



Critical thinking and research

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Definition

Critical thinking is a core competency for evidence based general practice¹ and an essential precursor to research. It is also essential for evaluating and understanding the implications of research for clinical practice.

Critical thinking involves a continual questioning of the assumptions underpinning all aspects of a general practitioner's professional life and consists of:

- critical appraisal — the process of assessing and interpreting evidence by systematically considering its validity, results and relevance² — necessary for the evaluation of research results and their application to clinical practice
- critical evaluation of the context of general practice
- critical introspection to gain an understanding of personal knowledge, experience and values that influence the way medicine is practised.³

General practice and primary care research have been described as 'the missing link in the development of high quality, evidence based healthcare for populations'.¹

Using a broad, conceptual definition, the research process can be summarised as deliberately asking questions within the framework of existing knowledge and seeking answers following a systematic process which includes:

- obtaining appropriate information in an ethical, transparent and reproducible manner
- appropriately analysing the information
- drawing conclusions on the basis of the validity and reliability of the information and meaning of the results, and comparing these results to other studies
- disseminating the implications widely, including to those who may effect change.

The spectrum of research activities is wide and can include evaluation studies, intervention studies, clinical audits, large scale multicentre clinical trials, and patient satisfaction studies. Research activities can use qualitative or quantitative research methods, or a combination of both. However, each of these activities must be conducted according to the established 'rules' of the research process in order to be considered research.

Curriculum in practice

The following case illustrates how the critical thinking and research curriculum applies to general practice:

- There has been a local outbreak of pertussis and, sadly, a number of children from your practice have been admitted to hospital; one baby has died. In reviewing local data pertaining to children with incomplete vaccinations, the number of children with exemptions from vaccination appears to be higher than expected. There are concerns that the outbreak may relate to parental anxieties triggered by a local anti-vaccination lobby group. Research confirms incomplete vaccination may be due to parents disagreeing with immunisation rather than medical contraindications or issues of access. This results in the public health unit developing a public education strategy.

Rationale and general practice context

GPs as critical thinkers

Critical thinking and research promote essential lifelong learning skills throughout the general practitioner's working life. Both enable the GP to provide the best possible patient care by developing the GP's ability to:

- identify the many important clinical and research questions arising in their everyday clinical practice
- critically appraise research papers to confidently and accurately answer these questions
- apply this research evidence to patients and communities.

To critically appraise a research paper, clinicians must have sufficient knowledge and understanding of a range of research methods, which can best be gained by undertaking formal and structured training in research methods.

Critical appraisal skills are also important in assisting clinicians to implement or participate in research projects. Such clinicians need opportunities to do research, as well as to access appropriate mentoring and support, particularly through linking with research organisations or academic institutions including university departments of general practice.

GPs as researchers

General practice research aims to solve the problems that arise within the specific context of general practice. The context and the way in which the research is conducted characterises general practice research rather than the nature of the problem investigated.⁴

General practitioners need to be researchers in order to pose relevant clinical questions for research, understand the complexity of the general practice context and therefore be able to facilitate research within this context.

General practice research must be conducted within general practice to provide answers to the specific and unique problems that arise within this context,⁵⁻⁹ in particular because:

- the general practice context is different from specialist and hospital contexts, especially regarding the holistic treatment of people with multimorbidities and undifferentiated illness within the context of uncertainty
- diagnostic delays lead to poorer outcomes for patients
- GPs play a pivotal role as gatekeepers to the health system and the absence of research evidence can lead to over-investigation, inappropriate treatment and diagnostic delay through inappropriate referrals
- decision about medication is significant and many patients take medication prescribed in primary care all their lives.¹
- as a person-focused, applied discipline, general practice research concentrates on applied research that goes beyond the biomedical aspects of illness and incorporates issues that address psychosocial aspects of wellbeing,¹⁰ which inherently requires multidisciplinary approaches and multiple methodologies.¹¹

Why critical thinking and research are needed in general practice

Critical thinking and research improve patient care in general practice. Research evidence is the fundamental way in which routine clinical practice is improved. Critical thinking and reflection are essential precursors for the incorporation of research evidence into practice. Training in these skills also cultivates an interest in undertaking much needed general practice research.

General practice research productivity is far lower than that of other medical disciplines, with an approximate publication rate of three publications per 1000 GPs per year compared to about 160 publications per 1000 physicians and 68 per 1000 surgeons.¹²

Levels of engagement in critical thinking and research

There are varying levels of engagement in critical thinking and research in general practice. Users and participants, as well as leaders, should be actively involved (*Figure 1*) at the highest order within each level of involvement.

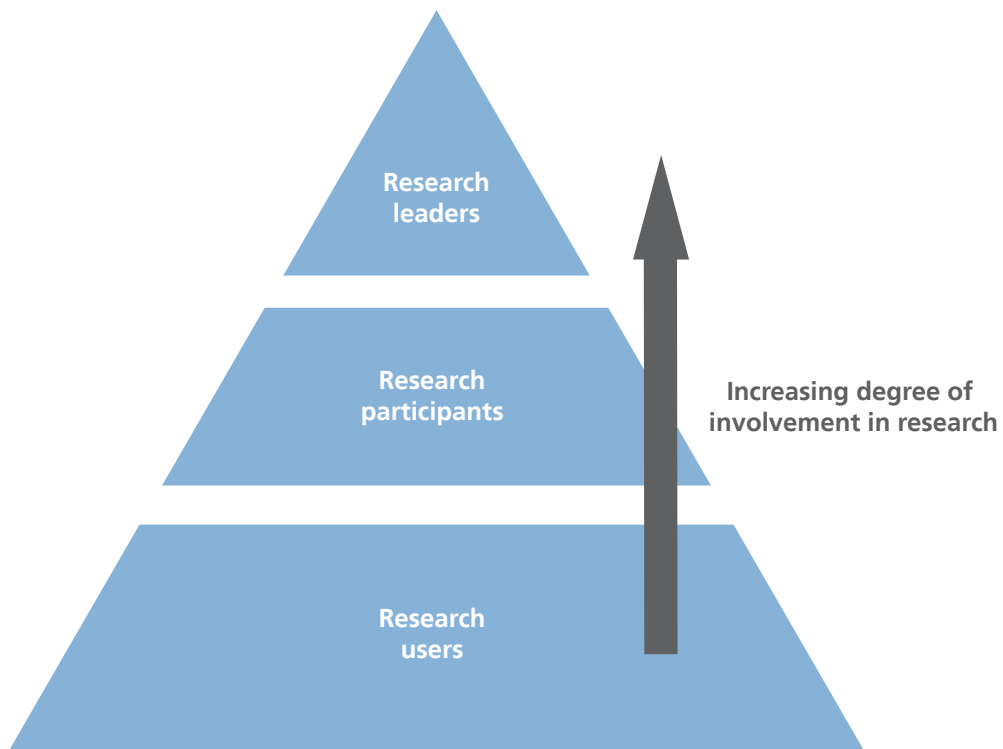


Figure 1. The levels of research engagement.

Adapted from 'Glasziou's triangle'¹³ and reproduced from Australian Family Physician with permission

Research leaders are those who conceptualise, design, find funding for, conduct and publish research.

Research participants are those who participate in general practice research. Highest order participants are intellectually engaged in the research, understand and feel aligned to its purpose, could describe the project to a third party, and are interested in the results. Usually they are sufficiently part of the research to earn authorship. Lower order participants may just recruit patients for research projects conceptualised and instigated by others such as universities, specialist colleagues or pharmaceutical companies. Involvement in research at medical school and during general practice training is associated with increased ability and confidence in interpreting research findings in subsequent clinical practice, in addition to increased subsequent involvement in general practice research.^{5,14,15}

All GPs are research users, using research evidence (the base of the triangle) as clinical practice within general practice, and are informed by research from a myriad of health related fields ranging from biochemical to macrosocial levels. This research evidence is accessed in a range of forms from a wide number of sources such as journals, medical newspapers, formal educational activities and discussions with their colleagues,¹⁶ and can lead to changes in practice. However, the critical thinkers consciously seek the best available research evidence, to appraise and combine with clinical experience and patient values to inform their clinical decision making (the principles of evidence based medicine [EBM]). The ability to critically appraise a research paper is a minimum entry level skill set for general practice.

Increasing the numbers of GPs actively using research evidence (practising EBM) encourages critical enquiry within the discipline and highlights gaps in the evidence. Some GPs will want to address these gaps through leading or participating in research.

Specific research needs of general practice

The specific needs of general practice research impact on all GPs, regardless of their level of involvement in general practice research.

General practice has specific research needs with a high degree of contextual complexity (a broad range of relatively unevolved signs and symptoms, presented within the patient's psychological and social setting) compared with the technical complexity of the medical specialties (a narrower range of defined symptoms across single organ systems, more severe illnesses and limited reference to the patient's social context).

There are gaps in the evidence that GPs need for making decisions, limiting the ability to provide the highest quality care. These gaps are:

- **basic science:** the lack of biomedical and psychosocial evidence. The gap in biomedical science is exemplified by the lack of knowledge about the pathophysiology and natural history of many of the diseases commonly seen in general practice. The limited understanding of help seeking behaviour is an example of a psychosocial gap (eg. why do some patients with upper respiratory tract infections present to their GP, while others with the same symptoms self medicate or take no action?)
- **effectiveness:** the lack of evidence demonstrating both the effectiveness and cost effectiveness of interventions routinely used in general practice (diagnosis, treatment and service delivery)
- **applicability:** a lack of 'translation research' to ensure that evidence generated in nonprimary care settings is applicable in general practice
- **implementation:** the gap between identifying effective care and who should receive it, and what occurs in routine general practice.

General practice research also focuses on the taxonomy of general practice itself. A better knowledge of the processes employed in general practice and successful models of healthcare delivery will support more effective, cost efficient and sustainable practice.

Training outcomes of the five domains of general practice

1. Communication skills and the patient-doctor relationship

- CTRT1.1 Communicate the evidence for management, diagnosis or screening to patients in a manner that is both understandable to the patient and is patient centred.
- CTRT1.2 Involve the patient in the evidence based decision making process about their health and acknowledge the informed patient's right to choose to accept or decline new interventions based on research evidence.
- CTRT1.3 Be aware that beliefs and values, in doctor and patient, influence the interpretation of research results in support of potentially divergent views.

2. Applied professional knowledge and skills

- CTRT2.1 Have well developed skills in reflective practice and critical thinking in order to identify and formulate questions as they arise in clinical practice.
- CTRT2.2 Have sound skills in evidence gathering (eg. where to find resources, how to search databases, internet searching skills).
- CTRT2.3 Have sound skills in critical appraisal of different types of evidence sources.
- CTRT2.4 Apply the hierarchy of evidence available for clinical decision making.
- CTRT2.5 Applying research evidence from clinical trials to individual patients within their unique context and comorbidities.
- CTRT2.6 Be able to share and disseminate the results of research or critical evaluation and literature reviews to peers or other health professionals.
- CTRT2.7 Understand the methods and practices to evaluate, reflect on and improve clinical and nonclinical practice (eg. clinical audit, needs analysis, quality improvement cycles).
- CTRT2.8 Develop a rational approach to prescribing and investigations that includes knowledge of risk, costs and benefits of management and tests.
- CTRT2.9 Understand how research funding and publication bias can lead to a bias in evidence.

3. Population health and the context of general practice

- CTRT3.1 Understand the role and importance of general practice and primary care to improving population health.
- CTRT3.2 Appreciate the importance of general practice and primary care research.
- CTRT3.3 Have a basic understanding of general practice research and epidemiological methods and concepts (eg. qualitative and quantitative research methods, and concepts such as incidence, prevalence and screening).
- CTRT3.4 Understand the basic statistical techniques for describing and interpreting results of research (eg. *p* values, confidence intervals, absolute and relative risk, positive and negative predictive value, number needed to treat, sensitivity and specificity) and be able to use these terms when critically appraising research results.
- CTRT3.5 Be familiar with the essential components of the research process (eg. developing a research question, identifying appropriate methods, basic qualitative and quantitative analysis skills, drawing appropriate conclusions, summarising and disseminating results).
- CTRT3.6 Be aware of the limited generalisability of research evidence when applying evidence about screening, diagnosis and treatment to individual patients and practices with attention to the general practice setting.

4. Professional and ethical role

- CTR4.1 Ensure that issues such as privacy and ethical principles are adhered to when undertaking research or quality improvement activities, and approval is obtained from an appropriate human research ethics committee as required.
- CTR4.2 Understand the power differential in the patient-doctor relationship when performing research or quality improvement activities, and ensure that a patient's vulnerability is recognised and appropriately managed, including providing full information and obtaining informed consent.
- CTR4.3 Think critically about issues arising both in individual clinical practice (eg. critical incidents, mistakes, patient feedback) and in the wider context of general practice (eg. population health status, medical politics).
- CTR4.4 Be aware of your own knowledge, limitations, biases and values that influence the way one practices medicine.
- CTR4.5 Be aware of external influences on own practice (eg. pharmaceutical companies, media) and be confident in dealing appropriately with these influences.
- CTR4.6 Be flexible and willing to change beliefs and practice in the face of new evidence.
- CTR4.7 Acknowledge uncertainty (to self and patients) in clinical practice, without forgoing the efforts to decrease uncertainty where feasible and necessary.
- CTR4.8 Facilitate, where appropriate, research within one's own general practice.

5. Organisational and legal dimensions

- CTR5.1 Understand the importance of, and have, the ability to continually evaluate and reflect on performance in clinical and nonclinical practice (both individually and with peers and within primary care teams) and use appropriate methods to implement and evaluate change where necessary, including in settings of quality improvement.
- CTR5.2 Understand the ethical and legislative requirements of privacy principles when using patient information for research or quality improvement purposes.
- CTR5.3 Have computer skills sufficient to access internet literature and to practise in a computerised general practice.
- CTR5.4 Understand the importance of, and the need to, practise the recording of patient data on clinical software systems in a way that enables quality improvement activities and research to be reliably conducted at a later date, and to know how to use clinical software to retrieve data for quality improvement activities or research (eg. performing a database search).

Learning objectives across the GP professional life

Medical student

1. Communication skills and the patient-doctor relationship

- CTRLM1.1 Describe the principles underpinning the skills required to communicate evidence for management, diagnosis or screening to patients.

2. Applied professional knowledge and skills

- CTRLM2.1 Outline the basic principles of clinical epidemiology, including basic statistical concepts.
- CTRLM2.2 Demonstrate skills in literature searching including the use of PubMed and Cochrane databases.
- CTRLM2.3 Outline the scientific method and the origins of medical knowledge.
- CTRLM2.4 Describe the challenges in applying research evidence to individual patients.
- CTRLM2.5 Demonstrate the beginning of skills in communicating health information to peers.

3. Population health and the context of general practice

- CTRLM3.1 Describe the basic statistical techniques for describing and interpreting results of research (eg. *p* values, confidence intervals, absolute and relative risk, positive and negative predictive value, number needed to treat, sensitivity and specificity) and be able to use these terms when critically appraising research results.
- CTRLM3.2 Give a basic description of population health issues in clinical epidemiology.
- CTRLM3.3 Give a basic overview of research concepts.

4. Professional and ethical role

- CTRLM4.1 Demonstrate development of skills in self directed learning, including reflective practice and critical thinking, to identify gaps in knowledge

5. Organisational and legal dimensions

- CTRLM5.1 Outline the ethical and legislative requirements of privacy principles when using patient information for research or quality improvement purposes.
- CTRLM5.2 Outline the quality improvement process.

Learning objectives across the GP professional life

Prevocational doctor

Assumed level of knowledge – medical student

1. Communication skills and the patient-doctor relationship

CTRLP1.1 Demonstrate the beginning of developing skills for communicating evidence for treatment or screening to patients.

2. Applied professional knowledge and skills

CTRLP2.1 Demonstrate the ability to apply best medical evidence in patient care.

CTRLP2.2 Detail diagnostic test characteristics, and their use in including and excluding diagnoses.

CTRLP2.3 Demonstrate the beginning of developing skills in rational prescribing and ordering of investigations.

CTRLP2.4 Demonstrate the use of clinical guidelines and recent evidence to guide patient care decisions.

3. Population health and the context of general practice

CTRLP3.1 Demonstrate the ability to use basic statistical techniques for describing and interpreting results of research (eg. *p* values, confidence intervals, absolute and relative risk, positive and negative predictive value, number needed to treat, sensitivity and specificity) and be able to use these terms when critically appraising research results.

4. Professional and ethical role

CTRLP4.1 Recognise that some patients may be involved in research or may want to be involved in research and, where appropriate, communicate and comply with the appropriate researchers.

CTRLP4.2 Describe and analyse, using critical thinking skills, the harm caused by system errors and failure, and recognise and manage adverse events and near misses.

5. Organisational and legal dimensions

CTRLP5.1 Describe processes for correctly documenting patients involved in research, where appropriate.

CTRLP5.2 Describe and demonstrate awareness of the legislative and ethical requirements for patients participating in research.

Learning objectives across the GP professional life

Vocational registrar

Assumed level of knowledge – prevocational doctor

1. Communication skills and the patient-doctor relationship

- CTRLV1.1 Demonstrate the ability to communicate the evidence for management, diagnosis or screening to patients in a manner that is both understandable to the patient and is patient centred.
- CTRLV1.2 Demonstrate the ability to involve the patient in the decision making process about their health and acknowledge the informed patient's right to choose to accept or decline new interventions based on research evidence.
- CTRLV1.3 Describe how beliefs and values, in doctor and patient, influence the interpretation of research results in support of potentially divergent views.

2. Applied professional knowledge and skills

- CTRLV2.1 Demonstrate well developed skills in reflective practice and critical thinking in order to identify and formulate questions as they arise in clinical practice.
- CTRLV2.2 Demonstrate sound skills in evidence gathering (eg. where to find resources, how to search databases, internet searching skills).
- CTRLV2.3 Demonstrate sound skills in critically appraising different types of evidence sources.
- CTRLV2.4 Develop a rational approach to prescribing and investigation that includes knowledge of risk, costs and benefits of treatment and tests.
- CTRLV2.5 Outline the hierarchies of evidence available for clinical decision making.
- CTRLV2.6 Outline how research funding and publication bias can influence the evidence base of clinical practice.
- CTRLV2.6 Outline the essential components of the research process (eg. developing a research question, identifying appropriate methods, basic qualitative and quantitative analysis skills, drawing appropriate conclusions, summarising and disseminating results).
- CTRLV2.7 Demonstrate skills in applying research evidence from clinical trials to individual patients within their unique context and comorbidities.
- CTRLV2.8 Where indicated, demonstrate an ability to disseminate the results of research, or critical evaluation/literature review to peers or other health professionals.
- CTRLV2.9 Outline methods to evaluate, reflect on and improve clinical and nonclinical practice (eg. clinical audit, needs analysis, quality improvement cycles).

3. Population health and the context of general practice

- CTRLV3.1 Outline the role and importance of general practice and primary care to population health in Australia and internationally.
- CTRLV3.2 Understand the importance of general practice and primary care research.
- CTRLV3.3 Demonstrate a basic understanding of general practice and primary care research and epidemiological concepts and methods (eg. qualitative and quantitative research methods, and concepts such as incidence, prevalence and screening).

- CTRLV3.4 Describe basic statistical techniques for describing and interpreting results of research (eg. *p* values, confidence intervals, absolute and relative risk, positive and negative predictive value, number needed to treat, sensitivity and specificity) and be able to use these terms when critically appraising research results.
- CTRLV3.5 Describe the principles underlying generalisability of research evidence when applying evidence about screening, diagnosis and treatment to individual patients and/or practices.

4. Professional and ethical role

- CTRLV4.1 Demonstrate adherence to privacy and ethical principles when undertaking research or quality improvement activities, and obtain approval from an appropriate human research ethics committee.
- CTRLV4.2 Describe the power differential in the patient-doctor relationship when performing research or quality improvement activities, and ensure that a patient's vulnerability is recognised and appropriately managed, including providing full information and obtaining informed consent.
- CTRLV4.3 Demonstrate critical thinking about issues arising both in individual clinical practice (eg. critical incidents, mistakes, patient feedback) and in the wider context of general practice (eg. population health status).
- CTRLV4.4 Describe how the individual clinician is aware of personal knowledge, limitations, biases and values that may influence the way one practises medicine.
- CTRLV4.5 Demonstrate awareness of external influences on one's practice (eg. pharmaceutical companies, media) and be confident in dealing appropriately with these influences critically.
- CTRLV4.6 Demonstrate flexibility and willingness to change beliefs and practice in the face of new evidence.
- CTRLV4.7 Outline processes for acknowledging uncertainty (to self and patients) in clinical practice, without forgoing the efforts to decrease uncertainty where feasible and necessary.

5. Organisational and legal dimensions

- CTRLV5.1 Describe the importance of, and have, the ability to be continually evaluating and reflecting on performance in clinical and nonclinical practice (both individually and with peers and within primary care teams) and use appropriate methods to implement and evaluate change where necessary.
- CTRLV5.2 Describe and comply with the requirements of privacy principles when using patient information for research or quality improvement purposes.
- CTRLV5.3 Demonstrate the use of computer skills sufficient to access internet literature and to practise in a computerised general practice.
- CTRLV5.4 Understand the importance of, and the need to, record patient data on clinical software systems in a way that enables quality improvement activities and research to be reliably conducted at a later date, and know how to use clinical software to retrieve data for quality improvement activities or research (eg. performing a database search).

Learning objectives across the GP professional life

Continuing professional development

Assumed level of knowledge – vocational registrar

1. Communication skills and the patient-doctor relationship

CTRLC1.1 Regularly review communication skills in relation to critical thinking and research.

2. Applied professional knowledge and skills

CTRLC2.1 Demonstrate ongoing development of skills in gathering evidence.

CTRLC2.2 Demonstrate continual refinement and development of a rational approach to prescribing and ordering investigations, which may include the use of tools such as clinical audits.

CTRLC2.3 Demonstrate continual development of skills in applying research evidence to the individual patient.

CTRLC2.4 Demonstrate competence in the use of at least one type of quality improvement measure and the use of this in practice.

3. Population health and the context of general practice

CTRLC3.1 Demonstrate the means to ensure balance in responsibility to individual patients and larger population health needs and constraints.

4. Professional and ethical role

CTRLC4.1 Demonstrate maintenance of high ethical and professional standards in the care of patients by a judicious balance of the 'science' and 'art' of medicine.

CTRLC4.2 Demonstrate maintenance of an up-to-date knowledge base by a combination of periodic knowledge updates and needs driven learning strategies. The latter requires 'information mastery' and evidence based practice skills.

5. Organisational and legal dimensions

CTRLC5.1 Demonstrate the adoption of new skills and technologies that assist best medical practice (eg. updating computer and internet skills and equipment).

CTRLC5.2 Conduct practice in a way that complies with privacy principles.

CTRLC5.3 Continue to develop information management and evidence gathering skills.

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