

The quality of mixed methods studies in health services research

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Objectives: To assess the quality of mixed methods studies in health services research (HSR).

Methods: We identified 118 mixed methods studies funded by the Department of Health in England between 1994 and 2004, and obtained proposals and/or final reports for 75. We applied a set of quality questions to both the proposal and report of each study, addressing the success of the study, the mixed methods design, the individual qualitative and quantitative components, the integration between methods and the inferences drawn from completed studies.

Results: Most studies were completed successfully. Researchers mainly ignored the mixed methods design and described only the separate components of a study. There was a lack of justification for, and transparency of, the mixed methods design in both proposals and reports, and this had implications for making judgements about the quality of individual components in the context of the design used. There was also a lack of transparency of the individual methods in terms of clear exposition of data collection and analysis, and this was more a problem for the qualitative than the quantitative component: 42% (19/45) versus 18% (8/45) of proposals ($p = 0.011$). Judgements about integration could rarely be made due to the absence of an attempt at integration of data and findings from different components within a study.

Conclusions: The HSR community could improve mixed methods studies by giving more consideration to describing and justifying the design, being transparent about the qualitative component, and attempting to integrate data and findings from the individual components.

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Introduction

Mixed methods studies are common in health services research (HSR).¹ They consist of two separate components of data collection and analysis within a single study: at least one quantitative method with structured data collection and statistical analysis, and at least one qualitative method with less structured data collection and thematic analysis.² Commissioners and consumers of research, as well as researchers themselves, need to judge whether a mixed methods study has been undertaken well or poorly, assessing whether it is good mixed methods research as well as good research. The quality of mixed methods research has been considered explicitly in health, educational and social research,^{3–8} and implicitly when researchers have discussed the challenges of designing and implementing these studies.^{9,10} However, the issue has received little

consideration overall, with a recent search for quality criteria for mixed methods research concluding that there were none available,⁷ even though attempts have been made to develop them.³ Given that there are no agreed criteria for assessing the quality of these studies,⁸ and that researchers are still debating the meaning of quality for mixed methods research,⁶ it is premature to attempt to develop definitive criteria. Instead, it seems sensible to follow an approach taken by researchers considering quality in the context of synthesizing qualitative and quantitative evidence¹¹ and devise a set of questions which could be applied to mixed methods primary research to facilitate judgements about quality. We devised a set of ‘quality questions’ and applied them to proposals and reports of mixed methods studies to assess the quality of mixed methods studies in HSR.

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Methods

This research was part of a wider study exploring the use of mixed methods research in HSR. The wider study consisted of a quantitative documentary analysis of 75 mixed methods studies to determine the type

and quality of mixed methods research undertaken, and qualitative interviews with 20 researchers to explore facilitators and barriers to exploiting the potential of this approach.^{1,12}

Devising questions about quality

We devised a framework for the quality assessment based on detailed consideration of the literature on mixed methods research in the fields of health, social and educational research. We searched the health databases MEDLINE and CINAHL. We then sought expert opinion encapsulated in key textbooks.^{10,13–20} Finally we searched the Social Science Citations Index, PsycINFO, ERIC and the British Education Index to identify social, behavioural and educational research. The search for literature took place in 2003 and was updated in 2006. Quality was one of 11 issues identified in this review.

Within the literature, one suggested assessment criterion for mixed methods studies was whether they had been completed successfully in terms of adequately addressing the research questions with allocated resources.⁵ Other researchers focused on the quality of methods. There was no suggestion of using a tool developed for generic use across all designs. Rather, researchers attempted to develop quality criteria by devising separate lists of criteria for the quantitative and the qualitative research.⁷ Their assumption was that methods are linked to paradigms and therefore the criteria used to assess different methods should also be linked to paradigms.⁷ However, not everyone agrees that methods are paradigm-specific¹⁸ or that different criteria are needed for qualitative and quantitative research.²¹ The same criteria have been proposed for both²¹ although the appropriate means for judging against these criteria may differ because of the research practices employed in different methodological approaches. The mixed methods design¹⁰ and the integration between methods³ can be assessed as well as the individual methods. A good mixed methods study clearly justifies why a mixed methods approach is necessary or superior to another, offers transparency of the mixed methods design, and offers appropriate sampling, data collection and analysis of individual components relating to that design.^{3,4,10} Thus the design may determine the criteria used to make judgements about the individual components of the study. Integration of data or findings from each component is a key part of mixed methods research,¹⁰ distinguishing it from qualitative and quantitative studies undertaken independently. When integration occurs, it is important that data transformations are defensible, that contradictory findings are explained and convergent findings are not related to shared bias between methods.³ Expertise may be needed within a research team to integrate at the analysis stage.²² Finally, researchers have discussed the importance of inferences from mixed methods studies being trustworthy⁶ and appropriate in the light of the design used.³ As yet

there are no criteria for assessing the quality of inferences from mixed methods research, although researchers are considering the complexity of this issue.²³

When developing the framework for our quality questions we chose not to use a generic tool because they have variable applicability across different research designs.²⁴ We chose to assess the qualitative and quantitative components separately because they each contribute to the study as a whole and because the quality of one or both components may suffer as a consequence of being part of a mixed methods study.^{25–27} In addition to the individual components, we included an assessment of the success of the study, the design, the integration and the inferences. Within this framework we constructed questions based on the literature review and reading the proposals and reports from four mixed methods studies in HSR.

Identifying mixed methods studies

In 2004, mixed methods studies were identified through a systematic search of summaries of studies funded by the Department of Health, a key commissioner of health services research in England at that time. The methods have been described elsewhere^{1,12} and are summarized here. Summaries of single studies funded between 1994 and 2004 through 10 programmes were read. The programmes were: Health Technology Assessment; Service Delivery and Organization; New and Emerging Applications of Technology; Policy Research Programme; and the NHS Research & Development programmes of maternal and child health, primary and secondary care interface, cardiovascular disease and stroke, forensic mental health, primary dental care, and promoting implementation of research findings. A total of 118 mixed methods studies were identified. The lead researcher of each study was written to with a request for the research proposal, the final report for completed studies and a list of any emerging publications.

Application of quality questions

A data extraction form was devised which consisted of the quality questions with the tick box options of 'yes', 'yes, but improvements are possible', 'no', 'not enough information (NEI)' and 'not applicable (N/A)'. Space for open comments was available alongside each question, where the assessor (AOC) could record details of good and poor practice. The data extraction form was applied to each study by one researcher, first to the proposal and then to the report. Finally, any differences between the proposal and report were noted.

Analysis

The structured data were entered into SPSS. The main analysis was descriptive, displaying the proportions of proposals and reports falling into each category of each question. The chi-squared test was used when

comparing results for the individual qualitative and quantitative components. Open comments were quantized²⁸ by transcribing them into Word, grouping them into themes, and counting the number of studies in which a theme occurred.²⁹

Results

Documentation was received for 75 mixed methods studies. Full proposals were obtained for 60% (45/75) of the studies. Final reports were only available for the 52 studies completed by the time of data collection, and were obtained for 92% (48), although one was a summary report that was too brief for inclusion in the assessment of quality, leaving 47 reports. Both a proposal and report was available for 20 studies.

Success

The potential to produce a successfully completed study was assessed using the research proposals. In most proposals, the quantitative methods appeared to be feasible within the time and money allocated (Table 1). However, even recognizing that some aspects of qualitative research cannot be fixed at the design stage (e.g. sample size for theoretical sampling), there was not enough detail to determine the feasibility of the qualitative methods in one-third of studies – for example, no indication of numbers of interviews to be undertaken or no indication of when the qualitative research would be conducted in the study timetable. We had concerns about the feasibility of the qualitative component in another one-third of proposals. From the open comments we identified 14 proposals where a large number of qualitative interviews were planned in a short time scale – for example, 40 interviews in four months without specifying the depth of interview and analysis. In nine of these studies the report was available and in four cases considerably fewer interviews were undertaken than planned. However, concerns highlighted about the feasibility of the qualitative research did not necessarily translate into shortfalls in the final study.

We defined a successful study as one that produced everything that had been planned at the proposal stage. A direct comparison of the final study report with the proposal was only possible on the subset of 20

studies for which both were available. In other cases the assessment relied on researchers detailing the planned and implemented study within their final report. Non-completion of a whole component of a study was rare (Table 1). However, in one-fifth of reports, one of the methods within a component was not executed as planned. This tended to be due to a range of problems in the field.

Mixed methods design

A justification for using mixed methods research was only given in one-third of proposals and reports (Table 2). A minority of studies explicitly articulated the design in terms of the priority of methods, the purpose of combining methods, the sequence of methods and the stage at which integration would or did occur. It was particularly helpful for the subsequent quality assessment of individual components if researchers were explicit about the priority of methods and the role of any less dominant method. For example, it seemed inappropriate to have 40 in-depth interviews as a preliminary aid to develop a questionnaire, but appropriate if these interviews were also to be used as a primary means of investigating the issue under study. A lack of transparency of the overall design could occur in the context of excellent description of individual components.

When the design was not discussed explicitly it was usually possible to work out the key elements from reading the documentation. In most cases the design was assessed as appropriate for addressing the research question. However, researchers rarely discussed issues of rigour in relation to the design employed. An example of addressing rigour for the design was where researchers proposed that qualitative findings would not be shared with quantitative colleagues undertaking a randomized controlled trial to minimize the possibility of contamination of that trial; in another two studies, the qualitative research was undertaken with people not participating in the trial in order to avoid contaminating the trial. While the extent to which this attention to contamination avoidance was necessary may be debatable, it constitutes some evidence that researchers had given serious consideration to design issues related to mixed methods research.

Table 1 Assessment of the success of mixed methods studies in HSR

	Proposal (n = 45)				Report (n = 47)			
	Yes	Yes, but	No	NEI or N/A	Yes	Yes, but	No	NEI or N/A
1 Is the quantitative component feasible?	82%	2%	4%	11%				
2 Is the qualitative component feasible?	38%	20%	13%	29%				
3 Is the mixed methods design feasible?	51%	0%	7%	42%				
4 Have both qualitative and quantitative components been completed?					87%	6%	2%	4%
5 Were some quantitative methods planned but not executed?					19%	0%	45%	36%
6 Were some qualitative methods planned but not executed?					21%	2%	38%	38%
7 Did the mixed methods design work in practice?					85%	0%	2%	13%

NEI, not enough information; N/A, not applicable

Table 2 Assessment of the mixed methods design of studies in HSR

	Proposal (n = 45)				Report (n = 47)			
	Yes	Yes, but	No	NEI or N/A	Yes	Yes, but	No	NEI or N/A
1 Is the use of mixed methods research justified?	31%	3%	60%	4%	30%	2%	66%	2%
2 Is the design for mixing methods described?								
Priority	16%	2%	78%	4%	15%	0	83%	2%
Purpose	42%	0	53%	4%	34%	4%	60%	2%
Sequence	56%	0	40%	4%	49%	0	49%	2%
Stage of integration	24%	0	71%	4%	21%	0	77%	2%
3 Is the design clearly communicated?	80%	0	16%	4%	81%	4%	9%	6%
4 Is the design appropriate for addressing the research questions?	87%	2%	2%	9%	87%	0%	2%	11%
5 Has rigour of the design been considered (proposal) or adhered to (report)?	7%	0	93%	0%	21%	0%	0%	79%

NEI, not enough information; N/A, not applicable

Quantitative component

The roles of the quantitative methods were usually communicated well within proposals and reports (Table 3). However, sufficient details were sometimes not given about these methods. In eight proposals the quantitative methods were only sketchily described and in a further 13 proposals some aspects of the quantitative methods were not described, in particular, the analysis (8) and the numbers involved (5). This was less of an issue for reports but nonetheless there were still problems with sketchy description overall (4) or little or no description of the analysis (5). This lack of transparency made it difficult to assess other aspects of quality.

Validity of the methods within the quantitative components was assessed by considering the attention researchers gave to issues such as confounding and bias. Validity was explicitly discussed in two-thirds of proposals, with little evidence that the rigour of any method was compromised (Table 3). There were few examples of an individual method being compromised by the mixed methods approach. One example was a Delphi exercise which was restricted in order to fit the timetable of the qualitative fieldwork.

It was difficult to determine the sophistication of proposed analyses due to the lack of detail about analysis in the research proposals. There was more information about analyses available in research reports and here

concerns were identified about the sophistication of one-quarter of quantitative analyses. We identified 12 studies where the reported quantitative results seemed simplistic, sometimes only presenting descriptive statistics with no statistical tests and in two cases using an experimental design which was then ignored in the analysis.

Qualitative component

The roles of the qualitative methods were usually communicated well within proposals and reports (Table 4). However, qualitative methods were often not described in sufficient detail and this occurred more frequently than for the quantitative components, both within proposals (p = 0.011) and reports (p = 0.08). First, there was sketchy description of the qualitative methods overall (15 proposals and 11 reports). In three of these reports there was no description of the qualitative methods at all, only the findings. Second, there were no details about an important aspect of the qualitative research, particularly the analysis (six proposals and nine reports). Third, one method was described in detail, usually interviews with a particular group, but a further qualitative method such as observation or focus groups appeared to be ‘tagged on’ with no description (six proposals). Fourth, the overall size of the qualitative component was not clear, with a few

Table 3 Assessment of the quantitative component of mixed methods studies in HSR

	Proposal (n = 45)				Report (n = 47)			
	Yes	Yes, but	No	NEI or N/A	Yes	Yes, but	No	NEI or N/A
1 Is the role of each method clear?	98%	0%	2%	0%	96%	2%	0%	2%
2 Is each method described in sufficient detail?	53%	29%	18%	0%	68%	13%	15%	4%
3 Is each method appropriate for addressing the research question?	93%	0	2%	4%	98%	0%	0%	2%
4 Is the approach to sampling and analysis appropriate for its purpose?	67%	4%	4%	24%	70%	9%	6%	15%
5 Is there expertise among applicants/authors?	67%	2%	7%	24%	30%	0%	0%	70%
6 Is there expertise on the team to undertake each method?	60%	0%	2%	24%				
7 Have issues of validity been addressed for each method?	64%	0%	30%	7%	49%	4%	40%	6%
8 Has the rigour of any method been compromised?	7%	0%	91%	2%	9%	4%	83%	4%
9 Is each method sufficiently developed for its purpose?	84%	0%	7%	9%	83%	0%	4%	13%
10 Is the (intended) analysis sufficiently sophisticated?	56%	4%	2%	38%	51%	15%	25%	9%

NEI, not enough information; N/A, not applicable

Table 4 Assessment of the qualitative component of mixed methods studies in HSR

	Proposal (n = 45)				Report (n = 47)			
	Yes	Yes, but	No	NEI or N/A	Yes	Yes, but	No	NEI or N/A
1 Is the role of each method clear?	87%	0%	9%	4%	92%	4%	4%	0%
2 Is each method described in sufficient detail?	24%	29%	42%	4%	38%	28%	30%	4%
3 Is each method appropriate for addressing the research question?	87%	7%	2%	4%	91%	2%	2%	4%
4 Is the approach to sampling and analysis appropriate for its purpose?	42%	4%	9%	40%	53%	9%	4%	34%
5 Is there expertise among the applicants/authors?	56%	2%	11%	31%	32%	4%	0%	64%
6 Is there expertise on the team to undertake each method?	44%	9%	7%	40%				
7 Have issues of validity been addressed for each method?	24%	0%	64%	11%	30%	2%	57%	11%
8 Has the rigour of any method been compromised?	2%	0%	91%	7%	6%	2%	81%	11%
9 Is each method sufficiently developed for its purpose?	64%	0%	9%	27%	77%	2%	9%	13%
10 Is the (intended) analysis sufficiently sophisticated?	40%	4%	7%	49%	51%	13%	19%	17%

NEI, not enough information; N/A, not applicable

interviews here and there throughout the study adding up to a sizeable qualitative component of over 100 interviews (10 proposals).

Validity of the methods within the qualitative components was assessed by considering the attention researchers gave to issues such as reflexivity and negative cases. Validity was not addressed within proposals for more qualitative than quantitative components ($p = 0.001$), although any apparent difference in reports was not statistically significantly different ($p = 0.100$) (Table 4). Researchers did take the validity of qualitative methods seriously in some proposals, for example, paying attention to deviant cases and peer review of transcripts.

Concerns were identified with the sophistication of one-fifth of qualitative analyses. In nine studies the reported qualitative findings remained at a descriptive level, or reported findings in a quantitative manner only, or failed to distinguish between data collected using different methods such as focus groups and interviews.

Integration

Integration of data or findings from the different methods received little attention in either proposals or

reports, with researchers rarely discussing the type of integration, how it occurred in the context of team working and who was involved in it (Table 5). Because of the lack of integration, questions about the appropriateness of integration and the effect of integration on the rigour of individual methods were irrelevant.

Inferences

In the reports, researchers were clear about which results had emerged from which methods, and inferences seemed appropriate (Table 6). For one-fifth of studies there was a concern that the inferences were based disproportionately on one method rather than the findings of all the methods. The imbalance was likely to be towards qualitative findings as it was towards quantitative findings.

Discussion

The quality of studies in HSR

Mixed methods studies tend to be successful in HSR insofar that the qualitative and quantitative components are usually completed as planned. The main quality issue identified was a lack of transparency of the

Table 5 Assessment of integration in mixed methods studies in HSR

	Proposal (n = 45)				Report (n = 47)			
	Yes	Yes, but	No	NEI or N/A	Yes	Yes, but	No	NEI or N/A
1 Is the type of integration stated?	11%	0%	84%	4%	2%	2%	94%	2%
2 Is the type of integration appropriate to the design?	16%	0%	0%	84%	34%	0%	2%	64%
3 Has enough time been allocated for integration?	2%	0%	13%	85%				
4 Is the approach to integration detailed in terms of working together as a team?	7%	0%	80%	13%				
5 Does the dissemination strategy detail how the mixed methods will be reported in final reports and peer-reviewed publications?	0%	0%	84%	16%				
6 Are the personnel who participate in the integration clearly identified?	9%	0%	80%	11%	6%	0%	70%	23%
7 Did appropriate members of the team participate in integration?					0%	0%	2%	98%
8 Is there evidence of communication within the team?					19%	0%	6%	75%
9 Has rigour been compromised by the process of integration?					4%	0%	0%	96%

NEI, not enough information; N/A, not applicable

Table 6 Assessment of the inferences made in completed reports of mixed methods studies in HSR

	Report (n = 47)			
	Yes	Yes, but	No	NEI or N/A
1 Is there clarity about which results have emerged from which methods?	87%	2%	6%	4%
2 Are inferences appropriate?	83%	4%	9%	4%
3 Are the results of all the methods considered sufficiently in the interpretation?	66%	6%	19%	9%

NEI, not enough information; N/A, not applicable

mixed methods aspects of the studies and the individual components. The qualitative components were more likely to be poorly described than the quantitative ones. To some extent the poor description of qualitative methods is not a surprising finding given the historical dominance of quantitative methods in HSR. However, it raises concerns that the HSR community may be failing on occasions to exploit the potential of qualitative methods within mixed methods studies. Where a qualitative component is in a supporting role to a more dominant method, and does not have stand-alone status in terms of independently addressing an aspect of the research question, then limited description is acceptable. However, because researchers were often not explicit about the status of methods within the study design, it was difficult to make judgements about the individual components in the context of the design used. Integration of data and findings is a key part of mixed methods research. There was no evidence that inappropriate integration was undertaken because there was a tendency for researchers to keep the qualitative and quantitative components separate rather than attempt to integrate data or findings in reports or publications.¹²

Developing quality criteria for mixed methods studies in HSR

There was a lack of transparency in the reporting of mixed methods studies in HSR which made it difficult to assess other aspects of the quality of these studies. This has been identified as a problem facing the quality assessment of other types of studies¹¹ and has led to the development of guidelines for reporting studies. Creswell has suggested a list of issues to consider when designing a mixed methods study¹⁰ and we have considered this in conjunction with the literature on the quality of mixed methods studies to suggest some guidelines for Good Reporting of A Mixed Methods Study (GRAMMS) (Box 1). We present this as guidance for researchers rather than as a formal checklist.

Box 1 Good Reporting of A Mixed Methods Study (GRAMMS)

- (1) Describe the justification for using a mixed methods approach to the research question
- (2) Describe the design in terms of the purpose, priority and sequence of methods
- (3) Describe each method in terms of sampling, data collection and analysis
- (4) Describe where integration has occurred, how it has occurred and who has participated in it
- (5) Describe any limitation of one method associated with the present of the other method
- (6) Describe any insights gained from mixing or integrating methods

Limitations

The study is based on mixed methods research funded by one commissioner in one country. The response rate to requests for documentation for mixed methods studies was good but non-responders may have been more likely to be problematic studies, biasing the findings towards higher quality studies. The questions were devised and applied by one researcher (AOC) in the context of team discussions which meant that the data extraction process was unchallenged by an external source. A coding protocol was devised to accompany the data extraction form to aid transparency and reduce intra-rater variability. However the studies could have been rated differently by another researcher. Finally, the studies included were funded between 1994 and 2004 and improvements may have occurred since then.

We have taken a technical stance in our discussions of quality in mixed methods research. However, the philosophical stance adopted by researchers may affect the quality criteria they use, and wish to see applied to their studies. Subtle realism³⁰ has been proposed as a philosophical position appropriate for qualitative and quantitative research in health technology assessment.²¹ An implication of this stance is that researchers would need to consider whether reflexivity has been applied to the whole of a mixed methods study rather than simply the qualitative component.

Conclusions

This is the first attempt to consider the quality of mixed methods studies in HSR. We are not offering this as a definitive approach to be used by others, but to start the debate about how to assess and improve quality. We recommend that if we use mixed methods studies in HSR then we need to be more transparent about the design and the individual components in the context of the design, and attempt to integrate data and findings from the qualitative and quantitative methods.

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References

- 1 O’Cathain A, Murphy E, Nicholl J. Why, and how, mixed methods research is undertaken in health services research: a mixed methods study. *BMC Health Serv Res* 2007;**7**:85
- 2 Bryman A. Quantitative and qualitative research: further reflections on their integration. In: Brannen J, ed. *Mixing Methods: Qualitative and Quantitative Research*. Aldershot: Ashgate, 1992:57–78
- 3 Caracelli VJ, Riggan LJC. Mixed-method evaluation: developing quality criteria through concept mapping. *Eval Pract* 1994;**15**:139–52
- 4 Creswell JW, Fetters MD, Ivankova NV. Designing a mixed methods study in primary care. *Ann Fam Med* 2004;**2**:7–12
- 5 Datta L. A pragmatic basis for mixed-method designs. In: Greene JC, Caracelli VJ, eds. *Advances in Mixed-method Evaluation: The Challenges and Benefits of Integrating Diverse Paradigms*. San Francisco, CA: Jossey-Bass, 1997:33–46
- 6 Teddlie C, Tashakkori A. Major issues and controversies in the use of mixed methods in the social and behavioural sciences. In: Tashakkori A, Teddlie C, eds. *Handbook of Mixed Methods in Social and Behavioural Research*. London: Sage Publications, 2003:3–50
- 7 Sale JEM, Brazil K. A strategy to identify critical appraisal criteria for primary mixed method studies. *Quality and Quantity* 2004;**38**:351–65
- 8 Creswell JW, Plano-Clark V. *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: Sage Publications, 2007
- 9 Brannen J. Combining qualitative and quantitative approaches: an overview. In: Brannen J, ed. *Mixing Methods: Qualitative and Quantitative Research*. Aldershot: Ashgate, 1992:3–38
- 10 Creswell JW. *Research Design. Qualitative, Quantitative, and Mixed Methods Approaches*. 2nd edn. London: Sage Publications, 2003
- 11 Mays N, Pope C, Popay J. Systematically reviewing qualitative and quantitative evidence to inform management and policy-making in the health field. *J Health Serv Res Policy* 2005;**10** (Suppl. 1):6–20
- 12 O’Cathain A, Murphy E, Nicholl J. Integration and publications as indicators of ‘yield’ from mixed methods studies. *Journal of Mixed Methods Research* 2007;**1**:147–63
- 13 Brewer J, Hunter A. *Multimethod Research*. London: Sage Publications, 1989
- 14 Tashakkori A, Teddlie C, eds. *Handbook of Mixed Methods in Social and Behavioural Research*. London: Sage, 2003
- 15 Tashakkori A, Teddlie C. *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. London: Sage, 1998
- 16 Gorard S, Taylor C. *Combining Methods in Educational and Social Research*. Maidenhead: Open University Press, 2004
- 17 Brannen J, ed. *Mixing Methods: Qualitative and Quantitative Research*. Aldershot: Ashgate, 1992
- 18 Bryman A. *Quantity and Quality in Social Research*. London: Routledge, 1988
- 19 Greene JC, Caracelli VJ, eds. *Advances in Mixed-method Evaluation: The Challenges and Benefits of Integrating Diverse Paradigms*. San Francisco, CA: Jossey-Bass, 1997
- 20 Fielding NG, Fielding JL. *Linking Data*. Sage Publications, 1986
- 21 Murphy E, Dingwall R, Greatbatch D, Parker S, Watson P. Qualitative research methods in health technology assessment: a review of the literature. *Health Tech Assess* 1998;**2**:16
- 22 Mason J. Linking qualitative and quantitative data analysis. In: Bryman A, Burgess RG, eds. *Analysing Qualitative Data*. London: Routledge, 1994:89–110
- 23 Miller S. Impact of mixed methods and design on inference quality. In: Tashakkori A, Teddlie C, eds. *Handbook of Mixed Methods in Social and Behavioural Research*. London: Sage Publications, 2003:423–55
- 24 Katrak P, Bialocerkowski AE, Massy-Westropp N, Kumar VS, Grimmer KA. A systematic review of the content of critical appraisal tools. *BMC Med Res Meth* 2004;**4**:22
- 25 Silverman D. *Doing Qualitative Research. A Practical Handbook*. London: Sage Publications, 2000
- 26 Steckler A, Mcleroy KR, Goodman RM, Bird ST, McCormick L. Toward integrating qualitative and quantitative methods: an introduction. *Health Educ Q* 1992;**19**:1–8
- 27 Chen H. Applying mixed methods: a dominant methodology for the future? In: Greene JC, Caracelli VJ, eds. *Advances in Mixed-method Evaluation: The Challenges and Benefits of Integrating Diverse Paradigms*. San Francisco, CA: Jossey-Bass, 1997:61–72
- 28 Sandelowski M. Combining qualitative and quantitative sampling, data collection, and analysis techniques in mixed-method studies. *Res Nurs Health* 2000;**23**:246–55
- 29 O’Cathain A, Thomas KJ. “Any other comments?” Open questions on questionnaires – a bane or a bonus to research? *BMC Med Res Meth* 2004;**4**:25
- 30 Hammersley M. *What’s Wrong with Ethnography?* London: Routledge, 1992