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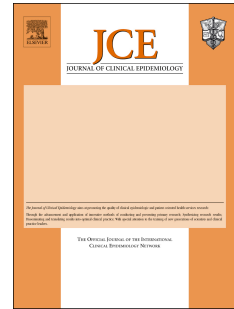
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# Accepted Manuscript

Lack of transparency in reporting narrative synthesis of quantitative data: a methodological assessment of systematic reviews

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1 Lack of transparency in reporting narrative synthesis of quantitative data: a methodological  
2 assessment of systematic reviews

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19 **Abstract**

20 **Objective:** To assess the adequacy of reporting and conduct of narrative synthesis of quantitative  
21 data (NS) in reviews evaluating the effectiveness of public health interventions.

22 **Study design and setting:** A retrospective comparison of a 20% (n=474/2372) random sample of  
23 public health systematic reviews from the McMaster Health Evidence database (January 2010-  
24 October 2015) to establish the proportion of reviews using NS. From those reviews using NS, 30%  
25 (n=75/251) were randomly selected and data extracted for detailed assessment of: reporting NS  
26 methods; management and investigation of heterogeneity; transparency of data presentation; and  
27 assessment of robustness of the synthesis.

28 **Results:** Most reviews used NS (56%, n=251/446), meta-analysis was the primary method of  
29 synthesis for 44%. In the detailed assessment of NS: 95% (n=71/75) did not describe NS methods;  
30 43% (n=32) did not provide transparent links between the synthesis data and the synthesis reported  
31 in the text; of 14 reviews that identified heterogeneity in direction of effect, only one investigated  
32 the heterogeneity; and 36% (n=27) did not reflect on limitations of the synthesis.

33 **Conclusion:** NS methods are rarely reported in systematic reviews of public health interventions and  
34 many NS reviews lack transparency in how the data are presented and the conclusions are reached.  
35 This threatens the validity of much of the evidence synthesis used to support public health.  
36 Improved guidance on reporting and conduct of NS will contribute to improved utility of NS  
37 systematic reviews.

38

39 **Key words:** systematic review, meta-research, methodology, narrative synthesis, evidence synthesis

40 **Running title:** Reporting and conduct of narrative synthesis in systematic reviews

41 **Word count:** 3055

42 **What is new?**43 **Key findings**

- 44 • Based on a sample of public health reviews, it is apparent that, despite being commonly  
45 used, narrative synthesis often lacks transparency.
- 46 • Synthesis methods are rarely reported, and presentation of data in the review often does  
47 not facilitate clear links between visual presentation of the data and the text.

48 **What this adds to what was known?**

- 49 • This is the first study to assess the adequacy of reporting of narrative synthesis of  
50 quantitative data in systematic reviews.

51 **What is the implication and what should change now?**

- 52 • Substantial improvements in clarity of reporting of narrative synthesis are required. There is  
53 a need for existing guidance to inform the development of a clear and concise reporting  
54 guideline for narrative synthesis.
- 55 • Greater transparency when reporting narrative synthesis will allow end users including  
56 practitioners and policy decision-makers to have greater confidence in the results of  
57 systematic reviews that use narrative synthesis.

58

## 59 1 INTRODUCTION

60 Well conducted systematic reviews have an important role in supporting evidence-informed policy  
61 and practice.[1, 2] The value of systematic reviews in supporting decision-making, compared with  
62 other types of review, is their use of a transparent method to draw conclusions based on the best  
63 available evidence. While meta-analysis is a cornerstone of many systematic reviews, statistical  
64 pooling may not always be appropriate or feasible due to high levels of heterogeneity or lack of  
65 available data to calculate standardised effect estimates (e.g. standardised mean difference, odds  
66 ratio, risk ratio). Heterogeneity, both statistical and methodological, is a common issue for public  
67 health reviews where it is typical to include diverse study designs, outcomes, contexts, populations,  
68 and interventions.[3] When meta-analysis is inappropriate or not possible, data may be synthesised  
69 narratively; this method is relied on heavily by those conducting reviews addressing public health  
70 issues. For example, 74% of National Institute for Health and Care Excellence (NICE) public health  
71 appraisals included NS.[4]

72 Concerns have been raised that Narrative Synthesis of quantitative data (NS) lacks transparency and  
73 has substantial potential for bias.[5-7] Specifically, there is concern that conclusions of NS are based  
74 on subjective interpretation[5, 7] with a risk of over emphasising selected results without clear  
75 justification. This lack of transparency, limits assessment of the level and sources of bias in NS,[5]  
76 threatens the replicability of the method, and may ultimately threaten the validity and value of  
77 review findings based on NS. However, empirical evaluations of the reporting and adequacy of NS  
78 are lacking. This paper presents the findings of a systematic review that aimed to establish current  
79 practice, and adequacy of reporting and conduct of NS of quantitative data in public health  
80 systematic reviews.

## 81 2 METHODS

82 To assess reporting and conduct of NS, we identified a random sample of recent public health  
83 systematic reviews and systematically assessed the adequacy of reporting and conduct by  
84 benchmarking against available published guidance. The methods of this review are described  
85 below, further details are available in the review protocol.[8]

86 To establish existing guidance on NS, we consulted publications, textbooks and methods papers,  
87 these are outlined in Box 1, along with the key elements of NS from the most comprehensive  
88 guidance of provided by Popay et al.[9] For the purposes of this work, we used the definition of NS  
89 as proposed by Popay et al. in the UK's Economic and Social Research Council (ESRC) guidance:

90 *“Narrative synthesis refers to an approach to the systematic review and synthesis of findings from*  
91 *multiple studies that relies primarily on the use of words and text to summarise and explain the*  
92 *findings of the synthesis. Whilst narrative synthesis can involve the manipulation of statistical data,*  
93 *the defining characteristic is that it adopts a textual approach to the process of synthesis to ‘tell the*  
94 *story’ of the findings from the included studies”.*[9, page 5]

### 95 **Box 1: Overview of ESRC guidance on narrative synthesis[9] and additional key sources consulted** 96 **to establish best practice in narrative synthesis**

The most comprehensive guidance on the conduct and reporting of NS was published in 2006,[9] commonly known as the ‘ESRC guidance on NS’. The general elements of narrative synthesis set out by Popay et al.[9] (page 12-16):

1. **Developing a theoretical model of how the interventions work, why and for whom**
2. **Developing a preliminary synthesis:** develop an initial description of the results of included studies.  
Tools and techniques suggested: textual descriptions of studies, groupings and clusters, tabulation, transforming data into a common rubric, vote counting, translating data thematic analysis, content analysis.
3. **Exploring relationships in the data:** examine emerging patterns in data to identify any explanations for differences in direction or size of effect across included studies  
Tools and techniques suggested: graphs, frequency distributions, funnel plots, forest plots, moderator variables and sub group analysis, idea webbing and conceptual mapping, translation reciprocal and refutational, qualitative case descriptions, investigator/methodological triangulation, conceptual triangulation
4. **Assessing the robustness of the synthesis product:** trustworthiness of the synthesis, incorporating the methodological quality of the included studies and the methods used in the synthesis.  
Tools and techniques suggested: weight of evidence, best evidence synthesis, use of validity assessment, reflecting critically on the synthesis process, checking the synthesis with authors of primary studies.

Additional sources consulted to develop data extraction tool:

- An introduction to systematic reviews [11]
- Systematic reviews in the social sciences: a practical guide [12]
- Synthesising qualitative and quantitative health evidence: a guide to methods [13]
- Guidelines for systematic reviews of health promotion and public health interventions [14]
- Cochrane handbook for systematic reviews of interventions [5]
- WHO Handbook for guideline development [16]

97

98

99 *2.1 Search strategy, inclusion criteria and review selection*

100 We obtained a download of systematic reviews, from the McMaster Health Evidence database  
101 (<http://www.healthevidence.org/>), which were published between January 2010 and October 2015  
102 inclusive. The Health Evidence database contains systematic reviews relevant to public health which  
103 meet each of the following criteria: address questions related to promotion, protection or  
104 prevention in public health or health; include participants from developed countries; examine an  
105 intervention/programme/service/policy; include evidence on outcomes; and describe a search

106 strategy (see <http://www.healthevidence.org/our-appraisal-tools.aspx>). The Health Evidence  
107 database uses a validated search filter which has high sensitivity, specificity and precision for  
108 retrieving systematic reviews of public health interventions.[10] In addition to the database inclusion  
109 criteria, we specified that reviews had to be systematic and contain synthesis; we excluded expert  
110 reviews, overviews, empty reviews and reviews with no synthesis.

111 Using the Microsoft Excel® random number function, a 20% random sample was selected from the  
112 full Health-Evidence database download. The Excel random number function was used to allocate a  
113 number to each database entry (the results of the Health Evidence database search) and numbers  
114 were sorted lowest to highest. The first 20% of the random numbers were used to identify and  
115 include the corresponding Health Evidence reviews. This sample of reviews was screened (by MC,  
116 HT, AS, SVK) to identify reviews using NS of quantitative data for their primary outcome. If the  
117 review did not state a primary outcome, we identified the “primary outcome” of interest by the  
118 review question(s). A further 30% sub-sample of reviews which used NS as the primary method of  
119 synthesis was randomly selected for more detailed data extraction and analysis.

## 120 *2.2 Data extraction*

121 The data extraction form was designed to reflect key elements of good practice in the conduct and  
122 reporting of NS of quantitative data. Key sources on the conduct of NS of quantitative data[11-16]  
123 informed the design of the data extraction form. (See Box 1) Three members of the research team  
124 (MC, HT & SVK) read the key sources independently and prepared a list of items or components that  
125 were common in the key sources. The lists were then collated to prepare items for inclusion in the  
126 draft data extraction form, which was then finalised in discussion with all authors (online Supporting  
127 Information file, Appendix Table S1). There was little variation in recommended practice for NS  
128 across the identified sources. The ESRC guidance provided the most comprehensive explanation and  
129 the other sources appeared to draw heavily on this guidance.[9] The data extraction form, therefore,  
130 largely reflects the core components recommended in the ESRC guidance. Five main aspects of NS  
131 were identified and covered by the data extraction exercise, namely:

- 132 • Reporting of NS methods
- 133 • Use of theory (i.e. articulation of how the intervention is expected to work)
- 134 • Management and investigation of heterogeneity across studies
- 135 • Transparency of data presentation and links to narrative
- 136 • Assessment of robustness of the synthesis (i.e. reflection of the synthesis methods used to  
137 assess the strength of the evidence from the included studies)

138 Two reviewers (MC and HT) independently piloted the data extraction form. All members of the  
139 project team conducted data extraction on a selection of the same five reviews until assessments  
140 were consistent across each member of the research team (MC, HT, SVK, AS). The data were entered  
141 directly into a Microsoft Excel® database. Health Evidence quality assessment ratings of the reviews  
142 were gathered after the data extraction exercise was complete.

## 143 *2.3 Summarising the data*

144 The extracted data were tabulated to reflect the five main aspects of NS (see above) and are  
145 described narratively, with frequencies and descriptive data. Text was extracted to illustrate the  
146 reporting of NS methods.

## 147 **3 Results**



148 A total of 2372 systematic reviews of public health interventions published between January 2010  
 149 and October 2015 were available from The McMaster Health Evidence database (see Figure 1). From  
 150 the initial 20% (n=474/2372) random sample of reviews, 28 (6%) were excluded as they did not fit  
 151 our inclusion criteria: not systematic review (expert review/overview) (n=8) or were empty reviews  
 152 (contained no studies) (n=2). We were unable to retrieve the full text of 18 further reviews. Of the  
 153 446 reviews included, 251 (56%) synthesised the data for the primary outcome narratively; of these,  
 154 215 (48%) used NS exclusively, and 36 (8%) used a combination of NS and meta-analysis for primary  
 155 outcome data (i.e. some data were included in the meta-analysis, with other data reported and  
 156 discussed in the narrative text). The remaining reviews (44%, n=195) used meta-analysis to  
 157 synthesise the primary outcome data.

### 158 3.1 Included reviews

159 All of the included reviews were published in international peer review journals. For a list of the  
 160 included reviews, see Appendix Table S2. A list of results of extracted items reported in the text of  
 161 this paper is provided in Appendix Table S3. The McMaster Health Evidence database provides a  
 162 quality assessment of each included review, this is based on a ten-item quality assessment tool that  
 163 covers all aspects of the systematic review process. The assessment incorporates clarity of review  
 164 question, appropriate search strategy, and risk of bias assessment, and two items assessing aspects  
 165 of synthesis ('Was it appropriate to combine the findings of results across studies?', 'Were  
 166 appropriate methods used for combining or comparing results across studies?')  
 167 (<https://www.healthevidence.org/our-appraisal-tools.aspx>). We randomly selected and analysed  
 168 the 75 reviews in our sample blind to the Health Evidence quality assessment scores and retrieved  
 169 these scores after our data extraction exercise was complete. Of the reviews in our sample, 37% had  
 170 a strong rating (score of 8 to 10/10), 60% moderate (score of 5 to 7/10), and 3% weak (score of 1 to  
 171 4/10). Therefore, we are confident that the majority of the sample reviews followed good practice;  
 172 however that assessment process did not fully examine the synthesis processes in the systematic  
 173 reviews.

174 The following sections report on the detailed data extraction conducted on the 30% (n=75/251)  
 175 random sample of the reviews that synthesised data narratively.

### 176 3.2 Reporting of narrative synthesis methods

177 While 75 reviews synthesised data narratively, i.e. using text only, a description of the methods used  
 178 for NS was absent in 95% of the reviews (n=71). Where methods were reported, the description was  
 179 typically sparse, see examples in Box 2. Few review authors used the term 'narrative synthesis' to  
 180 describe their synthesis; 27% (n=20/75) described their synthesis as 'narrative' or 'qualitative', and  
 181 justification for using NS was rarely provided (15%, n=3/20). In around half (51%, n=38/75) of the  
 182 reviews using NS, the authors stated that they were unable to conduct a meta-analysis but provided  
 183 no further details of how the data were synthesised (Table 1, items 1.1 – 1.3).

#### 184 **Box 2: Examples of narrative synthesis description**

185

##### **Examples of narrative synthesis description**

"A narrative synthesis was undertaken for each category of intervention to compare the effects of each on cervical screening uptake" Albrow R, Blomberg K, Kitchener H, et al. *Acta Oncologica* 2014; 53:445-51.

"The heterogeneous nature of the literature meant that a largely narrative synthesis approach

was employed [citation provided]." Abendstern M, Harrington V, Brand C, Tucker S, Wilberforce M, Challis D. *Aging Ment Health* 2012; 16:861-73.

"Because of heterogeneity in outcomes and outcome assessment methodology, meta-analysis was not undertaken. Results are presented in narrative form." Golley RK, Hendrie GA, Slater A, Corsini N. *Obesity Rev* 2011; 12:114-30.

"Results are presented as a narrative synthesis. Equity effect was summarised [citation provided]." Gallo MF, Nanda K, Grimes DA, Lopez LM, Schulz KF. *Cochrane Database Syst Rev* 2013; 2013:Art. No.: CD003989.

"Due to variability in participant and intervention characteristics, assessment tools used to diagnose frailty, and outcome measures used across studies, a meta-analysis could not be satisfactorily performed. Meta-analysis should only be considered when a group of studies have sufficient homogeneity between participants, interventions, and outcomes to provide a meaningful summary. In accordance with the Cochrane library if there is substantial clinical diversity a qualitative approach combining studies is appropriate." Theou O, Stathokostas L, Roland KP, et al. *J Aging Res* 2011;2011: Art. no: 569194.

For mixed meta-analysis and narrative synthesis: "Two studies that were conducted in children were not included in the meta-analyses and are reported separately." Balk EM, Earley A, Raman G, Avendano EA, Pittas AG, Remington PL. *Ann Intern Med* 2015: 437-51.

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188

**Table 1 Reporting and conduct of narrative synthesis**

	<b>Reviews which synthesised data narratively (n=75)</b>	
<b>1 Reporting narrative synthesis (NS) methods and use of theory</b>		
1.1 Method of narrative synthesis described	Yes	5% (n=4)
	State did NS, no description	16% (n=12)
	No mention of NS	79% (n=59)
1.2 Do authors state they will conduct narrative synthesis?	Yes	27% (n=20)
	No	73% (n=55)
1.3 What justification is given for using narrative synthesis?	Cannot conduct meta-analysis	51% (n=38)
	NS most appropriate method	4% (n=3)
	Providing summary of data	3% (n=2)
	No justification provided	5% (n=4)
	N/A (did not say would do NS)	37% (n=28)

1.4 Theory/rationale for how the intervention(s) of interest is expected to work (prior to synthesis)	Explicit	47% (n=35)
	Implicit	43% (n=32)
	None	10% (n=8)
<b>2 Management and investigation of heterogeneity across studies</b>		
2.1 Were data/studies split into sub-groups for presentation of synthesis?	Yes	80% (n=60)
	No	20% (n=15)
2.2 If data/studies not split into sub-groups, was there justification for this?	Yes	0% (n=0)
	No	20% (n=15)
	N/A (data split into sub-groups)	80% (n=60)
2.3 If studies were grouped/split, how were the studies grouped?	(multiple groupings in some reviews)	
	Study design	(n=13)
	Risk of bias	(n=5)
	Intervention	(n=36)
	Population	(n=9)
	Context (country, location/setting)	(n=6)
	Outcome	(n=26)
	Other	(n=6)
(Other = whether replication studies available (1), mechanisms (1), theoretical basis (3), comparisons(1))		
2.4 Did review authors identify heterogeneity in the direction of the <b>primary</b> outcome?	Yes	19% (n=14)
	No	60% (n=46)
	Unclear	21% (n=15)
2.5 If the authors reported heterogeneity in direction of primary outcome, was there any attempt to explain this?	To a large extent	2% (n=1)
	To some extent	13% (n=10)
	No	9% (n=7)
	N/A	75% (n=56)
	(on some occasions we commented on an	

	'unclear whether heterogeneity identified' item )	
<b>3 Transparency of data presentation and links to narrative</b>		
3.1 Did presentation of data facilitate clear links between the text and the data for the reader?	Yes	57% (n=43)
	Partially	32% (n=24)
	No	5% (n=4)
	No data presented in a table	5% (n=4)
3.2 The summary of characteristics table(s) provide details of:	Study design	95% (n=71)
	Risk of bias	52% (n=39)
	Intervention	95% (n=71)
	Population	88% (n=66)
	Outcome	88% (n=66)
	Context (country, location/setting)	65% (n=49)
	Other (Other includes: sampling strategy, theory, follow up time, details of study control groups, brief results)	47% (n=35)
3.3 In the conclusion, are the key findings clearly referring back to evidence in results (text or table/figure)?	Yes	60% (n=45)
	To some extent	33% (n=25)
	Unclear	7% (n=5)
<b>4 Robustness of synthesis</b>		
4.1 Authors' reflections on limitations of synthesis	Free text, broadly coded:	
	Inclusion criteria	35% (n=26)
	Heterogeneity (study characteristics, outcomes and analysis)	21% (n=16)
	Generalisability of review findings	4% (n=3)
	Analysis	11% (n=8)

	(alternative analysis/coding possible lack of meta-analysis) No mention of limitations of synthesis 36% (n=27)
4.2 Authors' reflections on limitations of evidence	Free text, broadly coded: Inadequate study quality 32% (n=24) Lack of high quality evidence 13% (n=10) Relevant/available studies 19% (n=14) Lack of intervention details 19% (n=14) Heterogeneity of measurement outcomes 5% (n=4) No mention of limitations of evidence 12% (n=9)

189

190 Ten reviews (13%) reported the type of synthesis approach that was followed or referred to specific  
191 guidance or methods texts: ESRC guidance (n=2);[9] NICE guidelines (n=1);[15] the Cochrane  
192 handbook (n=2);[5] thematic synthesis (n=1);[17] integrative review (n=1);[18] 'formative' review  
193 (n=1); 'freeplane' (n=1); and vote counting (n=1).

### 194 3.3 Use of theory

195 Nearly all (90%, n=67) of reviews reported how the intervention was expected to work or impact on  
196 the primary outcome. Around half of the reviews (47%, n=35) did this explicitly, with two including a  
197 visual diagram to illustrate the mechanisms of action. A further 10% (n=8) did not report any theory  
198 of change. (Table 1, item 1.4)

### 199 3.4 Management and investigation of heterogeneity across studies

200 Diversity of study characteristics was dealt with in most (80%, n=60) reviews by creating categories,  
201 usually by intervention, outcomes, or study design before conducting and presenting the synthesis  
202 (Table 1, item 2.1, 2.3). Two reviews (3%) reported conducting preliminary synthesis, a component  
203 of NS recommended in the ESRC guidance on NS.[9]

204 A small number of reviews (19%, n=14) reported heterogeneity in the direction of effect in the  
205 reported outcomes, (positive, negative or null effect, for the primary outcome) (Table 1, item 2.4).  
206 The lack of protocols for most reviews prevented recording whether investigation of heterogeneity  
207 was pre-specified. This study was not assessing the appropriateness of the investigation of  
208 heterogeneity. This would require expertise in the topic of investigation for all the reviews, which

our project team did not have. Rather, we describe how investigation of heterogeneity was conducted. Only one review investigated heterogeneity in the direction of effect; specifically, the authors explored differences in intervention components (treatment regimens) across studies, and provided an explanation for the heterogeneity. Ten reviews provided hypothetical explanations for the variance in reported effect directions and three reviews did not offer any explanation. Hypothesised explanations for heterogeneity focussed on differences in the characteristics or outcome measures of interventions, or the risk of bias of included studies. In one review (2%) the authors linked their hypothesised explanation of heterogeneity in reported effects to a pre-specified theory, suggesting that intervention adherence influenced the outcome.

### 3.5 Transparency of data presentation and links to narrative

Tables presenting outcome data were provided in 85% (n=64) of reviews, either alongside the text or as an online appendix. While 54% (n=40) of the reviews made the full data extraction available, either in the article (43%, n=32) or online (11%, n=8), the remaining 47% (n=35) of reviews did not provide access to all the data incorporated into the synthesis. In 15% (n=11) of reviews, not all the included studies were referred to in the narrative, leading to uncertainty as to whether the data from these studies had been included.

Using information about the type, detail, and clarity (including grouping) of reporting of data in each review, we assessed transparency; 57% (n=43) of reviews were assessed as promoting transparent links between the data and the text. A summary table presenting key characteristics of included studies was included in 97% (n=73) of reviews; providing information about study design, intervention, population, and outcomes (Table 1, item 3.1, 3.2).

We also assessed the extent to which review conclusions were linked to the included data, based on how clearly the conclusions referred to the reported results. We judged this to be clear, (i.e. the key findings in the conclusion clearly referred back to the text or visual evidence in the results), to a large extent or to some extent for most reviews (n=45 and n=25 respectively); however, in 7% (n=5) of reviews there was no clear link between the conclusions and the evidence referred to in the synthesis.

### 3.6 Assessment of the robustness of the synthesis

When considering the strengths and limitations of the evidence, review authors were more likely to reflect on the limitations of the primary studies included in the review (88%, n=66), rather than limitations of the synthesis they had conducted (64%, n=48). Limitations referred to risk of bias in included studies, relevance and reporting of study and intervention details, and heterogeneity of outcome measurements (Table 1, item 4.1). Where limitations of the synthesis were reported these included search and inclusion criteria (e.g. search limited to published articles, only English language text included), heterogeneity of study characteristics, outcomes, and generalisability of the review findings to other settings or populations (Table 1 item 4.2).

Each assessor provided an overall subjective assessment of the level of trust in the results of each synthesis; 44% (n=33) were considered to be trusted 'to a large extent', 44% (n=33) 'to some extent' and 'did not trust the synthesis' in 12% (n=9) of reviews assessed. See Appendix Table S4 for comparison of the project team's level of trust of review syntheses with the Health Evidence quality rating.

## 4 Discussion

251 Narrative synthesis is more commonly used than meta-analysis for synthesising quantitative data in  
252 systematic reviews of public health interventions. Despite its popularity, our detailed assessment  
253 shows that reporting of NS methods is almost totally absent, and the transparency of how NS is  
254 conducted is variable and currently inadequate. In 95% of reviews relying on NS for their primary  
255 outcome, all from international peer review journals, the methods used were not described. While  
256 the majority of reviews did incorporate some core components of good practice (describing the  
257 rationale for the intervention, transparently relating tabulated data to the text in the results, and  
258 reflecting on the robustness of the synthesis), fewer than 30% of the reviews adopted each of these  
259 components. Our findings support previous criticism of NS as being opaque, particularly in relation  
260 to interpreting the evidence and being susceptible to selective reporting. This potential for bias is  
261 important and threatens the value of systematic reviews that use NS. In public health, where NS is  
262 commonly used, these are important issues undermining the role of these key resources as tools to  
263 support evidence informed decision making in public health.

264 The findings of our work are based on a representative sample of reviews from the Health Evidence  
265 database; a comprehensive source of systematic reviews of public health interventions.[10]  
266 Limitations of our study include the lack of a gold standard with which to compare reporting of NS.  
267 We used single assessors for data extraction, however this was only after good agreement in the  
268 data extraction was achieved between independent assessors. Our sample of reviews allows an  
269 overall assessment of current practice within public health reviews, but we are aware that the  
270 sample is too small to allow robust comparison of reporting and conduct in reviews from different  
271 disciplines or different health topics. Despite the focus on public health, the findings are likely to be  
272 relevant to the wider field of evidence synthesis, regardless of topic. Indeed, we suspect that the  
273 conduct of NS may be poorer in other topic areas where there is less familiarity with NS as a method.  
274 NS will continue to be a necessary method of synthesis due to the complex nature of many  
275 interventions and the need to support evidence informed decision making.[19]

276 The limited reference to available guidance on NS and the near absence of reporting of NS methods,  
277 suggests that there is a general lack of familiarity with NS as a method among review authors.  
278 Furthermore, the lack of justification for using NS beyond statements such as 'it was not possible to  
279 conduct meta-analysis' suggests that review authors may not consider NS to be a discrete method of  
280 synthesis. This is supported by our own informal discussions with experienced review authors who  
281 have expressed uneasiness around how to conduct and assess NS, yet acknowledge that NS is an  
282 important and essential method for reviews with high levels of heterogeneity and where diverse  
283 types of evidence are included.

284 Despite its frequent use, development of NS methods has been scant. This is in contrast to work to  
285 promote rigor in statistical synthesis or meta-analysis,(5) as well as more recent work to improve  
286 synthesis of qualitative data.[17, 20, 21] Similarly, reporting guidelines for meta-analysis  
287 (PRISMA),[22] meta-ethnography (EMERGE)[23] and synthesis of qualitative data (ENTREQ)(24) are  
288 widely available, yet relatively little has been written on how to promote transparency in the  
289 conduct and reporting of NS. This further supports the notion that NS of quantitative data is not  
290 widely recognised as a discrete synthesis method.

291 Increasingly, systematic reviews need to address questions about complex interventions and go  
292 beyond straightforward questions of effectiveness.[3, 4, 19, 25-28] This issue goes beyond public  
293 health; the Cochrane 2020 strategy points to a move towards incorporating more diverse sources of  
294 evidence and addressing complex health decision making questions.[29] NS is well placed to support  
295 these types of reviews, not only as an alternative when meta-analysis is contra-indicated but as an  
296 important synthesis tool in its own right. It offers a method for exploring and understanding the

297 underlying arguments and justification of claims made in the included studies of a review.(28) NS  
298 enables reviewers to incorporate diversity in study designs, participants, interventions or outcomes.

299 NS is likely to remain an important method for bringing together heterogeneous evidence. The work  
300 reported here shows that current practice in the conduct and in particular, the reporting of NS, is not  
301 consistent with the standards of transparency expected from rigorous and reliable systematic  
302 reviews. There is a need to provide support to those conducting NS and those attempting to assess  
303 the reliability of NS of quantitative data. NS is used in Cochrane reviews, perhaps more often than  
304 presumed. We estimated at least 20% of recent Cochrane reviews used NS to synthesise outcome  
305 data.[30] We intend to contribute to the improved use of NS with The Improving the Conduct and  
306 reporting Of Narrative Synthesis of Quantitative data (ICONS-Quant) project, supported by the  
307 Cochrane Strategic Methods Fund which aims to produce guidance and reporting guidelines for  
308 authors conducting NS of quantitative data ([http://www.equator-network.org/library/reporting-](http://www.equator-network.org/library/reporting-guidelines-under-development/#74)  
309 [guidelines-under-development/#74](http://www.equator-network.org/library/reporting-guidelines-under-development/#74)). Improved guidance has been linked to improved reporting of  
310 research,[31] without which it is difficult for decision-makers to make use of research findings in the  
311 real world.[32]

312

## 313 5 Conclusion

314 Narrative Synthesis is a valuable method for synthesising quantitative data where meta-analysis is  
315 not appropriate. While NS of quantitative data is widely used, it is poorly reported and transparency  
316 is often lacking, threatening the credibility and value of many systematic reviews. The poor  
317 reporting suggests a lack of familiarity with, and confidence about, how to implement best practice  
318 when conducting NS. Improved guidance on the conduct and reporting of NS of quantitative data is  
319 required to support authors and ensure reviews using NS can be reliably used by decision makers.

320

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333



334 **References**

- 335 1. Lavis JN, Posada FB, Haines A, Osei E. Use of research to inform public policymaking. *Lancet*.  
336 2004;364:1615-21.
- 337 2. Ogilvie D, Craig P, Griffin S, Macintyre S, Wareham NJ. A translational framework for public health  
338 research. *BMC Public Health*. 2009;9:116.
- 339 3. Petticrew M, Anderson L, Elder R, Grimshaw J, Hopkins D, Hahn R, et al. Complex interventions  
340 and their implications for systematic reviews: a pragmatic approach. *J Clin Epidemiol*. 2013;66:1209-  
341 14.
- 342 4. Achana F, Hubbard S, Sutton A, Kendrick D, Cooper N. An exploration of synthesis methods in  
343 public health evaluations of interventions concludes that the use of modern statistical methods  
344 would be beneficial. *J Clin Epidemiol*. 2014;67:376-90.
- 345 5. Higgins JP, Green S, editors. *Cochrane Handbook for Systematic Reviews of Interventions*. Wiley  
346 Online Library; 2011.
- 347 6. Valentine JC, Cooper H, Patall EA, Tyson D, Robinson JC. A method for evaluating research  
348 syntheses: the quality, conclusions, and consensus of 12 syntheses of the effects of after-school  
349 programs. *Res Synth Methods*. 2010;1:20-38.
- 350 7. Valentine JC, Wilson SJ, Rindskopf D, Lau TS, Tanner-Smith EE, Yeide M, et al. Synthesizing  
351 evidence in public policy contexts. *Eval Rev*. 2017;41:3-26.
- 352 8. Campbell M, Thomson H, Katikireddi S, Sowden A. *Assessing Reporting of Narrative Synthesis of*  
353 *Quantitative Data in Public Health Systematic Reviews* [protocol]. Glasgow, UK: MRC/CSO Social and  
354 Public Health Sciences Unit. University of Glasgow, 2015.
- 355 9. Popay J, Roberts H, Sowden A, Petticrew M, Arai L, Rodgers M, et al. *Guidance on the Conduct of*  
356 *Narrative Synthesis in Systematic Reviews*. Swindon: ESRC Methods Programme, 2006.
- 357 10. Lee E, Dobbins M, DeCorby K, McRae L, Tirilis D, Husson H. An optimal search filter for retrieving  
358 systematic reviews and meta-analyses. *BMC Med Res Methodol*. 2012;12:1-11.
- 359 11. Gough D, Oliver S, Thomas J. *An Introduction to Systematic Reviews*. London: Sage; 2012.
- 360 12. Petticrew M, Roberts H. *Systematic Reviews in the Social Sciences: A Practical Guide*. Malden,  
361 MA: Blackwell; 2006.
- 362 13. Pope C, Mays N, Popay J. *Synthesising Qualitative and Quantitative Health Evidence: A Guide to*  
363 *Methods*. London: Open University Press; 2007.
- 364 14. Armstrong R, Waters E, Jackson N, Oliver S, Popay J, Shepherd J, et al. *Guidelines for Systematic*  
365 *Reviews of Health Promotion and Public Health Interventions*. Version 2. Australia: Melbourne  
366 University, 2007.
- 367 15. Popay J. *Methods for the Development of NICE Public Health guidance*. London: National Institute  
368 for Clinical Excellence, 2012.

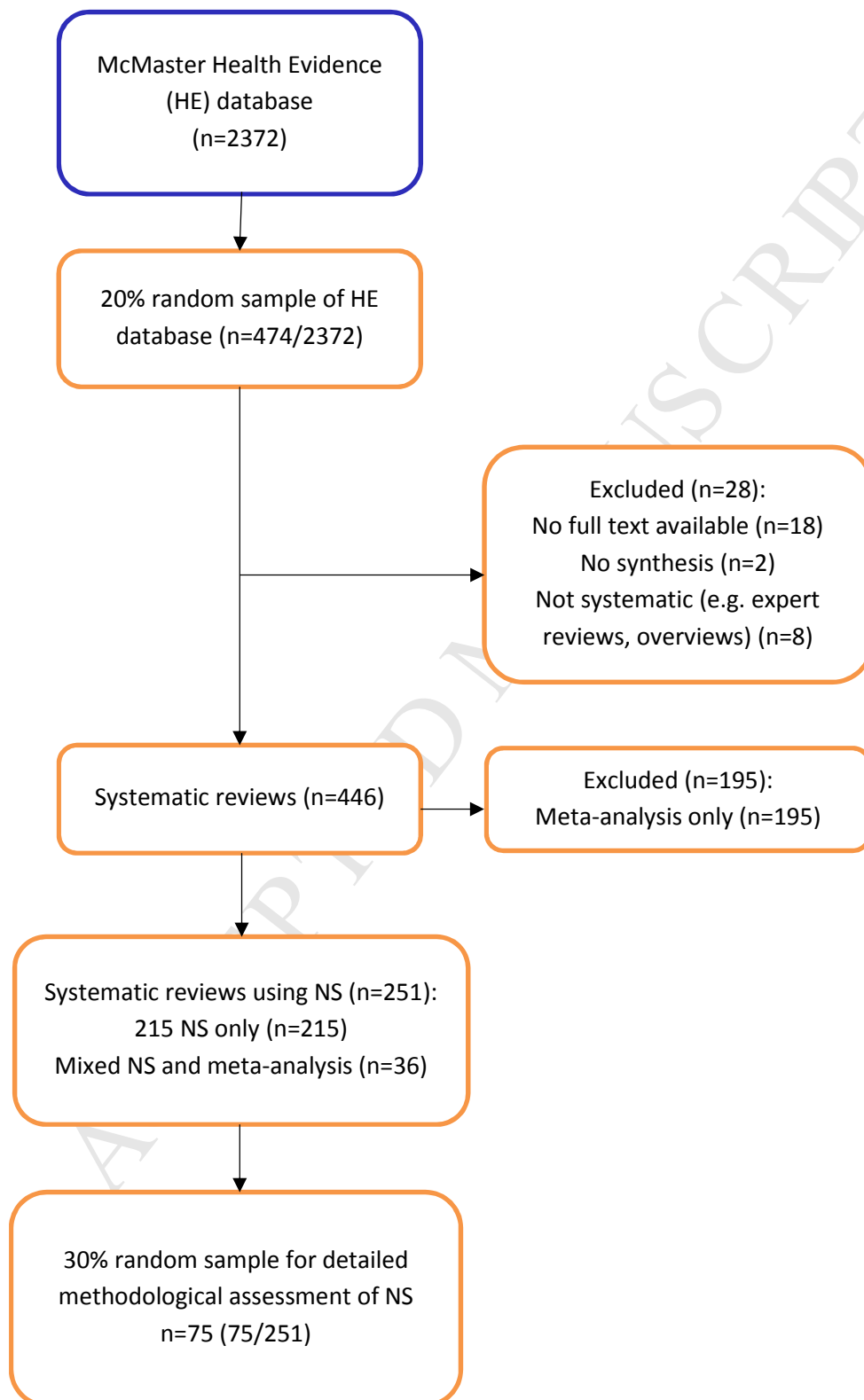
- 369 16. World Health Organization. *WHO Handbook for Guideline Development*. Geneva: World Health  
370 Organization; 2014.
- 371 17. Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic  
372 reviews. *BMC Med Res Methodol*. 2008;8:45.
- 373 18. Hedges LV, Cooper HM. *The Handbook of Research Synthesis*. New York: Russell Sage  
374 Foundation; 1994.
- 375 19. Petticrew M, Rehfuess E, Noyes J, Higgins JP, Mayhew A, Pantoja T, et al. Synthesizing evidence  
376 on complex interventions: how meta-analytical, qualitative, and mixed-method approaches can  
377 contribute. *J Clin Epidemiol*. 2013;66:1230-43.
- 378 20. France EF, Ring N, Thomas R, Noyes J, Maxwell M, Jepson R. A methodological systematic review  
379 of what's wrong with meta-ethnography reporting. *BMC Med Res Methodol*. 2014;14:119.
- 380 21. Lewin S, Glenton C, Munthe-Kaas H, Carlsen B, Colvin CJ, Gülmezoglu M, et al. Using qualitative  
381 evidence in decision making for health and social interventions: an approach to assess confidence in  
382 findings from qualitative evidence syntheses (GRADE-CERQual). *PLoS Med*. 2015;12:e1001895.
- 383 22. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and  
384 meta-analyses: the PRISMA statement. *BMJ*. 2009;339:2535.
- 385 23. France EF, Ring N, Noyes J, Maxwell M, Jepson R, Duncan E, et al. Protocol-developing meta-  
386 ethnography reporting guidelines (eMERGe). *BMC Med Res Methodol*. 2015;15:103.
- 387 24. Tong A, Flemming K, McInnes E, Oliver S, Craig J. Enhancing transparency in reporting the  
388 synthesis of qualitative research: ENTREQ. *BMC Med Res Methodol*. 2012;12:181.
- 389 25. Shepperd S, Lewin S, Straus S, Clarke M, Eccles MP, Fitzpatrick R, et al. Can We Systematically  
390 Review Studies That Evaluate Complex Interventions? *PLoS Med*. 2009;6:e1000086.
- 391 26. Viswanathan M, McPheeters M, Murad M, Butler MB, Devine E, Dyson M, et al. AHRQ Series on  
392 Complex Intervention Systematic Reviews – Paper 4: Selecting Analytic Approaches. *J Clin Epidemiol*.  
393 2017;90:28-36.
- 394 27. Lorenc T, Felix L, Petticrew M, Melendez-Torres G, Thomas J, Thomas S, et al. Meta-analysis,  
395 complexity, and heterogeneity: a qualitative interview study of researchers' methodological values  
396 and practices. *Syst Rev*. 2016;5:192.
- 397 28. Melendez-Torres GJ, O'Mara-Eves A, Thomas J, Brunton G, Caird J, Petticrew M. Interpretive  
398 analysis of 85 systematic reviews suggests that narrative syntheses and meta-analyses are  
399 incommensurate in argumentation. *Res Synth Methods*. 2016;8:109-18.
- 400 29. Cochrane Collaboration. *Cochrane strategy to 2020*. 2016. [https://community-  
401 archive.cochrane.org/sites/default/files/uploads/Strategy%20to%202020\\_updated\\_Final\\_Feb2016.p  
402 df](https://community-archive.cochrane.org/sites/default/files/uploads/Strategy%20to%202020_updated_Final_Feb2016.pdf) (accessed 10 May 2017).
- 403 30. Thomson H, Campbell M, Katikireddi S, Sowden A. An analysis of the transparency of narrative  
404 synthesis methods in systematic reviews of quantitative data. 24th Cochrane Colloquium; Seoul,  
405 South Korea; 2016.

406 31. Plint AC, Moher D, Morrison A, Schulz K, Altman DG, Hill C, et al. Does the CONSORT checklist  
407 improve the quality of reports of randomised controlled trials? A systematic review. *Med J Aust.*  
408 2006;185:263-7.

409 32. Glasziou P, Meats E, Heneghan C, Shepperd S. What is missing from descriptions of treatment in  
410 trials and reviews? *BMJ.* 2008;336:1472-4.

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Figure 1 Review selection flow chart



**Transparency in the reporting and conduct of narrative synthesis of quantitative data: a cross-sectional comparison of systematic reviews****What is new?****Key findings**

- Based on a sample of public health reviews, it is apparent that, despite being commonly used, narrative synthesis often lacks transparency.
- Synthesis methods are rarely reported, and presentation of data in the review often does not facilitate clear links between visual presentation of the data and the text.

**What this adds to what was known?**

- This is the first study to assess the adequacy of reporting of narrative synthesis of quantitative data in systematic reviews.

**What is the implication and what should change now?**

- Substantial improvements in clarity of reporting of narrative synthesis are required. There is a need for existing guidance to inform the development of a clear and concise reporting guideline for narrative synthesis.
- Greater transparency when reporting narrative synthesis will allow end users including practitioners and policy decision-makers to have greater confidence in the results of systematic reviews that use narrative synthesis.