inform research prioritization, but evidence sparsity alone does not establish that a question is important or worthy of study.

Conducting a focused search

A focused search begins by defining the clinical, educationalor health-system topic and identifying its key elements. For intervention questions, the Population, Intervention, Comparison and Outcome (PICO) framework can guide both search strategy and question formulation[12]. Other frameworks may be better suited to questions about prognosis, diagnosis, exposure, implementationor qualitative experience. Regardless of the framework used, investigators should define the population, setting, key exposure or intervention, comparator when relevant and outcomes of interest before searching.

The search should prioritize recent systematic reviews, high-quality clinical practice guidelines and major primary studies[12]. Investigators should document the databases searched, search terms, date limits and the final search date. Citation chaining, reviewing reference lists of key articles and identifying newer studies that cite them, can uncover influential or recently published literature missed by an initial search[11]. A transparent search record helps justify the proposed gap, update the evidence base as the project progresses and show that the question is not driven solely by convenience or anecdote.

Mapping the evidence

An evidence map organizes the literature by features that directly relate to the proposed uncertainty. A simple spreadsheet is often sufficient. For each relevant study or review, investigators can record the study design, population, setting, intervention or exposure, comparator, outcomes, principal findings and major limitations. This process makes heterogeneity easier to see and can reveal patterns that are easy to miss when studies are read one at a time.

For example, a topic may appear well studied until the evidence is mapped by setting and outcome[9]. The resulting map may show that most studies were conducted in tertiary centers, excluded older adults or patients with limited English proficiency, used surrogate measuresor had limited follow-up. In that case, the appropriate gap is not “few studies exist,” but a more precise statement about the limited applicability, outcome relevanceor methodological strength of the existing evidence[11,12].

Critically appraising residual uncertainty

A literature gap should be judged not only by the number of available studies but also by the trustworthiness and decision relevance of their findings. Investigators should consider whether prior evidence is limited by risk of bias, inadequate sample size, inconsistency across studies, indirectness relative to the intended population or setting, incomplete reportingor the use of outcomes that do not matter to patients, learnersor health systems[14]. A research question is most compelling when it addresses a limitation that plausibly alters the interpretation or applicability of the existing evidence.

This appraisal should also distinguish evidence gaps from implementation gaps. An intervention may be supported by high-quality efficacy studies yet remain difficult to adopt equitably, sustainablyor efficiently in routine practice. Conversely, variation in practice may reflect true evidentiary uncertainty rather than implementation failure. Determining which problem is present is essential because the appropriate next study may range from a pragmatic effectiveness trial to qualitative inquiry, implementation research, comparative observational analysisor a new evidence synthesis[11].

Prioritizing research gaps

After investigators establish that residual uncertainty exists and understand why the available evidence is insufficient, they must determine whether addressing that uncertainty should be a research priority. Priority setting is distinct from gap identification: a gap describes what remains unknown, whereas prioritization evaluates the relative value of generating new knowledge[10]. Structured priority-setting approaches commonly consider the importance of the health problem, the likely consequences of reducing uncertainty, feasibility and answerability, equity, available resources and alignment with the needs of patients, clinicians, health systems and other intended users of research[12].

Not every investigator-initiated project requires a formal consensus process. However, investigators should be able to articulate why the proposed question matters now, who would use the findings, what decision could change and why the proposed study is an appropriate next step. Questions may warrant particular attention when they address substantial disease burden, variation in care, health inequities, patient-important outcomesor major barriers to implementation[12]. A local question can also be important when its setting reflects a broader, inadequately studied context rather than an institution-specific operational preference.

Stakeholder relevance

Patients, caregivers, clinicians, educators, administrators, policymakers and funders may view the importance of a research question differently. Incorporating these perspectives can help ensure that a proposed study addresses issues that matter to those who will experience, deliver, implementor act on its findings[6]. For example, the James Lind Alliance model brings patients, carers and clinicians together to identify and prioritize unanswered questions that research could address[15]. More broadly, stakeholder participation can contribute at multiple points in priority setting, including the identification, refinement, ranking, validation and dissemination of research questions[16].

The appropriate form of engagement depends on the project's scope and purpose. For an individual trainee project, this may involve consulting patient partners, community representatives, frontline clinicians, educatorsor operational leaders during project development[17]. For a larger research program, formal approaches such as surveys, interviews, Delphi processes, nominal group techniquesor established priority-setting partnerships may be appropriate[9]. Regardless of the method, investigators should report whose perspectives informed the question, how those perspectives were obtained and how they influenced the proposed research.

Impact, equity and feasibility

A gap is more compelling when resolving it could plausibly improve outcomes, reduce uncertainty in a consequential decision, inform policy, improve educational practiceor promote equitable care[9]. Investigators should determine whether prior research included the populations most affected by the condition or intervention. They should also consider whether the proposed outcomes are important to patients, learnersor health systems and whether the question could reduce disparities in access, quality, experienceor outcomes[10]. Explicit consideration of equity also helps prevent replicating evidence bases that are large overall yet poorly applicable to populations historically excluded from research[18].

Feasibility should be assessed alongside importance rather than treated as an afterthought. A high-priority uncertainty may require a multicenter trial, prospective cohort, qualitative inquiry, implementation studyor an updated systematic review that exceeds the resources of a single investigator or trainee[9,10]. In such cases, a smaller project may still make a useful contribution by addressing a defined component of the larger question, such as validating an outcome measure, describing practice variation, assessing barriers to implementationor generating preliminary data needed for a larger study. The aim is not to select only questions that are easy to study, but to match an important uncertainty with a rigorous and achievable next research step[19].

Translating a gap into a research question

A prioritized research gap must be converted into a question that can be answered through an appropriate, rigorous study design. The transition should be explicit. The gap statement identifies what is known, what remains uncertain and why the uncertainty matters. The research question then specifies the population, phenomenon or intervention, comparator (when applicable), outcome, setting and time frame needed to address it. Frameworks such as PICO or PICOT support focused question development for intervention-focused clinical research by defining the population, intervention, comparison, outcome and, when relevant, time horizon.

Not all questions fit a PICO structure[2]. Diagnostic questions may specify the target population, index test, reference standard and diagnostic outcome; prognosis questions may focus on a population, prognostic factor and outcome over time. Qualitative or implementation questions may emphasize the population, setting, phenomenon of interest and contextual factors. The framework should clarify the question rather than force a research problem into an ill-fitting format[20]. The type of question also informs the optimal study design; for example, diagnostic-accuracy questions generally require comparison with an

appropriate reference standard, whereas causal questions about treatment effects may require a randomized or well-designed comparative observational approach when randomization is not feasible[21].

Writing a Defensible Gap Statement

A concise gap statement generally contains three elements:[2,20]

- What is known: Summarize the relevant evidence and its principal conclusion.
- What remains uncertain: Specify the population, setting, outcome, methodologic limitationor implementation issue that has not been adequately addressed.
- Why it matters: Identify the clinical, educational, health-systemor policy decision that remains uncertain and the intended users of new evidence.

For example

"Although simulation-based communication curricula can improve short-term learner performance, existing studies have primarily evaluated outcomes at single institutions using immediate assessments. Whether longitudinal simulation training improves observed communication behaviors in routine clinical practice among residents remains uncertain. This uncertainty limits educators' ability to determine whether the additional curricular resources required for longitudinal simulation are justified."

This statement identifies the evidence base, residual uncertainty and decision consequences. It also suggests a feasible next step: a longitudinal, multisite educational evaluation using an observed workplace performance outcome.

Matching questions to designs

The study design should align with the reason the evidence remains insufficient. When uncertainty stems from a limited evidence base, an updated systematic review, descriptive study, qualitative inquiryor pilot study may be appropriate[20]. When findings are inconsistent, a study designed to explore heterogeneity (such as differences in populations, exposure definitions, settingsor outcome measurement) may be more useful than an undifferentiated replication. When available evidence is indirect, a pragmatic study in the population or setting of interest may be needed. When the primary problem is implementation, mixed-methods or implementation-science approaches may be more informative than another efficacy trial[21,22].

Investigators should also distinguish among questions intended to describe a problem, estimate an association, establish diagnostic performance, determine an intervention effect, understand lived experienceor evaluate implementation. Each type of question requires distinct approaches to sampling, measurement, analysis and study design. Choosing a design for convenience, rather than one that can reduce the stated uncertainty, risks producing findings that are difficult to interpret or apply[23].

Assessing question quality

Before finalizing a protocol, investigators should evaluate the research question using the FINER criteria: feasible, interesting, novel, ethical and relevant[20]. **(Table 3)** extends these criteria by providing a structured guide for assessing the evidentiary basis, decision relevance, stakeholder importance, equity, feasibility, ethical appropriateness and design alignment of a proposed research question.

Table 3: Criteria for Prioritizing a Research Gap and Developing an Answerable Research Question.

Domain	Key question	Indicators of a strongly proposed question	Common warning signs
Evidentiary basis	Is the proposed gap supported by a current and adequately searched evidence base?	Recent reviews and pivotal studies are identified; the specific limitation in existing evidence is clearly described	The rationale relies on a few articles, anecdote, an outdated reviewor the claim that "little has been studied"
Specificity	Can the uncertainty be described precisely?	Population, setting, intervention or exposure, outcome and relevant comparison are defined as applicable	The gap is broad, vagueor combines multiple unrelated uncertainties
Decision relevance	What decision could new evidence inform?	Findings could influence patient care, education, implementation, policy, resource allocationor future research	The question is interesting but unlikely to affect a decision
Stakeholder importance	Who is affected and were their perspectives considered?	Patients, caregivers, clinicians, educators, community partnersor health-system leaders identify the uncertainty as relevant	The question reflects investigator preference alone
Equity and applicability	Does the question address an important population, settingor outcome inadequately represented in prior research?	Prior evidence has limited applicability to groups, settingsor outcomes relevant to the proposed study	"Different population" is used as a rationale without explaining why that difference matters
Novelty and contribution	Would the study add useful knowledge?	It resolves a defined uncertainty, improves prior methods, tests a credible explanation for inconsistent findingsor examines evidence in a consequential new context	The only rationale is that no prior study has been performed at the investigator's institution
Feasibility	Can the study be completed rigorously with available resources?	Access to participants or data, adequate expertise, timeline, funding and institutional support are established	The design is selected because it is easy, but cannot meaningfully address the uncertainty
Ethical appropriateness	Are risks, burdens, consent issues and data protections proportionate to the anticipated value?	The design minimizes avoidable harm and is appropriate for the evidence needed	Risks or participant burdens are not justified by the importance of the question

Design alignment	Can the proposed design reduce the identified uncertainty?	Design, comparator, sample, outcomes and analysis directly address the stated gap	The stated gap concerns causation, implementationor lived experience, but the design cannot answer it
Dissemination and use	Is there a plausible pathway for findings to be used?	Intended audiences, publication venues, implementation partnersor next research steps are identified	No clear audience or potential use beyond completing a project

Note: The criteria in this table synthesize frameworks for identifying research gaps, appraising evidence, setting research priorities, formulating answerable questions and evaluating feasibility, novelty, ethics, relevance, applicability, equity and likely use of findings[2,9,10,13,18,20].

A strong research question aligns four elements: a clearly documented uncertainty, a sound rationale, a study design capable of reducing that uncertainty and a feasible plan for execution[9,10]. When these elements do not align, investigators should refine the gap statement, narrow or broaden the question, seek input from relevant stakeholdersor reconsider the study design before committing resources to data collection[18].

Digital and AI-enabled tools for gap identification

Digital tools can support the iterative process of identifying and evaluating research gaps. Citation-network platforms, bibliographic databases, evidence maps and literature-management software can help investigators identify related publications, trace influential studies, visualize evidence clusters and identify populations, settings, outcomesor methods that have received limited attention[12]. AI-enabled systems can also help organize the literature and support early synthesis. **(Table 4)** summarizes appropriate applications, major limitations and practical safeguards for using digital and AI-enabled tools in research-gap identification.

Table 4: Appropriate Uses, Limitations and Safeguards for Digital and AI-Enabled Tools in Research-Gap Identification.

Activity	Potential contribution	Key limitations	Recommended safeguards
Search-term development	Generate synonyms, related concepts, abbreviations and candidate controlled-vocabulary terms	May omit essential concepts, introduce imprecise termsor reflect biased terminology	Review proposed terms with a librarian, content expertor methodological mentor; test and refine the strategy in the selected database
Literature discovery	Identify related studies, citation networks, influential publications and emerging topics	Results may be incomplete, overemphasize highly cited workor fail to identify relevant evidence outside indexed databases	Search multiple bibliographic databases; use backward and forward citation chaining; document the search process
Study screening and triage	Group citations by topic, summarize abstracts and prioritize records for full-text review	Abstracts may be incomplete; AI summaries may misrepresent design, findingsor limitations	Confirm eligibility and study characteristics by reviewing the full text
Evidence mapping	Extract and organize preliminary information on populations, settings, interventions, outcomes and designs	Automated extraction may misclassify study features or overlook contextual details	Manually verify extracted data against source articles; retain an auditable evidence table
Identifying candidate gaps	Highlight sparse evidence clusters, inconsistent findings, underrepresented populationsor unmeasured outcomes	Sparse evidence does not establish importance and tools cannot determine stakeholder relevance, priorityor feasibility	Assess candidate gaps through critical appraisal, stakeholder consultation and comparison with current reviews and guidelines
Drafting gap statements or research questions	Produce preliminary wording, alternative question formatsor structured templates	May generate unsupported rationale, superficial novelty claimsor fabricated references	Verify every claim and citation; revise wording to reflect the actual evidence base and intended study design
Summarizing literature	Facilitate orientation to a large or unfamiliar body of evidence	Outputs may be inaccurate, outdated, nonreproducibleor insufficiently sensitive to study quality	Use summaries only for orientation; rely on original articles and formal evidence syntheses for substantive conclusions
Handling project materials	Assist with organization of publicly available information	Public systems may create privacy, confidentiality, intellectual-propertyor data-governance risks	Do not upload protected health information, unpublished data, confidential manuscripts, peer-review materials, grant applicationsor proprietary documents without explicit authorization
Reporting AI assistance	Support transparent documentation of tool use	Journal, funder and institutional requirements vary	Disclose material AI use in accordance with applicable journal, institutional and funder policies; do not list AI tools as authors

Note: This table synthesizes published literature on machine learning and generative AI in research-gap identification, evidence synthesis and research-question development. AI-assisted outputs should be verified against original sources and interpreted using human methodological and subject-matter judgment[24-27].

Limitations and Safeguards

Digital tools and generative AI systems can produce outputs that are incomplete, inaccurate, outdatedor nonreproducible. They may omit relevant studies, overemphasize highly cited publications, fail to distinguish between high- and low-quality evidenceor generate incorrect citations and unsupported interpretations[24-26]. Their performance may also vary across disciplines, languages, databases and rapidly evolving topics. Therefore, all factual claims, references, study characteristics and conclusions should be verified against original sources.

Users should also consider privacy, confidentiality, authorship and transparency. Unpublished data, protected health information, confidential peer-review materials, grant applications and proprietary institutional documents should not be entered into publicly available systems unless institutional policy and data-governance requirements permit it. When AI substantially contributes to literature organization, drafting, codingor analysis, investigators should follow the disclosure policies established by their institution, funder and target journal[26,28].

Human judgment remains essential

Researchers still make the central judgments in identifying research gaps. Investigators must decide whether existing evidence is trustworthy and applicable; whether uncertainty affects an important decision; whose perspectives should inform priority setting; whether a proposed study is ethically and practically appropriate; and how findings could be interpreted in context[2]. Technology may accelerate literature discovery and organization, but it cannot independently establish the relevance, priorityor scientific value of a research question.

When used thoughtfully, digital and AI-enabled tools can make the early stages of gap identification more efficient and accessible. Their greatest value lies in supporting structured search, evidence mapping and critical reflection-not in replacing careful appraisal, stakeholder inputor human judgment[9,10].

Educational and mentorship implications

The ability to identify and prioritize research gaps should be taught explicitly and over time rather than assumed to develop through isolated project experiences. Medical student research curricula commonly combine foundational instruction with mentored application and programs that extend at least one academic year have reported more advanced educational outcomes than shorter interventions[5]. This skill fits longitudinal training well because learners improve through repeated practice in searching, synthesizing, appraising, discussing and refining research questions.

Instruction should move beyond asking learners to identify an "interesting topic." Instead, curricula can require students and trainees to develop a written gap statement that specifies what is known, what remains uncertain, why the uncertainty matters and how a proposed study could reduce it[29]. Faculty can make this reasoning visible through structured exercises in journal clubs, research electives, scholarly concentrations and proposal-development courses. For example, learners might create an evidence map based on a recent systematic review, identify limitations in applicability or outcome selection, gather stakeholder feedback and then defend a focused research question and proposed design.

Role of mentorship

Effective mentorship is essential because research-gap identification requires judgment that is difficult to acquire through didactic instruction alone. Mentors can help learners distinguish an important uncertainty from a merely unstudied or convenient topic. They can also judge whether the evidence has been searched and appraised adequately and align project scope with the learner's time, skills, resources and methodological support. Most medical student research curricula described in a systematic review incorporated mentorship, underscoring its central role in connecting research instruction with applied scholarly work[30].

Mentors should model the iterative nature of research development. This includes explaining why a proposed question may need to be narrowed, redirectedor abandoned after reviewing the literature or consulting stakeholders[6]. Such conversations normalize revision as an expected part of rigorous scholarship rather than a failure of creativity or productivity. Mentoring programs should provide mentors with clear expectations, appropriate training, protected time when feasible and recognition for scholarly supervision[8].

Assessing learner competence

Programs should assess research-gap identification directly rather than inferring competence from project completion, poster presentationsor publications. A learner's ability to articulate a well-supported gap statement, construct a focused search strategy, develop an evidence map, critically appraise relevant studies and justify an aligned research question provides stronger evidence of competency than whether a short-term project yields a positive result[5].

Potential assessment approaches include written gap statements, annotated evidence tables, critiques of research questions, protocol sections, structured oral defenses and peer review. Evaluation should determine whether learners can distinguish novelty from importance, identify limitations in the certainty or applicability of evidence, consider relevant stakeholder perspectives and select a study design that addresses the stated uncertainty[30]. Explicit alignment among intended learning outcomes, teaching activities, assessments and program evaluation matters, as reviews of mandatory student research programs have found inconsistent alignment among these elements.

Embedding these practices in clinical and educational research training may help develop clinicians and educators who approach uncertainty systematically. The goal is not simply to increase trainee productivity but to improve judgment about which questions are evidence-based, ethically sound, feasible and worth pursuing.

Discussion

This review frames research-gap identification as a structured process for recognizing and prioritizing residual uncertainties that matter to clinical care, health professions education, health systemsor policy. A meaningful gap is not merely a topic with few published studies. It is an unresolved limitation in the available evidence that constrains an important decision and could be addressed through additional research[2,9,10].

The proposed framework links four related tasks: defining residual uncertainty, appraising available evidence, establishing priority and translating the gap into an answerable question with a suitable study design. These tasks are iterative. New evidence, stakeholder inputor feasibility constraints may prompt investigators to revisit an earlier step, refine the questionor select a different next study.

The framework also emphasizes the distinction between an evidence gap and a research priority[6]. Evidence may be incomplete for many reasons, but not every uncertainty warrants immediate investigation. Priority depends on the consequences

of the uncertainty, its relevance to patients and other stakeholders, the potential to improve decisions or outcomes, equity considerations and the feasibility of generating useful evidence[13,18].

Digital tools and AI-enabled systems may improve the efficiency of literature discoveryorganization and preliminary evidence mapping. However, they cannot independently determine whether evidence is trustworthy, whether uncertainty is importantor whether a proposed study is ethically justified and likely to inform practice[24,25]. Researchers remain responsible for verifying outputs against original sources and for interpreting evidence within its clinical, educational, methodological and social context[28].

Research-gap identification should also be treated as a teachable scholarly skill. Explicit instruction, repeated practice and mentorship can help trainees move beyond locally convenient or merely novel topics toward questions that are evidence-based, feasible and likely to yield useful knowledge. Embedding this work in longitudinal research curricula may also help learners develop habits of critical appraisal, stakeholder engagement and purposeful study design that extend beyond a single project.

Implications for research training

Explicit instruction in research-gap identification can help learners and early-career investigators begin with what is known, what remains uncertain and why resolving that uncertainty matters, rather than starting with a preferred method, an available datasetor a broad personal interest[29]. Programs can teach this process through journal clubs, research electives, scholarly concentrations, mentoring and proposal-development curricula. Faculty development is equally important: mentors shape not only project design but also judgments about whether a project is worth undertaking. Assessing learners' ability to formulate and defend a gap statement may provide a more direct indicator of research competence than project completion or publication alone[30,31].

Limitations

This article is a narrative review and practical framework, not a systematic review, formal consensus statementor empirically validated educational intervention. Narrative reviews synthesize heterogeneous literature and support conceptual interpretation, but author judgment shapes literature selection and conclusions and they are not intended to provide exhaustive or fully reproducible coverage. Although the review emphasizes transparency in literature identification and interpretation, it may have missed relevant sources and the relative importance of the proposed framework domains may vary across clinical, health services, implementation and health professions education research.

The framework also requires prospective evaluation. Future work should assess whether its use improves the quality of gap statements, research questions, protocol development, stakeholder alignment, project completion and the practical relevance of trainee and faculty research. Comparative studies could evaluate the framework across research curricula, mentorship programs, journal clubs and scholarly project pathways. Further refinement should incorporate perspectives from patients, community partners, clinicians, educators, administrators, methodologists and funding organizations.

Conclusion

Meaningful research begins not with identifying an unstudied topic, but with recognizing a consequential, clearly defined uncertainty in the evidence base. Focused searching, evidence mapping, critical appraisal, stakeholder-informed prioritization and deliberate question formulation can help investigators design projects that address consequential uncertainties and inform decisions. Used well, this process can strengthen research training and direct limited scholarly resources toward questions most likely to add value.

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