

Why you should read this article:

- To appreciate why reading and understanding research is an important part of evidence-based practice
- To benefit from an easy-to-use critical appraisal framework to evaluate quantitative, qualitative and mixed-methods research
- To understand critical concepts and how to apply them to contextualise the framework

A simplified approach to critically appraising research evidence

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Abstract

Background Evidence-based practice is embedded in all aspects of nursing and care. Understanding research evidence and being able to identify the strengths, weaknesses and limitations of published primary research is an essential skill of the evidence-based practitioner. However, it can be daunting and seem overly complex.

Aim To provide a single framework that researchers can use when reading, understanding and critically assessing published research.

Discussion To make sense of published research papers, it is helpful to understand some key concepts and how they relate to either quantitative or qualitative designs. Internal and external validity, reliability and trustworthiness are discussed. An illustration of how to apply these concepts in a practical way using a standardised framework to systematically assess a paper is provided.

Conclusion The ability to understand and evaluate research builds strong evidence-based practitioners, who are essential to nursing practice.

Implications for practice This framework should help readers to identify the strengths, potential weaknesses and limitations of a paper to judge its quality and potential usefulness.

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Keywords

literature review, qualitative research, quantitative research, research, systematic review

Introduction

Reading, understanding and critically appraising research is a fundamental part of nursing practice and for those working in allied health professions (Greenhalgh 2019). However, there is a general aversion to engaging with research and a (false) belief that evaluating published articles is an excessively technical and tricky task.

The following article and appraisal framework is the culmination of more than 20 years of teaching evidence-based practice to healthcare professionals. Other tools and frameworks do exist (Letts et al 2007, Critical Appraisal Skills Programme 2017) but these are often targeted at specific research approaches, so different frameworks are needed for

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different research designs. This universal, easy-to-use tool provides a one-stop approach to evaluating all types of primary research. We hope it supports the development of evidence-based practice, while simultaneously enabling its users to deconstruct papers straightforwardly and systematically.

New questions will always arise and methods will invariably adapt to address new areas of research. In light of this, you should view the framework as what we intend it to be: a utensil for evaluating research, not a rigid system of analysis that should constrain independent thought.

Critically appraising research

Good quality research papers should provide us with enough information about how the researchers constructed and conducted the study described to allow us to make judgments about its strengths, weaknesses and limitations. Extensive guidance for researchers on the reporting of different types of research is available (Equator Network 2020). Researchers' use of these reporting frameworks can be helpful for those of us who need to assess the quality of research, too, as all the information we need to make a decision should be reported.

When assessing research, it is important to determine the effects the various stages of the research process have on the 'reliability', 'validity' or 'trustworthiness'

of the study (Craig and Smyth 2011, Denscombe 2014, Moule 2015, Aveyard and Sharp 2017) – these being concepts applied in the critique of research to determine the quality of the research and how applicable it is to practice.

Any exploration of the literature relating to critically appraising research will unearth a plethora of approaches. As different 'communities of inquiry' have developed, so too have the ways in which quality is assessed (Creswell 2013). For the purposes of this framework, we have chosen to use the concepts of validity and reliability for quantitative studies and trustworthiness for qualitative studies.

The appraisal concepts

There are numerous components of validity and reliability (Heale and Twycross 2015). This article will delineate validity solely by internal and external validity, primarily to simplify these terms for those unfamiliar with the research process (Table 1). From a qualitative perspective, the terms used to establish the given quality of published research (Polit and Beck 2014, Connelly 2016) differ from those outlined above; nonetheless, there are parallels between them (Table 2).

Applying these concepts to the critique

It is evident that various elements of the research process may affect specific components of validity, reliability or

Key points

- Assessing the quality of published research is fundamental to evidence-based practice
- The tools provided in this article will enable you to identify the pertinent strengths and limitations of published research
- You can apply this framework to quantitative, qualitative and mixed-methods research

Table 1. Terms used in the appraisal of quantitative research

Term	Definition	Example
Internal validity	Relates to the accuracy of the research: adhering to protocol and eliminating extraneous factors are vital to achieving this	An experimental study focusing on the effect of a high-fat diet on weight would need to control variables, such as participants' eating habits and levels of exercise. Failing to do so could mean that the end results give a false reading of the effect of diet on weight
External validity	Relates to our ability to generalise the findings of the research to other people and places: specific healthcare contexts and/or populations may not be applicable to other contexts and/or populations	If the sample used was comprised entirely of men over the age of 60 years old, it would be difficult to generalise the results to other groups in the wider population. Similarly, community contexts may not produce findings applicable in the acute setting
Reliability	Concerns the consistency of the data collected: using well recognised and well calibrated data collection tools will always produce more consistent and thereby reliable results	If the researchers in the above example were to use a broken set of scales to measure participants' weight, the data provided would be inconsistent

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trustworthiness. This often causes confusion as to exactly which of these is most significantly affected in any given instance.

Table 3 simplifies this by applying the above concepts to various elements of the research process. These concepts are interrelated and mutually interdependent – were internal validity to be compromised, it is unlikely the research would possess either reliability or external validity. It would be necessary to use both sets of terms for each respective element in mixed-methods research.

Explanatory notes

The following discussion clarifies the questions posed in the framework (Table 4) and helps to identify issues that you should look out for.

The research question

Questions A and B

It is important that researchers state the purpose or aim of their research. Failure to do this can leave the reader confused as to what exactly they are trying to achieve. A paper that is clear and unambiguous in describing the study’s aim enables readers to establish the precise purpose of the study and its applicability to their own fields of practice.

From a qualitative perspective, it is equally important for researchers to elaborate on the exact nature of the research. For example, if the researchers were exploring the effect of pressure ulcers on the quality of life, it would be important to highlight the specifics of their approach – which patients, what types of pressure ulcers and what aspects of quality of life did they investigate?

Question C

From a quantitative perspective, it is important to state any hypothesis being investigated. A hypothesis will not be present in all quantitative research – rather, hypotheses will be present in studies that aim to assess differences between variables, such as the effects of differing types of wound dressing on healing rates. In such instances, it is important to identify the specific variables being investigated – for example, healing rate (dependent variable) would depend on the type of wound dressing (independent variable). You should be aware of how many conditions of the independent variable exist. For example, a study investigating wound healing rates could look at numerous types of dressing.

The design

The approach taken for the research should be clear and unambiguous. As well as the

Table 2. Terms used in the appraisal of qualitative research

Term	Definition	Example
Credibility	Relates to the accuracy of data collection: poorly constructed research designs would limit the credibility of any paper	An exceptionally short interview, conducted in a busy public setting, would be unlikely to capture the participants’ true feelings on any given issue. Hence, we would not have an accurate or credible insight into the participants’ views
Transferability	Relates to the applicability of the research in other contexts and with other people: by providing a rich description of the context, the population and the research setting, applicability can be considered	Research conducted in a community setting may not always be applicable to acute settings and vice versa
Dependability	Relates to the replicability of the research: transparency regarding research methods will support the dependability of a study	Researchers who are explicit about how they selected the sample, how they devised their interview schedule, what questions they asked in interviews and how they analysed data are more likely to leave a pathway other researchers can follow
Confirmability	Relates to the degree of ‘objectivity’ demonstrated: any evidence of bias will invariably lead to a reduction in the confirmability of any given study	Researchers with a vested interest in the phenomenon being investigated may taint the research with their own pre-existing perspectives

general design – qualitative, quantitative or mixed-methods – the methodological approach should also be apparent. For instance, has the author employed a phenomenological (Smith et al 2009), ethnographic (Hammersley and Atkinson 1995) or grounded theory (Glaser and Strauss 2017) approach for a qualitative study? Lack of clarity here makes it difficult to establish the researchers’ motives, raising questions about the quality of the research.

The setting

It is always worth considering geographical location, as fundamental differences may exist with regards to healthcare provision and delivery and cultural variances, making it difficult to generalise the research’s findings to other settings. An issue to consider here would be attempting to apply research conducted in an inpatient setting to that of a community setting, for example. Similarly, the health profiles of rural communities may differ markedly to those of urban communities.

Sampling

The four components of this question all relate to the manner with which the researchers acquired the sample.

Question A

It is good practice to identify a specific sampling method. For example, it is common in qualitative research to use a purposive sampling technique (Etikan et al 2016), while in quantitative research, we may expect to find various forms of probability sampling (Polit and Beck 2014). Identifying the sampling method helps us to establish the degree of bias, if any, that may have crept into selecting the sample, which assists us in determining the representativeness of the sample.

Question B

Sample representativeness can be further exacerbated or minimised with regards to how potential participants are approached – did the researchers approach potential participants or offer an incentive? A gatekeeper may be used to contact potential participants and can reduce biases caused by these approaches, but gatekeepers may also be biased. As ever, there is a trade-off in any decision made in research.

Questions C and D

An important factor in considering the representativeness of any piece of

Table 3. Constructs related to the stages of the research process

Stage	Reason	Quantitative term	Qualitative term
Research question or hypothesis	Questions and hypotheses that are ill-defined are likely to lead to unfocused forms of research	Internal validity	Credibility
Study design	It is imperative that the research design is suited to the aim of the research	Internal validity	Credibility
Setting and sampling	It is difficult to generalise when the sample and/or location is unrepresentative	External validity	Transferability
Data collection methods	Poor data collection techniques invariably produce inaccurate findings	Internal validity	Credibility
Data collection tools	Poorly calibrated or subjective measures give inconsistent responses	Internal validity and reliability	Credibility and dependability
Data analysis	If data analysis techniques are not fully described, repetition of this process becomes difficult	Reliability and internal validity	Dependability
The researcher	Impartial researchers are less likely to produce research that is biased	Internal validity	Confirmability

Table 4. Critical appraisal framework

Study aspect	Type of study	Questions to ask
Research question	All	A) Is a clear question or focus identified? B) Is the subject/phenomenon of interest clearly identified?
	Quantitative	C) What is the hypothesis? With.....as the independent variable and as the dependent variable, including number of levels
Design	All	A) Is this study qualitative, quantitative or mixed-methods? B) What specific type of design is being used - for example, randomised controlled trial, single-blind crossover design, ethnography or phenomenology? C) Is this particular design suitable, considering the question being asked? D) Would a different design have measured more precisely the phenomenon being observed? If so, why?
Setting	All	A) Where does the study take place? B) Are there any peculiar characteristics of the study's setting and/or context? C) Are there any unique characteristics of the study's setting? D) Are the participants found in the location of the study likely to be similar to those in other settings? E) Are the eligibility criteria appropriate to the aims of the study?
Sampling	All	A) What sort of sampling strategy is involved and was it appropriate? B) How were potential participants approached? C) How many people are in the sample? D) Do the researchers justify the sample size (for example, using a power calculation for quantitative studies)? E) Who was - and how were they - included or excluded? F) Is the sample unique in any way? G) Do all initial participants complete the research? If not, do the researchers adequately explain this?
	Quantitative survey	H) Is a response rate indicated?
	Quantitative	I) Is the sample randomly selected?
Data collection	Survey or questionnaire	A) Have the researchers used a validated questionnaire, survey or checklist? B) Do the researchers pilot the questionnaire or seek any peer, patient and public involvement or feedback? C) Do the researchers provide evidence of the types of questions asked? D) Is there any evidence of leading or misleading questions? E) What is the response format - for example, five-point Likert scale or yes/no response?
	Experimental research designs	A) Are the participants randomly allocated to different groups? If so, how? B) Does any form of 'blinding' occur? C) What is the administered intervention? What happens to the intervention and control groups? Dosage? D) What do other groups - for example, the control group - receive? E) Are there problems in terms of how the interventions were administered? F) What data collection tools were used to assess the effects of the interventions - for example, visual analogue scale or standardised inventory?
	Interview or focus groups	A) Do the researchers provide evidence of an interview schedule and, if they do, how they created it? B) Do they provide a list of questions? C) How did they record the interviews? D) How long did the interviews last? E) In which locations did they conduct the interviews?
	Observational research	A) What method of observation did the researchers use - for example, overt, covert, participant or non-participant? B) Was the researchers' presence likely to have upset the setting being observed ('the Hawthorne effect')? C) Was an adequate period of time spent observing? How long was it?
	General	A) Are the methods appropriate to the type of study undertaken? B) Are there any advantages to using this method of collecting data? C) Are there any disadvantages to using this method of collecting data? D) Did the researchers pilot the methods of collecting data? E) Did they use multiple methods of collecting data throughout ('triangulation')?
Data analysis	All	A) How did the researchers analyse the data? Was this appropriate? B) Do they provide sufficient information about the techniques used to analyse the data? C) Do the researchers use any pre-existing frameworks in their analysis? D) Is there any example of a follow-up to confirm the data collected, such as member checks, peer review, audit trail or a reflexive diary (all for qualitative research)?
Findings/ results	All	A) How were the results presented? B) Are they presented clearly and unambiguously?
	Qualitative	C) Are there any clear findings? What are they?
	Quantitative	D) Are there any statistically significant findings? What are they?
	Quantitative and qualitative	E) Is there anything here that could or should be applied in practice?
Any conflicting interests	All	A) Who are the researchers? B) Do they give a rationale as to why they are conducting the study? C) Are there any conflicting interests that may influence its outcome?
Ethics	All	A) Has the study received ethical approval?

research is the sample size. The use of a power calculation can help to determine an appropriate sample size in quantitative research (Clark-Carter 1997), but qualitative research is much more reliant on the researchers' judgement for determining sample size (Patton 2014). Furthermore, the demands of qualitative research necessitate that sample sizes are relatively small (Patton 2014).

Nonetheless, methodological questions can be raised if it does not appear that a sample size is likely to yield enough information to provide a depth and understanding of the phenomenon being investigated. This can be countered by the researchers achieving data saturation (Guest et al 2020), whereby the data produced from the sample have seemingly covered all the main themes that are likely to be generated.

Question E

The tighter the inclusion criteria, the harder it is to generalise. This would be most notable with regards to quantitative research, but it is not entirely redundant in qualitative research. A good rule of thumb is to assume that we can only generalise to those represented in the sample, though we should give greater degree of flexibility to qualitative studies, where the depth of the data should have precedence over the specifics of the sample's composition.

Data collection

Completing this section of the checklist will depend on the methodological approach employed. Hence, there are four sections relating to the four major approaches.

Survey or questionnaire

Question A

It could be considered beneficial to use a survey that has been used in other research, as there is a degree of standardisation evident, which bolsters the reliability and validity of measurement. This is not to suggest that such tools would be without fault or flaw.

Question B

Pilot testing will further strengthen the methodological quality of any given piece of survey research, even, at its most basic level, in terms of testing the applicability of the tool to the desired area of research.

Questions D and E

Similarly, when researchers provide evidence of questions used in their survey, we are better placed to determine if the questions are appropriately worded and whether the response format offers enough variation in response options to enable participants to accurately record their respective views.

Experimental research designs

With regards to experimental research, there is a degree of precision expected for studies to achieve valid results.

Question A

The first stage of this would be the random allocation of participants to treatment groups, which would help remove any form of selection bias on behalf of those conducting the trial. It is important to ensure that this was achieved through a concealed method, so as to maintain its integrity.

Question B

Blinding would be a technique used to eliminate unwanted effects on behalf of the participants and/or the researchers. In this respect double or triple blinding would be preferable to single blinding. However, it is worth noting that blinding would not be possible in cases where there is a clear and obvious difference between the treatment groups – for instance, a study testing the effectiveness of analgesia prescribed by a clinician versus one prescribed by a patient.

Questions C, D and E

A fundamental consideration is how interventions differ between groups, particularly when inequity exists in the manner respective treatments are

administered, such as in multi-centre studies where maintaining a strict protocol becomes problematic. Fundamentally, a failure to maintain strict control over experimental processes enables other factors (extraneous variables) to interfere with measurement procedures, thereby reducing the overall validity of the study.

Question F

This will clearly influence the effectiveness of any data collection tools used, but it can be countered by including an adequate control group. The effects of performance bias can be monitored via follow-up procedures, and to ensure that all involved in the trial are accurately following protocol. You should also consider whether the tools used by the researchers are appropriate and – much as with survey designs – are valid and reliable measures of the phenomenon being investigated.

Interview or focus groups

It is vital that researchers provide a rich description of their methods and of the context in which they conducted their research is conducted.

Questions A and B

In interview research, researchers need to be clear and transparent in detailing their methods of collecting data. Hence, evidence of an interview schedule or questions discussed will enable the reader to determine the degree of consistency in how the researchers approached the interviews.

Question C

Likewise, the method of recording the interviews is important to ensure data are not lost, which may be the case if researchers take notes, as opposed to using an audio recorder.

Questions D and E

You can determine methodological rigor from details about the length of interviews and their locations. Here it is worth considering the nature of the

subject being investigated – although a participant's home may be appropriate for an interview concerning perspectives of care, it would not be for an investigation of domestic abuse.

Observational research

Question A

Perhaps the most important element of any observational study is the manner in which the researcher actually observes – whether it is as participant or non-participant, overtly or covertly.

Question B

Such information also helps establish the presence of the Hawthorne effect, which relates to the view that those who are aware they are being observed will modify their 'normal' behaviour (Landsberger 1955, 1958). This effect can be minimised by familiarity with observation, even where the observation is of an overt nature.

General

Question A

A question to raise when considering the general aim of the research is whether the approach selected was appropriate. For example, to understand an issue such as the experience of being homeless, it is important to enable participants to express themselves openly, to help our own understanding; limiting participants' responses by using a survey would reduce the level of the knowledge acquired.

Question E

'Triangulation' involves implementing several strategies for collecting data to provide a more comprehensive picture. For instance, a qualitative researcher may decide to use interviews and observational methods, to better understand interactions between nurses and patients. The interviews may present a certain perspective, which may be very different from the perspective intuited through observation. However, both methods combine to provide a fuller, more comprehensive understanding.

Data analysis

When assessing the techniques used in quantitative research, one of the initial questions to raise is whether the researchers used descriptive or inferential testing. Descriptive statistics are used to present data in ways such as frequencies and percentages; inferential statistics seek to ‘infer’ the strength of a relationship between variables – does one have an effect on another? Certain assumptions about the nature of the data need to be true, for many tests to run effectively. However, from the perspective of critiquing research, it is perhaps a moot point as to whether the correct test was selected, should the previous stages of the research process be flawed.

Qualitative data analysis is different to its quantitative counterpart. It is important that researchers are clear and concise in detailing exactly how they have analysed their data. Perhaps the most common qualitative method of analysis is thematic. This involves the researcher searching for prevalent ideas or themes in the raw data – typically, field notes or interview transcripts. There are several guidelines and frameworks they can use (Burnard 1991, Braun and Clarke 2006, Abaos et al 2016), but much will depend on the specific approach used throughout.

If researchers provide an in-depth overview of the methods and techniques they used, this may enable the reader to determine the transparency and likely trustworthiness of the process. There are techniques that researchers can use to further enhance credibility, such as member-checking, peer review and using an audit trail or reflexive diary. Evidence of these is likely to make the data analysis more rigorous.

Nevertheless, researchers may have justifiable reasons for omitting these processes. For example, participants may be unwilling to further discuss the issue being investigated, thereby precluding the use of member checking or respondent validation. This may be the case if the phenomenon of interest is one that is

likely to evoke highly emotive responses from participants.

Findings/results

The findings are the culmination of the research and must be assessed with regards to the stages involved in the creation of the data. Before doing this and determining any relevant – or irrelevant – implications for practice, it is important to consider any evidence of reporting bias that may have had a detrimental effect on how the data have been managed and presented.

Any conflicting interests

You should establish if there are any issues relating to funding or any conflicting interests that may have influenced the research. An obvious example is of a pharmaceutical corporation funding research into its own product, but biases may be far more subtle. For instance, a staff nurse conducting qualitative research into patients’ experiences of care may be inclined to view the data in a particular light based on her own perceptions of the care provided. It is therefore important that researchers are transparent about any factors that may have influenced them.

Ethics

Consider the ethics in how the study is constructed and conducted. Always ensure that an appropriate research ethics and governance committee has granted the researchers ethical approval, if it is appropriate for the type of research being conducted – systematic reviews and some types of documentary analysis do not require formal ethical approval, for example.

Another important aspect is whether the researchers considered ethical issues at all stages of the study. For example, did they consider how they presented information to potential participants? Children and young people (Twycross 2009) and people with learning difficulties (Department of Health and Social Care 2010) need appropriate information presented in suitable formats.

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The researchers should have adequately explained how they informed potential participants about the study – or explained their rationale, if they did not fully inform participants about the nature of the study (Heale and Shorten 2017). Likewise, an explanation about how they obtained and recorded consent should be present, alongside consideration of how they maintained anonymity, confidentiality and privacy. Confidentiality might be breached in some instances, such as safeguarding young and vulnerable participants; informed consent might be tricky to obtain in some types of observational research (Moore and Savage 2002).

As nurses, it is also essential to consider and reflect on the principles of autonomy, beneficence, non-maleficence and justice, which are the tenets of the nursing profession (Nursing and Midwifery Council 2018).

Conclusion

The applicability of research to practice forms the basis of the reviewing process and of this conclusion. Having considered the main stages of any paper, it is important to determine whether there are any fundamental issues that may mean the findings of the evidence being reviewed are inappropriate to your own area of practice.

Although there will always be some potential issues regarding context, it is worth considering the methodological aspects of the paper that have been highlighted as you have worked through the framework (Table 4). For example, a fundamental flaw in sampling methods will invariably weaken data collection and so on. This would be a reason to question the validity or trustworthiness of the paper or to look for other evidence to either support or refute it. Poorly constructed data collection will produce similar issues.

Table 5 acts as a guide to summarise these issues and to help determine applicability to your own given area of practice. Use this table to highlight the methodological quality of the various stages of the paper you are reviewing, by inserting ‘yes’ or ‘no’. This will help to determine the overall quality of the article and its resultant application to practice. You can also use this to record any notes that you think are significant for each of these elements.

Ultimately, research that is fundamentally flawed would be difficult to apply in practice. Conversely, well-constructed research will help to illuminate areas for practice development. To this end, we hope that the paper provides a useful tool in the development of evidence-based practitioners.

Table 5. Concluding/determining applicability to practice			
	Fundamental flaws evident	Some minor issues/queries	Robust and applicable
Contextual factors	Yes/No Comments:	Yes/No Comments:	Yes/No Comments:
Sampling methods	Yes/No Comments:	Yes/No Comments:	Yes/No Comments:
Data collection methods	Yes/No Comments:	Yes/No Comments:	Yes/No Comments:
Data analysis techniques	Yes/No Comments:	Yes/No Comments:	Yes/No Comments:
Findings	Yes/No Comments:	Yes/No Comments:	Yes/No Comments:
Applicable to practice	Yes/No Comments:		

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