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Article

Evaluating Approaches to Quality Assessment in Library and Information Science LIS Systematic Reviews: A Methodology Review

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Objective – Systematic reviews are becoming increasingly popular within the Library and Information Science (LIS) domain. This paper has three aims: to review approaches to quality assessment in published LIS systematic reviews in order to assess whether and how LIS reviewers report on quality assessment a priori in systematic reviews, to model the different quality assessment aids used by LIS reviewers, and to explore if and how LIS reviewers report on and incorporate the quality of included studies into the systematic review analysis and conclusions.

Methods – The authors undertook a methodological study of published LIS systematic reviews using a known cohort of published systematic reviews of LIS-related research. Studies were included if they were reported as a "systematic review" in the title, abstract, or methods section. Meta-analyses that did not incorporate a systematic review and studies in which the systematic review was not a main objective were excluded. Two reviewers independently assessed the

studies. Data were extracted on the type of synthesis, whether quality assessment was planned and undertaken, the number of reviewers involved in assessing quality, the types of tools or criteria used to assess the quality of the included studies, how quality assessment was assessed and reported in the systematic review, and whether the quality of the included studies was considered in the analysis and conclusions of the review. In order to determine the quality of the reporting and incorporation of quality assessment in LIS systematic reviews, each study was assessed against criteria relating to quality assessment in the PRISMA reporting guidelines for systematic reviews and meta-analyses (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009) and the AMSTAR tool (Shea et al., 2007).

Results – Forty studies met the inclusion criteria. The results demonstrate great variation on the breadth, depth, and transparency of the quality assessment process in LIS systematic reviews. Nearly one third of the LIS systematic reviews included in this study did not report on quality assessment in the methods, and less than one quarter adequately incorporated quality assessment in the analysis, conclusions, and recommendations. Only nine of the 26 systematic reviews that undertook some form of quality assessment incorporated considerations of how the quality of the included studies impacted on the validity of the review findings in the analysis, conclusion, and recommendations. The large number of different quality assessment tools identified reflects not only the disparate nature of the LIS evidence base (Brettle, 2009) but also a lack of consensus around criteria on which to assess the quality of LIS research.

Conclusion – Greater clarity, definition, and understanding of the methodology and concept of "quality" in the systematic review process are required not only by LIS reviewers but also by editors of journals in accepting such studies for publication. Further research and guidance is needed on identifying the best tools and approaches to incorporate considerations of quality in LIS systematic reviews. LIS reviewers need to improve the robustness and transparency with which quality assessment is undertaken and reported in systematic reviews. Above all, LIS reviewers need to be explicit in coming to a conclusion on how the quality of the included studies may impact on their review findings.

Introduction

Systematic reviews aim "to systematically search for, appraise and synthesize research evidence" (Grant & Booth, 2009, p. 95). Unlike traditional literature reviews, the systematic review aims to minimize bias by following a systematic and transparent approach to defining the question, searching the literature, extracting relevant data, assessing the quality of the literature, and synthesizing and drawing conclusions on the state of the evidence base (Boland, Cherry, & Dickson, 2013; Higgins et al., 2011; Centre for Reviews and Dissemination [CRD], 2009).

Systematic reviews in LIS, as in other professional domains, are becoming increasingly popular. Paralleling the evidence based medicine paradigm, systematic reviews are considered high levels of evidence within the LIS domain (Eldredge, 2000) and incorporate into their methodology one of the core skills of LIS professionals—literature searching. The number of systematic reviews in the LIS field is growing (Koufogiannakis, 2012), and journal editors are actively encouraging librarians to undertake them (Sampson, 2014). However, LIS research methods are diverse (Brettle, 2009), and they are not easy to work with in the context of a systematic review (Koufogiannakis, 2012). LIS systematic reviewers, therefore, may be faced

with the prospect of including and assessing the quality of a diverse evidence base.

This study aims to provide an overview of approaches to quality assessment used by LIS systematic reviewers. The paper models and presents a collation of quality assessment tools. The results will be particularly useful for those undertaking LIS systematic reviews and evidence summaries.

Literature Review

In defining quality as a "multidimensional concept which could relate to the design, conduct, and analysis of a trial, its clinical relevance, or quality of reporting," Jüni, Altman, & Egger (2001, p. 42) identify three approaches to quality assessment: internal validity, external validity, and reporting quality. Internal validity refers to the robustness of the methods and the extent to which bias (i.e. systematic errors in studies that may lead to an overestimation or underestimation of the true result) is minimized and the results of the study can be considered reliable. External validity is the extent to which the study results can be considered generalizable to other settings or populations, and reporting quality assesses the completeness of the reporting.

Quality assessment is an integral part of the systematic review process (Boland, Cherry, & Dickson, 2013). Details on how reviewers intend to assess the quality of the included studies should be outlined a priori in the review methods section (Moher et al., 2009). In addition, the results of the quality assessment of the included studies should be presented and consideration given not only to the quality of the individual studies but also to how the overall quality of the included studies impacts on the validity of the review findings (Shea et al., 2007). Given the subjective nature involved in quality assessment, it is imperative that more than one reviewer undertakes this process.

A multitude of tools are available to help reviewers assess the quality of the included studies. Tools for assessing the quality of research fall into three categories: scales, checklists, and domains (see box 1; West et al., 2002). Despite a lack of consensus about which quality assessment tools are best, there is some agreement that scales are not the most appropriate tool. The shortcomings of scales are that different scales can produce different results (Jüni et al., 2001; Booth, 2007) and that users may assume each criteria on a scale is equally weighted. In the case of double-blinding in a randomised controlled trial, for example, such an assumption may not be appropriate (Schulz, Chalmers, Hayes, & Altman, 1995).

Quality assessment of studies is essential to maintaining the integrity of the systematic review since the validity of the review conclusions rely upon the quality of the included studies (Jüni et al., 2001; Deeks et al., 2003; Sampson, 2014). Empirical research in the health and medical field found that poor methodological quality of trials can overestimate or underestimate the true result (Schulz et al., 1995). Combining such studies in a systematic review, therefore, can only serve to emphasize such biases even further.

There is limited empirical evidence of how quality assessment is incorporated in LIS systematic reviews. A recent editorial undertook a brief examination of systematic reviews published in the *Journal of the Medical Library Association* (Sampson, 2014). Whilst the number of systematic reviews identified was small (four), only two of them assessed the quality of the literature of the included studies. With the growing popularity of systematic reviews within the LIS field, it is timely to consider how and to what extent LIS reviewers incorporate assessments of quality in LIS systematic reviews.

Box 1
Categories of Quality Assessment Tools[a]

Checklist: "Instruments that contain a number of quality items, none of which is scored numerically."
Scale: "Instruments that contain several quality items that are scored numerically to provide a quantitative estimate of overall study quality."
Domain (or component): "Individual aspect of study methodology (e.g. randomisation, blinding, follow-up) that has a potential relation to bias in estimation of effect."

[a]West et al., 2002, p. 33

Aims

To provide an overview of approaches to quality assessment in published LIS systematic reviews. In particular, to:

- assess whether and how LIS reviewers report on quality assessment a priori in systematic reviews,
- model the different quality assessment aids used by LIS reviewers, and
- explore if and how LIS reviewers report on and incorporate the quality of included studies into the systematic review analysis and conclusions.

Methods

The authors undertook a methodological study of published LIS systematic reviews. A cohort of published systematic reviews of LIS-related research was identified from the literature in November 2014, using an existing wiki that claims to document "all the known systematic reviews in library and information studies" (Koufogiannakis, Brettle, Booth, Kloda, & Urquhart, 2015).

Studies in the list were included if they were reported as a systematic review in the title, abstract, or methods section. Meta-analyses that did not incorporate a systematic review and studies in which the systematic review was not a main objective were excluded. Two reviewers independently assessed the studies against the inclusion criteria. In the event of disagreement, consensus was reached via discussion.

Data were extracted on the type of synthesis, whether quality assessment was planned and undertaken, the number of reviewers involved in assessing quality, the types of tools or criteria used to assess the quality of the included studies, how quality assessment was presented in the systematic review, and whether the quality of the included studies was considered in the analysis and conclusions of the review.

To determine the quality of the reporting and incorporation of quality assessment in LIS systematic reviews, two reviewers independently assessed each included study against criteria relating to quality assessment in the PRISMA reporting guidelines for systematic reviews and meta-analyses (Moher et al., 2009) and the AMSTAR tool (Shea et al., 2007) (see box 2). The PRISMA guidance (Moher et al., 2009) assesses the quality of the reporting in systematic reviews. Within the 27-item checklist, four items relate to the reporting of quality assessment within systematic reviews. AMSTAR (Shea et al., 2007) is an 11-item checklist that aims to assess the methodological quality of systematic reviews. Four of the items relate to quality assessment.

Studies were classed as adequate if they were explicit in meeting the PRISMA or AMSTAR

Box 2
PRISMA and AMSTAR Quality Assessment Criteria

PRISMA[a]

Item #12: Risk of bias in individual studies
Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study level or outcome level) and how this information is to be used in any data synthesis

Item #15: Risk of bias across studies
Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies)

Item #19: Risk of bias within studies
Present data on risk of bias of each study and, if available, any outcome level assessment

Item #22: Risk of bias across studies
Present results of any assessment of risk of bias across studies

AMSTAR[b]

Item #7:
Was the scientific quality of the included studies assessed and documented?

Item #8:
Was the scientific quality of the included studies used appropriately in formulating conclusions?

Item #10:
Was the likelihood of publication bias assessed?

[a]Moher et al., 2009
[b]Shea et al., 2007

criteria, inadequate if they partially met the criteria, or unclear if the study did not report on the item. A narrative synthesis of the results is presented.

Results

A total of 40 studies reported on the wiki met the inclusion criteria. Of the 10 studies excluded, four were meta-analyses (Aabø, 2009; Ankem, 2006b; Salang, 1996; Saxton, 1997), five were not reported as systematic reviews (Haug, 1997; Julien, Leide, & Bouthillier, 2008; Mairs, McNeil, McLeod, Prorok, & Stolee, 2013; Ward, Stevens, Brentnall, & Briddon, 2008; Williams, Nicholas, & Rowlands, 2010), and in one study (Sampson, McGowan, Lefebvre, Moher, & Grimshaw, 2008), the systematic review was not the objective of the study.

Table 1 outlines the characteristics of the 40 systematic reviews included in the analysis. More than half were published in the health LIS field. The number of studies included in the systematic reviews ranged from 3 to 333. Nine systematic reviews were undertaken by only one

author, 15 reported two authors, and 16 reported more three or more authors. Five systematic reviews reported including only one type of study design, 22 included more than one type of study design, and 13 did not report on study designs.

Reporting of Quality Assessment Methods in LIS Systematic Reviews

Table 2 outlines the approach to quality assessment undertaken in the included studies. Fourteen of the 40 failed to state they would undertake quality assessment in the methods. Of these 14, 10 were narrative reviews, three were qualitative, and one a meta-analysis with narrative review. Of the 14 systematic reviews that did not report on quality assessment in the methods, six did report on the quality of the included studies in the results or discussion (Ankem, 2006a; Fanner & Urquhart, 2008; Genero, Fernandez-Saez, Nelson, Poels, & Piattini, 2011; Kelly & Sugimoto, 2013; Matteson, Salamon, & Brewster, 2011; Wagner & Byrd, 2004).

Less than half of those that did undertake quality assessment (11 of 26) actually defined what they meant by quality. Eight studies defined quality as an assessment of the methodological quality (Koufogiannakis and Wiebe, 2006; Zhang, Watson, & Banfield, 2007; Joshi & Trout, 2014; Golder & Loke, 2009, 2010; Perrier et al., 2014; Gagnon et al., 2010; Divall, Camosso-Stefinovic, & Baker., 2013), and three studies (Perrier et al, 2014; Gagnon et al, 2010; Divall et al., 2013) specified quality as the risk of bias. Two studies defined quality assessment as assessing the quality of the study design, or level of evidence (Manning Fiegen, 2010; Ndabarora, Chipps, & Uys, 2014). One study assessed the quality of the reporting (Crumley, Wiebe, Cramer, Klassen, & Hartling, 2005).

Fourteen studies reported the number of people involved in undertaking quality assessment. The number of authors undertaking quality assessment in a systematic review ranged from 1 to 8. Three studies (Joshi & Trout, 2014; Manning Fiegen, 2010; Perrier et al., 2014) reported an assessment of the inter-rater agreement of quality assessment between reviewers. Nine studies reported using quality assessment as part of their inclusion and exclusion criteria.

Quality Assessment Tools

Table 3 outlines the aids used by LIS systematic reviewers. LIS reviewers referenced four types of aids to quality assessment: 14 published tools designed specifically to assess quality, 3 research design books, 11 journal articles, and 1 web resource. Twenty-nine unique aids were referenced.

Twenty-one studies that reported on quality assessment in the methods section referenced the tools or aids used: 14 studies reported using one aid, four studies reported using two aids, and three studies used three or more aids (see table 3). Seven studies modified the aids (see table 2), but in four of these studies (Beverley, Bath, & Booth, 2004; Brettle, 2007; Brettle et al, 2011; Gray, Sutton, & Treadway, 2012) what modifications were made is unclear. Four studies reported using bespoke (i.e. custom-made) criteria to assess the quality of the included studies.

Of the nine studies that referenced aids other than published tools, six reported the criteria on which their quality assessment would be undertaken (Brettle et al., 2011; Gagnon et al., 2010; Golder & Loke, 2009; Crumley et al., 2005; Sommestad, Hallberg, Lundholm, & Bengtsson, 2014; Weightman & Williamson, 2005). Three studies (Beverley et al., 2004; Booth, Carroll, Papaioannou, Sutton, & Wong, 2009 [for survey tool]); Gray et al., 2012) did not report on the criteria used to assess the quality of their included studies.

Of the 14 published tools specifically designed to assess the quality of research, nine were checklists, three were scales and one was

Table 1
Characteristics of Included Studies

Characteristics	**Number of reviews**
Journal	
Health Information and Libraries Journal	14
Journal of the Medical Library Association	4
Information Research	2
Journal of Academic Librarianship	2
Journal of Documentation	2
Reference Services Review	2
BMC Medical Research Methodology	1
Evidence Based Library and Information Practice	1
Health and Social Care in the Community	1
Health Informatics Journal	1
Information Development	1
Information Management and Computer Security	1
International Journal of Medical Informatics	1
Journal of Information Science	1
Journal of the American Medical Informatics Society	1
Journal of the American Society for Information Science and Technology	1
Journal of Database Management	1
Library and Information Science Research	1
LIBRES: Library and Information Science Research Electronic Journal	1
Mousaion	1
Reference and User Services Quarterly	1
Date published	
2003	2
2004	3
2005	3
2006	4
2007	4
2008	3
2009	2
2010	6
2011	3
2012	2
2013	5
2014	4
Number of systematic review authors	
1	9
2	15
3	8
4	2
5	3
8	1
10	1
13	1

Type of systematic review (synthesis)	
Narrative	30
Qualitative (e.g. meta-synthesis, meta-ethnography, framework)	7
Meta-analysis with narrative	3

domain-based. No single tool was preferred over others, with the Glynn (2006), CRiSTAL checklist (Booth, 2000; Booth & Brice, 2004), HCPRDU Evaluation Tools (Long et al., 2002a, 2002b, 2002c) and the Cochrane Effective Practice and Organisation of Care (2010) each being cited by three studies.
Only one study (Catalano, 2013) reported using a validated tool.

Incorporation of Quality Assessment in Systematic Reviews

All studies incorporating quality assessment presented a narrative synthesis of their results. Twelve studies (Beverley et al., 2004; Booth et al., 2009; Brettle et al., 2011, Brettle, 2007; Catalano, 2013; Divall et al., 2013; Gagnon et al., 2010; Golder & Loke, 2009; Ndabarora et al., 2014; Perrier et al., 2014; Sommestad et al., 2014; Weightman & Williamson, 2005) also tabulated their quality assessment. Table 4 outlines the appraisal of the included studies according to the incorporation of quality assessment criteria in the PRISMA reporting guidelines and AMSTAR quality assessment tool.

PRISMA Assessment

Of the 26 studies reporting a planned quality assessment in the methods, all but three did not report on how the data would be used in the synthesis, thereby failing to meet the first PRISMA quality criteria (item #12): "Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study level or outcome level) and *how this information is to be used in any data synthesis* [emphasis added]" (Moher et al., 2009, p. W-67). Only one study (Sommestad et al., 2014) reported an assessment of publication bias a priori in the methods (PRISMA item #15).

When reporting the results of the quality assessment, only five studies adequately "presented data on the risk of bias of each study and, if available, any outcome level assessment" (PRISMA item #19; Moher et al., 2009, p. 266). Twenty-one studies were classed as inadequate. Of these, 18 studies (Bergman & Holden, 2010; Beverley et al., 2004; Booth et al., 2009; Brennan, Mattick, & Ellis, 2011; Brettle, 2003, 2007; Brown, 2008; Catalano, 2013; Crumley et al., 2005; Golder & Loke, 2010; Kelly & Sugioto, 2013; Koufogiannakis & Wiebe, 2006; Manning Fiegen, 2010; Ndabarora et al., 2014; Perrier et al., 2014; Sommestad et al., 2014; Weightman & Williamson, 2005; Winning & Beverley, 2003) reported summary data only. Thus, the systematic reviews were either unclear about which of the included studies met each of the criteria assessed, or the systematic reviews were unclear about what criteria was used to assess the included studies. Two studies reported only criteria relating to the validity and reliability of the outcome tool (Ankem, 2005; Ankem, 2006a) while one study failed to report on all studies in the quality assessment (Gray et al., 2012). The remaining 14 studies were assessed as unclear as they did not report on quality assessment of the included studies in the results section of their review.

Four studies "presented results of any assessment of risk of bias across studies" (PRISMA item #22; Moher et al., 2009, p. W-67). Two studies (Brennan et al., 2011; Perrier et al., 2014) assessed selective reporting; the other two (Divall et al., 2013; Sommestad et al., 2014) assessed publication bias. Three of the studies (Brennan et al., 2011; Divall et al., 2013; Perrier et al., 2014) presented a descriptive analysis while

Table 2
Quality Assessment (QA) in LIS Systematic Reviews

Study	QA reported in methods	Authors defined QA	No. of authors undertaking QA	Number of QA tools used	Model of QA (tools only)	Published, modified, or bespoke	QA reported as an inclusion criteria
Ankem (2005)	✓	NR	1	NR	NR	NR	✓
Ankem (2006a)	NR	NR	NR	NR	NR	NR	NR
Bergman & Holden (2010)	✓	NR	NR	1	Checklist	Published	NR
Beverley et al. (2004)	✓	NR	NR	3	Checklist, Scale	1 Published 2 Modified (unclear)	NR
Booth et al. (2009)	✓	✓	NR	3	Checklist	Published	NR
Brennan et al. (2011)	✓	NR	NR	1	Domain	Published	NR
Brettle (2003)	✓	NR	1	1	Checklist	Published	NR
Brettle et al. (2011)	✓	NR	8[a]	2	Checklist	Modified (unclear)	NR
Brettle (2007)	✓	NR	1	2	Checklist	Modified (unclear)	NR
Brown (2008)	✓	NR	NR	NR	NR	NR	NR
Burda & Teuteberg (2013)	NR	NR	NR	NR	NR	NR	✓
Catalano (2013)	✓	NR	1[b]	1	Checklist	Published	NR
Childs et al. (2005)	NR	NR	NR	NR	NR	NR	NR
Cooper and Crum (2013)	NR	NR	NR	NR	NR	NR	NR
Crumley et al. (2005)	✓	✓	2	1	Unclear	Bespoke (other journal article)	NR
Divall et al. (2013)	✓	✓	NR	1	Domain	Published	✓
Du Preez (2007)	NR	NR	NR	NR	NR	NR	NR
Duggan & Banwell (2004)	NR	NR	NR	NR	NR	NR	NR
Fanner & Urquhart (2008)	NR	NR	NR	NR	NR	NR	NR

Gagnon et al. (2010)	✓	✓	2	NR	Unclear	Bespoke (other journal articles)	✓
Genero et al. (2011)	NR	NR	NR	NR	NR	NR	NR
Golder & Loke (2010)	✓	✓	NR	1	Unclear	Bespoke (own criteria)	NR
Golder & Loke (2009)	✓	✓	NR	2	Unclear	Modified (journal articles, web resource)	NR
Grant (2007)	NR	NR	NR	NR	NR	NR	NR
Gray et al. (2012)	✓	NR	3[c]	3/4[d]	Unclear	Modified (journal articles)	NR
Joshi & Trout (2014)	✓	✓	2	NR	NR	NR	NR
Kelly & Sugimoto (2013)	NR	NR	NR	NR	NR	NR	NR
Koufogiannakis and Wiebe (2006)	✓	✓	1	1	Unclear	Published (other journal article)	NR
Manning Fiegen (2010)	✓	✓	6[a]	1	Checklist	Published	NR
Matteson et al. (2011)	NR	NR	NR	NR	NR	NR	NR
Ndabarora et al. (2014)	✓	✓	NR	NR	NR	NR	✓
Perrier et al. (2014)	✓	✓	2	2	Scale	Published	✓
Phelps & Campbell (2013)	NR	NR	NR	NR	NR	NR	NR
Rankin et al. (2008)	✓	NR	NR	1	Checklist	Published	NR
Sommestad et al. (2014)	✓	NR	NR	1	Unclear	Modified (other journal article)	✓
Urquhart & Yeoman (2010)	NR	NR	NR	NR	NR	NR	NR

Wagner & Byrd (2004)	NR	NR	NR	NR	NR	NR	✓
Weightman & Williamson (2005)	✓	NR	2	1	Unclear	Bespoke (books)	✓
Winning & Beverley (2003)	✓	NR	NR	1	Checklist	Published	NR
Zhang et al. (2007)	✓	✓	2	1	Scale	Modified	NR

Note: NR = not reported. Bespoke = custom-made.

[a]Two reviewers appraised each paper

[b]One study that was appraised by two reviewers

[c]Three reviewers appraised three included studies collectively and then they appraised the rest individually. Two reviewers checked all appraisals for accuracy.

[d]Authors report using three tools but they reference four.

Table 3

Bibliography of Quality Assessment Tools and Resources Used in LIS Systematic Reviews

Quality assessment tools	**Number of studies (and the studies) using the tool**
Checklists	
CRiSTAL Booth, A. (2000). Research. *Health Information & Libraries Journal, 17*(4), 232-235. Booth, A., & Brice, A. (2004). Appraising the evidence. In Booth & Brice (Eds.), *Evidence-based practice for information professionals A handbook.* London, UK: Facet Publishing.	3 (Beverley et al, 2004; Rankin et al., 2008; Winning & Beverley, 2003)
Glynn, L. (2006). A critical appraisal tool for library and information research. *Library Hi Tech, 24*(3), 387-99.	3 (Bergman et al., 2010; Catalano, 2013; Manning Fiegen, 2010)
HCPRDU Evaluation Tools Long, A. F., Godfrey, M., Randall, T., Brettle, A., & Grant, M. J. (2002a). *HCPRDU evaluation tool for qualitative studies.* Leeds: University of Leeds, Nuffield Institute for Health.	3 (Brettle, 2003[a], 2007; Brettle et al., 2011)

Long, A. F., Godfrey, M., Randall, T., Brettle, A., & Grant, M. J. (2002b). *HCPRDU evaluation tool for quantitative studies.* Leeds: University of Leeds, Nuffield Institute for Health. Long, A. F., Godfrey, M., Randall, T., Brettle, A., & Grant, M. J. (2002c). *HCPRDU evaluation tool for mixed methods studies.* Leeds: University of Leeds, Nuffield Institute for Health.	
Koufogianniakis, D., Booth, A., & Brettle, A. (2006). ReLIANT: Readers guide to the literature on interventions addressing the need for education and training. *Library and Information Research, 30*, 44-51.	1 (Brettle, 2007)
Kmet L. M., Lee R. C., & Cook L. S. (2004). *Standard quality assessment criteria for evaluating primary research papers from a variety of fields*. Edmonton: Alberta Heritage Foundation for Medical Research (AHFMR). HTA Initiative #13.	1 (Booth et al., 2009)
Atkins, C., & Sampson, J. (2002). Critical appraisal guidelines for single case study research. *Proceedings of the Xth European Conference on Information Systems (ECIS),* Gdansk, Poland, 6-8 June 2002.	1 (Booth et al., 2009)
Morrison, J. M., Sullivan, F., Murray, E. & Jolly, B. (1999). Evidence-based education: development of an instrument to critically appraise reports of educational interventions. *Medical Education*, *33*, 890-893.	1 (Koufogiannakis & Wiebe, 2006)
Scales	
Downs, S. H. & Black, N. (1998). The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care -interventions, *Journal of Epidemiology and Community Health, 52*(6), 377-384.	1 (Zhang et al., 2007)
Nelson E.A. (1999). Critical appraisal 8: Questions for surveys. *Nursing Times Learning Curve, 3*(8), 5-7. Wells G., Shea B. J., O'Connell, D., Peterson, D., Welch, V., Losos, M., & Tugwell, P. (n.d.). The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Available at http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp	2 (Beverley et al., 2004) 1 (Perrier et al., 2014)

Domain-based Cochrane Effective Practice and Organisation of Care (EPOC) Group. (2010). Draft EPOC methods paper: Including interrupted time series (ITS) designs in a EPOC review.	3 (Brennan et al, 2011; Divall et al., 2013; Perrier et al., 2014)
References to other publications	**Study referencing the publication**
Books Burton, D. (Ed.) (2000). *Research training for social scientists*. London: Sage Publications.	(Weightman & Williamson, 2005)
de Vaus, D. A. (1991). *Surveys in social research, 3rd edition*. London: Allen & Unwin.	(Weightman & Williamson, 2005)
Gomm, R., Needham, G., & Bullman, A. (2000). *Evaluating research in health and social care*. London: Sage Publications.	(Beverley et al., 2004)
Journal articles Boynton, P. M. (2004). Hands on guide to questionnaire research: selecting, designing and developing your questionnaire. *British Medical Journal*, *328*, 1312.	(Booth et al., 2009)
Jamtvedt, G., Young, J. M., Kristoffersen, D. T., O'Brien, M.,A., & Oxman, A. D. (2006). Audit and feedback: effects on professional practice and health care outcomes. *Cochrane Database Systematic Reviews*. http://dx.doi.org/10.1002/14651858.CD000259.pub2	(Gagnon et al., 2010)
Lijmer J. C., Mol, B. W., Heisterkamp, S., Bonsel, G. J., Prins, M. H., van der Meulen J. H., Bossuyt, P. M. (1999). Empirical evidence of design-related bias in studies of diagnostic tests. *Journal of the American Medical Association, 282*, 1061-1066.	(Crumley et al., 2004)
Malhotra, M. K., & Grover, V. (1998). An assessment of survey research in POM: from constructs to theory. *Journal of Operations Management, 16*(4), 407-425.	(Sommestad et al., 2014)

McDonald, S., Crumley, E., Eisinga, A., & Villanueva, E. (2007). Search strategies to identify reports of randomized trials in MEDLINE (protocol). *Cochrane Database of Systematic Reviews*. http://dx.doi.org/10.1002/14651858.MR000018.pub2	(Golder & Loke, 2009)
Mi, M., & Gilbert, C., M. (2007). Needs assessment: Prerequisite for service excellence. *Journal of Hospital Librarianship, 7*, 31-52.	(Gray et al., 2012)
Polgar, S., & Thomas, S. A. (1995). Critical evaluation of published research. In *Introduction to research in the health sciences, 3rd edition* (343–355). Melbourne: Churchill Livingstone.	(Gray et al., 2012)
Robinson, L., & Bawden, D. (2007). Evaluation of outreach services for primary care and mental health; assessing the impact. *Health Information and Libraries Journal*, *24*, 57-66.	(Gray et al., 2012)
Urquhart, C. J., & Hepworth, J. B. (1996). Comparing and using assessment of the value of information to clinical decision-making. *Bulletin of the Medical Library Association*, *84*, 482-489.	(Gray et al., 2012)
Weightman, A. & Williamson, J. (2005). The value and impact of information provided through library services for patient care: a systematic review. *Health Information and Libraries Journal*, *22*, 4-25.	(Brettle et al., 2011)
Yeoman, A. J., Cooper, J. M., Urquhart, C. J., & Tyler, A. (2003). The management of health library outreach services: evaluation and reflection on lessons learned on the VIVOS project. *Journal of the Medical Library Association, 91*, 426-33.	(Gray et al., 2012)
Web resource	
InterTasc Information Specialists' Sub-Group Search Filter Resource. (2008). *ISSG search filter resource*. Retrieved from https://sites.google.com/a/york.ac.uk/issg-search-filters-resource/home	(Golder & Loke, 2009)

[a]Brettle 2003 was based on earlier versions of the HCPRDU Evaluation Tools

Table 4
PRISMA and AMSTAR Assessment of Quality Criteria

STUDY	**PRISMA**				**AMSTAR**		
	PRISMA #12[a]	**PRISMA #15[b]**	**PRISMA #19[c]**	**PRISMA #22[d]**	**AMSTAR #7[e]**	**AMSTAR #8[f]**	**AMSTAR # 10[g]**
Ankem (2005)	Inadequate	Unclear	Inadequate	Unclear	Inadequate	Inadequate	Unclear
Ankem (2006a)	Unclear	Unclear	Inadequate	Unclear	Inadequate	Unclear	Unclear
Bergman & Holden (2010)	Inadequate	Unclear	Inadequate	Unclear	Inadequate	Inadequate	Unclear
Beverley et al. (2004)	Inadequate	Unclear	Inadequate	Unclear	Adequate	Inadequate	Unclear
Booth et al. (2009)	Adequate	Unclear	Inadequate	Unclear	Adequate	Unclear	Unclear
Brennan et al. (2011)	Inadequate	Unclear	Inadequate	Adequate	Inadequate	Adequate	Unclear
Brettle (2003)	Inadequate	Unclear	Inadequate	Unclear	Inadequate	Adequate	Unclear
Brettle et al. (2011)	Inadequate	Unclear	Adequate	Unclear	Adequate	Adequate	Unclear
Brettle (2007)	Inadequate	Unclear	Inadequate	Unclear	Inadequate	Adequate	Unclear
Brown (2008)	Unclear	Unclear	Inadequate	Unclear	Inadequate	Unclear	Unclear
Burda & Teuteberg (2013)	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear
Catalano (2013)	Inadequate	Unclear	Inadequate	Unclear	Adequate	Inadequate	Unclear
Childs et al. (2005)	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear
Cooper and Crum (2013)	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear
Crumley et al. (2005)	Inadequate	Unclear	Inadequate	Unclear	Inadequate	Inadequate	Unclear
Divall et al. (2013)	Inadequate	Unclear	Adequate	Adequate	Adequate	Inadequate	Unclear
Du Preez (2007)	Unclear	Unclear	Unclear	Unclear	Unclear	Inadequate	Unclear
Duggan & Banwell (2004)	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear
Fanner & Urquhart (2008)	Unclear	Unclear	Unclear	Unclear	Inadequate	Inadequate	Unclear
Gagnon et al (2010)	Inadequate	Unclear	Adequate	Unclear	Adequate	Adequate	Unclear
Genero et al. (2011)	Unclear	Unclear	Unclear	Unclear	Inadequate	Inadequate	Unclear
Golder & Loke (2010)	Inadequate	Unclear	Inadequate	Unclear	Inadequate	Inadequate	Unclear
Golder & Loke (2009)	Inadequate	Unclear	Adequate	Unclear	Adequate	Unclear	Unclear
Grant (2007)	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear
Gray et al. (2012)	Inadequate	Unclear	Inadequate	Unclear	Inadequate	Unclear	Unclear
Joshi & Trout (2014)	Inadequate	Unclear	Unclear	Unclear	Unclear	Inadequate	Unclear
Kelly & Sugimoto (2013)	Unclear	Unclear	Inadequate	Unclear	Inadequate	Inadequate	Unclear

Koufogiannakis and Wiebe (2006)	Adequate	Unclear	Inadequate	Unclear	Inadequate	Adequate	Unclear
Manning Fiegen (2010)	Inadequate	Unclear	Inadequate	Unclear	Inadequate	Adequate	Unclear
Matteson et al. (2011)	Unclear	Unclear	Unclear	Unclear	Inadequate	Unclear	Unclear
Ndabarora et al. (2014)	Inadequate	Unclear	Inadequate	Unclear	Inadequate	Inadequate	Unclear
Perrier et al. (2014)	Inadequate	Unclear	Inadequate	Adequate	Unclear	Inadequate	Unclear
Phelps & Campbell (2013)	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear
Rankin et al., (2008)	Inadequate	Unclear	Unclear	Unclear	Inadequate	Inadequate	Unclear
Sommestad et al. (2014)	Adequate	Adequate	Inadequate	Adequate	Adequate	Adequate	Adequate
Urquhart & Yeoman (2010)	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear
Wagner & Byrd (2004)	Unclear	Unclear	Unclear	Unclear	Inadequate	Inadequate	Unclear
Weightman & Williamson (2005)	Inadequate	Unclear	Inadequate	Unclear	Adequate	Inadequate	Unclear
Winning & Beverley (2003)	Inadequate	Unclear	Inadequate	Unclear	Inadequate	Inadequate	Unclear
Zhang et al. (2007)	Inadequate	Unclear	Adequate	Unclear	Adequate	Adequate	Unclear

[a]Risk of bias in individual studies; Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study level or outcome level) and how this information is to be used in any data synthesis

[b]Risk of bias across studies; Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies)

[c]Risk of bias within studies; Present data on risk of bias of each study and, if available, any outcome level assessment

[d]Risk of bias across studies; Present results of any assessment of risk of bias across studies

[e]Was the scientific quality of the included studies assessed and documented?

[f]Was the scientific quality of the included studies used appropriately in formulating conclusions?

[g]Was the likelihood of publication bias assessed?

Sommestad et al. (2014) presented an analytical analysis using a funnel plot.

AMSTAR Assessment

Only one quarter (10 of 40) of the systematic reviews included in this analysis adequately assessed and documented the scientific quality of the included studies (AMSTAR item #7; Shea et al., 2007). Twenty studies were assessed as inadequate because, although quality assessment was documented, 14 studies (Ankem, 2005; Bergman & Holden, 2010; Brennan et al., 2011; Brettle, 2003, 2007; Brown, 2008; Crumley et al., 2005; Golder & Loke, 2010; Gray et al., 2012; Koufogiannakis and Wiebe 2006; Manning Fiegen, 2010; Ndabarora et al., 2014; Rankin 2008; Winning & Beverley, 2003) failed to report "some kind of result for each study" (AMSTAR criteria #7; Shea et al., 2007, p. 5) and six studies (Ankem, 2006a; Fanner & Urquhart, 2008; Genero, 2011;, Kelly & Sugimoto, 2013; Matteson et al., 2011; Wagner & Byrd, 2004) did not report their quality assessment methods a priori. In one study (Perrier et al., 2014), determining whether quality assessment was documented and assessed in accordance with the AMSTAR item #7 was not possible because the link to the online supplementary table detailing the quality assessment was unavailable. The remaining eight studies failed to report on quality assessment at all; therefore, whether they met AMSTAR item #7 was unclear.

In assessing the included studies against AMSTAR item #8, which reads

> Was the scientific quality of the included studies used appropriately in formulating conclusions? The results of the methodological rigor and scientific quality should be considered in the analysis and the conclusions of the review, and explicitly stated in formulating recommendations. (Shea et al., 2007, p. 5).

Studies were classed as adequate if they incorporated how the quality of the included studies impacted on the validity of the systematic review findings in both the analysis *and* conclusion *and* also considered quality issues in their recommendations. The studies were classed as inadequate if they addressed the quality of the included studies in only one of these sections. They were classed as unclear if the studies did not report the quality of the included studies anywhere.

Using the above criteria, only 9 of the 40 included systematic reviews adequately incorporated quality assessment in the analysis, conclusions, and recommendations. Just one study (Sommestad et al., 2014) met the final AMSTAR quality criteria—assessing the likelihood of publication bias (item #10)—by providing a funnel plot.

Five studies (Du Preez, 2007; Fanner & Urquhart, 2008; Genero et al., 2011; Kelly & Sugimoto, 2013; Wagner & Byrd, 2004) incorporated some discussion of the quality of the included studies without explicitly reporting that quality assessment would be undertaken in the review methods.

Discussion

The results section demonstrates great variation on the breadth, depth, and transparency of the quality assessment process in LIS systematic reviews. Nearly one third of the LIS systematic reviews included in this study did not report on quality assessment in the methods. Less than one quarter adequately incorporated quality assessment in the analysis, conclusions, and recommendations. Quality assessment is an essential part of the systematic review process (Moher et al., 2009; Higgins et al., 2011; CRD, 2009). Without it, a systematic review loses one of the advantages it has over traditional literature reviews and is in danger of conforming to the old adage of "garbage in, garbage out" (Yuan and Hunt, 2009), where ignoring the impact of methodological quality

may result in misleading conclusions (Verhagen, de Vet, de Bie, Boers, & van den Brandt, 2001; Mallen, Peat, & Croft, 2006).
In particular, a lack of consistency in the understanding and application of the systematic review terminology appears to exist not only between LIS authors but also across studies published in the same journal. For example, the majority (14) of LIS systematic reviews were published in *Health Information and Libraries Journal*. Of these, four reported only one author (Brettle, 2003, 2007; Brown, 2008, Grant, 2007), and three did not assess the quality of the included studies (Childs, Blenkinsopp, Hall, A. & Walton, 2005, Fanner & Urquhart, 2008; Grant, 2007).

The question is, does it matter if authors do not consider quality assessment in the analysis of a systematic review? Although no empirical evidence within the LIS domain suggests that the quality of the studies impacts on the validity of findings in LIS-related systematic reviews, there is evidence that the quality of the included studies can yield differences in review results (Voss & Rehfuess, 2013). Although guidance on the reporting of qualitative synthesis includes four items on the appraisal of the included studies (Tong, Flemming, McInnes, Oliver, & Craig, 2012), the debate on whether to undertake quality assessment in qualitative systematic reviews is ongoing with insufficient evidence to support the inclusion or exclusion of quality assessment (Noyes et al., 2015).

Only nine of the 26 systematic reviews that undertook some form of quality assessment incorporated considerations of how the quality of the included studies impacted on the validity of the review findings in the analysis, conclusion, and recommendations. Ignoring the extent to which the quality of the included studies may impact on the validity of the review findings, undertaking quality assessment in isolation makes the act of quality assessment within the systematic review a rather futile exercise (de Craen, van Vliet, & Helmerhorst, 2005). The fact that LIS systematic reviewers fail to incorporate how the quality of the included studies impacts on the overall review findings is not surprising given that similar studies in the field of health and medicine have shown only slightly better results (Katikireddi, Egan, & Petticrew, 2015; de Craen et al., 2005; Moher et al., 1999; Hayden, Côté, & Bombardier, 2006). The findings of this study agree with Katikireddi et al. when they state that systematic review conclusions "are frequently uninformed by the critical appraisal process, even when conducted" (2015, p. 189).

Conversely, a number of systematic reviews (Du Preez, 2007; Fanner & Urquhart, 2008; Genero et al., 2011; Kelly & Sugimoto, 2013; Wagner & Byrd, 2004) raised the issue of the quality of the included studies in their discussion; however, their comments may not be valid since it was unclear how the quality of the studies was assessed. Similarly, four studies (Brennan et al, 2011; Divall et al., 2013; Perrier et al., 2014; Sommestad et al., 2014) reported on publication or selection bias, but only one outlined their methods a priori (Sommestad et al., 2014).

De Craen et al. (2005) put forward a number of theories as to why systematic reviewers may not incorporate quality assessment into the analysis. Firstly, reviewers may not *know* that quality assessment *should be considered* in the analysis, or secondly, they simply may not know *how* to incorporate the quality assessment into the analysis. Conversely, it may be that the reviewers' focus is more on the tools used to assess quality, many of which are designed to assess the quality of *individual* studies, rather than *across a group* of studies. This raises important questions over the nature of the guidance used by LIS reviewers when undertaking a systematic review. A quick look at the guidance referred to in the systematic reviews in this study reveals that LIS reviewers follow a range of guidance when undertaking a systematic review, from the more formal (e.g., Higgins & Green, 2011; CRD, 2009) to single journal articles providing a rather short, introductory overview of the systematic review.

While there are numerous texts explaining how to conduct a systematic review, they are largely written from the perspective of the healthcare professional rather than the LIS professional (e.g. Booth, Papaioannou, & Sutton, 2012; CRD, 2009; Higgins & Green, 2011). Currently there is no comprehensive guidance with a focus on the different approaches to evidence synthesis written purely from a LIS perspective with relevant guided examples of how to undertake and incorporate quality assessment in the analysis. The findings of this study appear to demonstrate a need for such a resource or series of guides. However, even when comprehensive guidance is available, such as in the healthcare domain, the findings of previous methodology studies examining the incorporation of quality assessment in systematic reviews (Hayden et al., 2006; Katikireddi et al., 2015) seem to suggest that reviewers still fail to address how the quality of included studies impacts on the validity of the review findings.

De Craen et al. (2005) also suggest that reviewers may see the incorporation of quality assessment in the analysis as a "cumbersome procedure" which might "further complicate the interpretation of its results" (p. 312). It is certainly the case that the heterogeneous nature of the LIS evidence base requires LIS reviewers to consider the quality of studies across diverse research designs. This adds another level of complexity to the quality assessment process since different biases may arise according to the type of research design, which makes comparisons across studies more difficult. Furthermore, quality assessment is something that is out of the comfort zone of many librarians (Maden-Jenkins, 2011).

Critical to the understanding of how quality impacts on the review findings is the reviewers' definition of quality. Four definitions of quality were identified in LIS systematic reviews: reporting quality, study design, methodological quality (internal and external validity), and risk of bias (internal validity). While an assessment of bias in research does rely on the quality of the reporting, assessing the quality of the reporting can become more of a descriptive exercise in recording whether or not methods were reported, rather than assessing whether the methods were adequately conducted in order to reduce bias. Similarly, basing quality assessment on study design may lead reviewers to base quality on the level of evidence rather than the process used to conduct the study, which ignores the possibility that high levels of evidence, such as systematic reviews or randomized controlled trials, may have been poorly conducted and therefore susceptible to bias.

Part of this problem may be that quality assessment tools that purport to assess methodological quality are, on further examination, actually assessing the reporting quality. The JADAD tool (Jadad et al., 1996) is a prime example of this where reviewers are asked to assess whether the study was *described* as a double-blinded randomized controlled trial. Even the criteria used in AMSTAR to critique the approach to quality assessment in systematic reviews goes no further than to address whether or not the methods were reported a priori. Reviewers, therefore, should critique their own approach to quality assessment to ensure that the criteria or tool they select for quality assessment is appropriate and fit for purpose.

For those systematic reviews in this study that do report on quality assessment in the methods, there is need for greater transparency in the reporting process. This can be a fairly simple process of tabulating the quality assessment in tables or figures, such as in Cochrane reviews. Reporting on the quality assessment items for each study allows the reader to see exactly on what criteria (methodology, reporting, etc.) judgments of quality were made, while at the same time making it easier for reviewers to judge the overall quality of the evidence base.

Identifying the type of tool and resources LIS reviewers used to assess the quality of the evidence was not straightforward. The aids

identified went beyond the use of tools developed specifically for quality assessment. The large number of different quality assessment tools identified reflects not only the disparate nature of the LIS evidence base (Brettle, 2009), but also a lack of consensus around criteria on which to assess the quality of LIS research. Given the diverse nature of the LIS evidence base and the multiple study designs often incorporated into LIS reviews (see table 1), quality assessment tools with a more generic focus on qualitative, quantitative, or mixed methods focus rather than a study design focus (e.g. randomized controlled trial) may help reviewers compare and contrast the quality of the included studies more easily. LIS reviewers may wish to look at how reviews incorporating a wide variety of study designs approach quality assessment (e.g. The Campbell Collaboration).

Due to the broad nature of some of the AMSTAR and PRISMA criteria, it was sometimes difficult to interpret the criteria and make a clear judgment on some of the quality items assessed. For example, AMSTAR item #8 asks "Was the scientific quality of the included studies used appropriately in formulating conclusions?" (Shea et al., 2007, p. 5). The accompanying notes suggest that "The results of the methodological rigor and scientific quality should be considered in the analysis and the conclusions of the review, and explicitly stated in formulating recommendations" (Shea et al., 2007, p. 5). For example, some studies reported on the impact of quality assessment on the review findings in the analysis but not the conclusions, while others reported recommendations for improving the quality of future research but failed to assess the impact the quality of the included studies had on the review findings. The criteria also lacked transparency in assessing whether the tools and approaches to quality assessment were appropriate.

For those undertaking LIS systematic reviews, consideration therefore should be given to the PRISMA and AMSTAR criteria (box 2) for incorporating considerations of quality assessment in systematic reviews, specifically how the quality of the included studies may impact on the validity of the overall review findings. In addition, reviewers should ensure that whatever criteria or tool they use for quality assessment is fit for purpose. In other words, reviewers should critique their chosen set of criteria or tool to ensure it reflects the purpose of the quality assessment (e.g. methodological quality versus reporting quality). Given that tools aiming to assess methodological quality often, on further examination, are found to actually assess reporting quality, further research on the appropriateness of tools and criteria selected to quality assessment in LIS reviews is warranted. Further research should also examine what criteria are necessary to adequately assess the quality of studies included in LIS systematic reviews. Above all, there is a need for tailored LIS systematic review guidance with accompanying exemplar case studies of LIS systematic reviews.

Strengths and Limitations

One reviewer of this study extracted data from all included studies. One of the reviewers (MM) also co-authored one of the included studies (Brettle et al., 2011); therefore, a second reviewer (EK) checked the data extraction for accuracy. While we used an existing resource that listed published LIS systematic reviews, it is possible that other published LIS systematic reviews were not listed on the wiki. We included only studies that reported themselves as being a systematic review. Other studies may have followed systematic review principles but were not explicit in labelling themselves as such. No attempt was made to contact the authors of the included studies for further clarification. This study did not seek to critique the reviewers choice of quality assessment tool but rather to identify the tools used and the approach for incorporating considerations of quality assessment in systematic reviews. Finally, perhaps the major limitation in the way this

study was conducted is that 18 of the included LIS studies were published before the PRISMA guidelines (Moher et al., 2009) were available, and 11 were published before AMSTAR tool (Shea et al., 2007) was available. However, even studies published after these dates show only a very small improvement in meeting the criteria (see table 4) and there is still a long way to go in improving quality assessment methods in LIS systematic reviews.

Conclusions

Although quality assessment of included studies is an integral part of the systematic review methodology, the extent to which it is documented and undertaken in LIS systematic reviews varies widely. The results of this study demonstrate a need for greater clarity, definition, and understanding of the methodology and concept of quality in the systematic review process, not only by LIS reviewers but also by editors of journals who accept such studies for publication. Due to the diverse nature of the LIS evidence base, work still needs to be done to identify the best tools and approaches for incorporating considerations of quality in LIS systematic reviews. What is clear from this analysis is that LIS reviewers need to improve the robustness and transparency with which they undertake and report quality assessment in systematic reviews. Above all, LIS reviewers need to be explicit in coming to a conclusion on how the quality of the included studies may impact on their review findings. In considering this, LIS reviewers can therefore increase the validity of their systematic review.

Disclaimer: The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health.

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