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# 1 **Methodological guidance for the conduct of mixed methods systematic reviews**

## 2 **Abstract**

3 **Introduction:** Mixed methods systematic reviews (MMSR) provide a more complete basis for  
4 complex decision-making than that currently offered by single method reviews, thereby maximizing  
5 their usefulness to clinical and policy decision-makers. Although MMSR are gaining traction, guidance  
6 regarding the methodology of combining quantitative and qualitative data is limited. In 2014, the  
7 Joanna Briggs Institute (JBI) Mixed Methods Review Methodology Group developed guidance for  
8 MMSR, however, since the introduction of this guidance, there have been significant developments in  
9 mixed methods synthesis. As such, the methodology group recognized the need to revise the  
10 guidance to align it with the current state of knowledge on evidence synthesis methodology

11 **Objective:** To outline the updated methodological approach for conducting a JBI MMSR with a focus  
12 on data synthesis, specifically, methods related to how data is combined and the overall integration of  
13 the quantitative and qualitative evidence.

14 **Methods:** Between 2015 and 2019 the JBI Mixed Methods Review Methodology Group undertook an  
15 extensive review of the literature, held annual face-to-face meetings (which were supplemented by  
16 teleconferences and regular email correspondence), sought advice from experts in the field and  
17 presented at scientific conferences. This process led to the development of guidance in the form of a  
18 Chapter included in the JBI Reviewer's Manual, the official guidance for conducting JBI systematic  
19 reviews. In 2019, the guidance was ratified by the JBI International Scientific Committee.

20 **Results:** The updated JBI methodological guidance for conducting a MMSR recommends reviewers  
21 take a convergent approach to synthesis and integration whereby the specific method utilized is  
22 dependent on the nature/type of question(s) that is(are) posed in the systematic review. The JBI  
23 guidance is primarily based on Hong et al and Sandelowski's typology on MMSR. If the review  
24 question can be addressed by both quantitative and qualitative research designs, the convergent  
25 integrated approach should be followed which involves data transformation and allows reviewers to  
26 combine quantitative and qualitative data. If the focus of the review is on different aspects or  
27 dimensions of a particular phenomenon of interest, the convergent segregated approach is  
28 undertaken which involves independent synthesis of quantitative data and qualitative data leading to  
29 the generation of quantitative evidence and qualitative evidence which are then integrated together.

## 30 **Conclusions:**

31 The updated guidance on JBI MMSR provides foundational work to a rapidly evolving methodology  
32 and aligns with other seminal work undertaken in the field of mixed methods synthesis. Limitations to  
33 the current guidance are acknowledged and a series of methodological projects identified by the JBI  
34 Mixed Methodology Group to further refine the methodology are proposed. Mixed methods review  
35 offers an innovative framework for generating unique insights related to the complexities associated  
36 with healthcare quality and safety.

37

38 **Keywords:**

39 mixed methods; systematic review; integration; data transformation; synthesis

40

41

42 **Introduction**

43 Qualitative and quantitative systematic reviews each contribute to our understanding of the best  
44 available evidence on a topic, yet increasingly, both perspectives are required to inform clinical, policy  
45 or organizational decisions. Decision-makers who use systematic reviews increasingly argue for a  
46 more **complete** synthesis of the evidence than that currently offered by these single method reviews.<sup>1</sup>  
47 Mixed methods systematic reviews (MMSR) have therefore become an important development in  
48 evidence-based healthcare as they maximize the ability of review findings to assist in clinical and  
49 policy decision-making. This type of review is also referred to as mixed methods research syntheses<sup>2</sup>,  
50 and mixed research syntheses<sup>3</sup>.

51 The conceptual foundation of MMSR is informed by two research paradigms, namely positivism and  
52 constructivism. Positivism is associated with quantitative studies such as prevalence/incidence or  
53 descriptive studies, or an analytical study that examines associations between variables or a cause-  
54 and-effect relationship.<sup>4</sup> Conversely, constructivism is commonly associated with qualitative studies  
55 that explore a complex phenomenon of interest.<sup>4</sup> Through the development of well-structured MMSR,  
56 the objective numerical data inherent in the logical empiricist paradigm combines with the equally  
57 important subjective opinions and perspectives presented in the constructivist paradigm. For example,  
58 Classen and Lopez (2006) used a mixed methods review approach to achieve a better understanding  
59 of safety issues among older drivers. An initial quantitative synthesis identified risk and protective  
60 factors of older driver safety (i.e. etiologic studies), followed by a synthesis of qualitative studies that  
61 captured the perspectives of older adults relating to their driving ability and safety.<sup>5</sup> Without the  
62 integration of quantitative results and qualitative results, a **complete** overarching picture of the  
63 inherent complexities associated with older driver safety could not be obtained. More commonly,  
64 MMSR bring together the findings of effectiveness (quantitative evidence) and patient experiences  
65 (qualitative evidence) to allow better understanding of whether and how an intervention works (or  
66 does not work) and inform subsequent clinical decision-making. For example, although quantitative  
67 evidence suggests that the use of larval therapy is clinically and financially effective in the  
68 debridement of wounds<sup>6-10</sup>, evidence from qualitative studies indicates that negative patient  
69 experiences and perceptions impact on the acceptability of the therapy.<sup>11,12</sup> Much like the first  
70 example, **without “combining the power of stories and the power of numbers”,<sup>4</sup>** the understanding  
71 about the treatment of wounds using larval therapy is incomplete, which can preclude the  
72 development of best practice recommendations.

73 Depending on the review question(s) posed, MMSR can examine the degree of concordance between  
74 quantitative and qualitative data to validate or triangulate results/findings, identify discrepancies within

75 the available evidence, and determine whether the quantitative and qualitative data address different  
76 aspects of a phenomenon of interest (which can subsequently assist in highlighting gaps in research).  
77 Mixed methods systematic reviews also allow one type of data to explore, contextualize or explain the  
78 findings of the other type of data. The methodology for conducting MMSR is an emerging field of  
79 enquiry. While there is a degree of complexity in conducting MMSR, the core intention is to combine  
80 quantitative and qualitative data (from primary studies) or integrate quantitative evidence and  
81 qualitative evidence to create a breadth and depth of understanding that can confirm or dispute  
82 evidence and ultimately answer the review question/s posed. Although MMSRs are gaining traction  
83 among healthcare professionals due to their usefulness and practicality, guidance regarding the  
84 methodology of combining quantitative and qualitative data is limited and largely at the theoretical  
85 stage.<sup>13-21</sup>

86 In 2014, the Joanna Briggs Institute (JBI) Mixed Methods Review Methodology Group developed  
87 guidance for MMSR based on the segregated approach to mixed methods synthesis as described by  
88 Sandelowski et al. (2006), which consists of separate syntheses of the quantitative and qualitative  
89 component of the systematic review.<sup>14,22</sup> A Bayesian approach was then recommended to pool the  
90 findings from the individual syntheses. Since the introduction of this guidance, there have been  
91 significant developments in the area of mixed methods synthesis.<sup>13,15,17,23-25</sup> As such, the methodology  
92 group recognized the need to revise the guidance to ensure it was accurate and aligned with the  
93 current evidence base.

94 This article describes the methods utilized to revise the guidance and presents the updated  
95 methodological approach for undertaking such reviews. It focuses on the *conduct* of MMSR as  
96 opposed to the reporting of MMSR - the full official guidance (including reporting requirements) is  
97 available in the [JBI Reviewer's Manual](#).<sup>26</sup> Mixed methods systematic reviews share features that  
98 apply to all types of reviews including formulation of review question/s, establishment of eligibility  
99 criteria, development of a search strategy, searching and retrieval of relevant studies, assessment of  
100 methodological quality and data extraction. Therefore, the focus of this paper is on illustrating the  
101 distinct features of MMSR as they relate to data synthesis, specifically, methods related to how data is  
102 combined and the overall integration of the quantitative and qualitative evidence.

## 103 **Methods**

104 In 2015 it became apparent to the JBI Mixed Methods Review Methodology Group that revision of the  
105 guidance was required. In the following year, the Group convened to re-visit the existing guidance and  
106 update the MMSR methodology. The Group was composed of a Chair (responsible for chairing the  
107 meetings and providing feedback on written work), two convenors (responsible for drafting and  
108 coordination of written work, organizing meetings and reporting progress to the JBI Scientific  
109 Committee) and six members (responsible for regular meeting attendance and provision of feedback  
110 on written work). All members were academics and experienced in conducting different types of  
111 systematic reviews. Group members were from Australia, Canada, Portugal, United Kingdom and  
112 United States of America. An extensive review of the literature was undertaken which focused on

113 locating all available methodological guidance in the area of MMSR as well as published examples of  
114 MMSR. Where needed, other experts in the field of mixed methods synthesis were contacted for  
115 support and clarification. A series of teleconferences and annual face-to-face meetings were also held  
116 between 2016 and 2018, and supplemented by regular email correspondence. Half-day face-to-face  
117 meetings were held on the: 10<sup>th</sup> November 2016 (Adelaide, South Australia), 15<sup>th</sup> September 2017  
118 (Cape Town, South Africa) and 1<sup>st</sup> May 2018 (Antwerp, Belgium). Minutes were recorded to ensure a  
119 formal approach to tracking progress, allocating work and responsibilities, and completing milestones  
120 was maintained. The proposed guidance was presented at scientific conferences in South Africa  
121 (2017 Global Evidence Summit) and Belgium (2018 10<sup>th</sup> Biennial JBI Colloquium), during which,  
122 international researchers provided comments that were valuable in informing the methodology.

123 The final draft of the updated guidance (in the form of a Chapter included in the JBI Reviewer's  
124 Manual) was completed following a consensus among members, and on the 6<sup>th</sup> August 2018 was  
125 submitted to the JBI International Scientific Committee for consideration, discussion and approval.  
126 Following initial submission, the Committee approved the guidance pending minor revisions.  
127 Comments and feedback were formally addressed by the methodology group and a revised version  
128 was resubmitted to the Scientific Committee on the 31<sup>st</sup> January 2019. On the 13<sup>th</sup> February 2019, the  
129 JBI MMSR methodological guidance was ratified at a meeting of the Scientific Committee and thus  
130 supersedes all previous MMSR guidance produced by JBI.<sup>14,22</sup>

### 131 **Results: The JBI methodological approach for conducting a MMSR**

132 To avoid confusion in describing this approach it is important to outline a few core concepts related to  
133 MMSR in order to fully inform this approach (Table 1).

#### 134 **Table 1: Summary of core concepts related to MMSR**

135

136 The JBI approach **to MMSR is based upon** the typology developed by Hong **et al's review of**  
137 systematic reviews which examined the different methods used to synthesize quantitative and  
138 qualitative data or integrate quantitative and qualitative evidence. Following the inclusion of 459  
139 reviews, Hong and colleagues identified a number of frameworks used for integration. However, in  
140 their work, it became evident there were two frameworks that were predominant: the convergent  
141 approach (where the synthesis occurs simultaneously) and the sequential approach (where the  
142 synthesis occurs consecutively).<sup>17</sup> Based on minimal usage of the sequential approach by systematic  
143 reviewers (approximately 5%), the JBI MMSR methodology currently focuses exclusively on the  
144 convergent approach. The convergent design can be broken down into a series of methods that have  
145 been simplified into two groups – **convergent integrated** (which involves data transformation and  
146 allows reviewers to combine quantitative and qualitative data) and **convergent segregated** (which  
147 involves independent synthesis of quantitative data and qualitative data leading to the generation of  
148 quantitative evidence and qualitative evidence which are then integrated together). The decision as to  
149 which approach to use is dependent on the nature/type of question(s) that is(are) posed in the  
150 systematic review. If the review question can be addressed by both quantitative and qualitative

151 research designs, the **convergent integrated** approach should be followed; if the focus of the review  
152 is on different aspects or dimensions of a particular phenomenon of interest, the **convergent**  
153 **segregated** approach is undertaken. Some example review questions are provided below which  
154 delineate the different approaches.

**Example 1:**

*'What are the barriers and enablers to the adoption of electronic health records to support self-management in adult patients with a chronic disease?'*

- Here the focus is on barriers and enablers, which can be addressed through qualitative research (e.g. through a phenomenological study of healthcare professionals involved in supporting adult patients with a chronic disease through the use of electronic health records) as well as quantitative research (e.g. through a survey of healthcare professionals involved in the use of electronic health records conducted as part of a cross sectional study).
- Since this review question can be answered by both quantitative AND qualitative studies it would follow a **convergent integrated approach** to its synthesis and integration.

155

**Example 2:**

*'What are the effects of canine-assisted interventions (CAIs) on the health and social care of older people residing in long-term care?' and 'What is the experience of older people residing in long-term care who receive CAIs?'*

- Here both questions relate to a common phenomenon i.e. CAIs for older people but they are addressing two different aspects associated with it – namely what effects these interventions have on older people in terms of the effect of the interventions on outcomes such as stress and anxiety and how older people experience or perceive them. We know that questions of effectiveness are answered through quantitative research (e.g. through a randomized controlled trial comparing CAIs with standard interventions) and questions of experience/perception are answered through qualitative research (e.g. through an ethnographic study where the researcher undertakes fieldwork on a group of older people receiving these interventions).
- Since this review focuses on different dimensions of a phenomenon it would follow a **convergent segregated approach** to its synthesis and integration.

156

157 The methodological guidance for the synthesis and integration of these two approaches is presented  
158 separately in the succeeding sections.

159

160 **MMSR questions that take a CONVERGENT INTEGRATED approach to synthesis and**  
161 **integration**

162 The convergent integrated approach, outlined in example 1 above, refers to a process of combining  
163 extracted data from quantitative studies (including data from the quantitative component of mixed  
164 methods studies) and qualitative studies (including data from the qualitative component of mixed  
165 methods studies), and involves data transformation. In order for qualitative and quantitative data to be  
166 integrated and thus fully inform the topic, one approach is for the data to be transformed into a  
167 mutually compatible format.<sup>27</sup> Data transformation can occur either by converting qualitative data into  
168 quantitative data (i.e. quantitizing) or by converting quantitative data into qualitative data (i.e.  
169 qualitizing). Quantitizing is a process in which qualitative data are assigned numerical values,  
170 whereas qualitizing refers to quantitative data being converted into themes, categories, typologies or  
171 narratives.<sup>2,3,23</sup>

172 For data transformation, JBI recommends that quantitative data be 'qualitized', as codifying  
173 quantitative data is less error-prone than attributing numerical values to qualitative data.<sup>22</sup> 'Qualitizing'  
174 involves extracting data from quantitative studies and translating or converting it into 'textual  
175 descriptions' to allow integration with qualitative data. 'Qualitizing' involves a narrative interpretation of  
176 the quantitative results. At the simplest level, qualitized data might comprise describing a sample (or  
177 members of it) using word categories based on supplementary descriptive statistics such as average  
178 or percentage scores.<sup>28</sup> Qualitized data can also include profiling of the sample using cluster or factor  
179 analysis.<sup>28</sup> Data with a temporal or longitudinal component,<sup>28</sup> or those that examine associations and  
180 relationships using inferential statistics such as linear or logistic regression analysis also have  
181 narrative potential and can therefore be qualitized by identifying variables included in the analysis. By  
182 qualitizing, the reviewer converts the 'quantities' into declarative stand-alone sentences, in a way that  
183 answers the review question.

184 The textual descriptions ('qualitized data') from quantitative studies are then assembled and pooled  
185 with the qualitative data extracted directly from qualitative studies. Reviewers are then required to  
186 undertake repeated, detailed examination of the assembled data to identify categories on the basis of  
187 similarity in meaning, much like the process of meta-aggregation for qualitative synthesis.<sup>29</sup> A  
188 category will integrate two or more: qualitative data, 'qualitized' data or a combination of both. In some  
189 instances however, data may not have the same meaning as others (i.e. may not reciprocally  
190 translate across studies)<sup>30</sup> and therefore cannot be combined to form a category. Where possible,  
191 categories are then aggregated to produce the overall integrated finding(s) of the review. This process  
192 is illustrated in Figure 1.

193

194 **Figure 1: JBI Convergent integrated approach where qualitized findings are assembled into**  
195 **categories with qualitative findings extricated directly from qualitative studies based on**  
196 **similarity of meaning.**

197

198 **MMSR questions that take a CONVERGENT SEGREGATED approach to synthesis and**  
199 **integration**

200 A convergent segregated approach consists of conducting separate quantitative synthesis and  
201 qualitative synthesis, followed by integration of evidence derived from both syntheses. By integrating  
202 the quantitative and qualitative synthesized findings, a greater depth of understanding of the  
203 phenomena of interest can be obtained, compared to undertaking two separate component syntheses  
204 without formally linking the two sets of evidence. The guidance developed for this approach currently  
205 focuses exclusively on reviews addressing questions of meaningfulness/experience (qualitative) and  
206 effectiveness (quantitative).

207 In example 2 above, quantitative data is synthesized in the form of a meta-analysis (or a narrative  
208 summary if meta-analysis is not possible) to determine the effects of canine-assisted interventions on  
209 older adults residing in long-term care. Additionally, all the qualitative data is pooled (in the case of  
210 the JBI approach, through the process of meta-aggregation (or a narrative summary if a meta-  
211 aggregation is deemed inappropriate) to determine the experiences/perceptions of older adults  
212 receiving these interventions. There is no order to which synthesis is done first as they are  
213 independent; however, both must be completed before moving onto the next step, integration of  
214 quantitative evidence and qualitative evidence. This next step involves juxtaposing the synthesized  
215 quantitative results with the synthesized qualitative findings and organizing or linking the results and  
216 findings into a line or argument to produce an overall 'configured analysis.' This is where the reviewer  
217 considers how (and if) the results and findings complement each other by using one type of evidence  
218 to explore, contextualize or explain the findings of the other type of evidence. In this step, results and  
219 findings cannot be reduced but are organized into a coherent whole.<sup>3</sup> In this approach, the reviewer  
220 repeatedly compares the results of the quantitative synthesis with the findings of the qualitative  
221 synthesis, analyzing the intervention which had been investigated for effectiveness (quantitative) in  
222 light of the experiences of the participants (qualitative). The following questions act as a guide for this  
223 process:

- 224 • Are the results/findings from individual syntheses supportive or contradictory?
- 225 • Does the qualitative evidence explain why the intervention is/is not effective?
- 226 • Does the qualitative evidence help explain differences in the direction and size of effect  
227 across the included quantitative studies?
- 228 • Which aspects of the quantitative evidence are/are not explored in the qualitative studies?
- 229 • Which aspects of the qualitative evidence are/are not tested in the quantitative evidence?



230 In some instances, the reviewer may find that the results of the quantitative synthesis is not  
231 complementary or has no relationship with the findings of the qualitative synthesis, or vice-versa. In  
232 such cases the reviewer may identify gaps where further research may be useful to explain the  
233 contradictory findings or when there is no relationship between the qualitative findings and  
234 quantitative results. The JBI convergent segregated approach to synthesis and integration is  
235 illustrated in figure 2 while figure 3 provides a summary of both approaches.

236 **Figure 2: JBI Convergent segregated approach where separate quantitative synthesis and**  
237 **qualitative syntheses are undertaken followed by integration of evidence derived from both**  
238 **syntheses.**

239 **Figure 3: The JBI Approach for Mixed Methods Systematic Reviews**  
240

## 241 Discussion

242 Mixed methods systematic reviews provide an innovative approach for addressing important  
243 questions in healthcare.<sup>31</sup> The increasing interest in this type of review and the variability and lack of  
244 clear detail in the methods to synthesize quantitative and qualitative data or integrate quantitative and  
245 qualitative evidence indicates the need for clear guidance for how MMSR should be undertaken.  
246 Based on a review of the international literature on MMSR and with input from experienced  
247 researchers in this field, JBI updated its methodological guidance and identified two synthesis designs  
248 for conducting MMSR: convergent integrated and convergent segregated.

249 The JBI methodological approach is based upon the typology developed by Hong et al (2017)<sup>17</sup> as  
250 well as the seminal work undertaken by Sandelowski and colleagues.<sup>3,32</sup> The convergent integrated  
251 approach is similar to Sandelowski's *integrated* design which involves direct assimilation, and is  
252 based on the assumption that quantitative and qualitative data can both address the same research  
253 question.<sup>3,32</sup> As such they can be combined once data have been transformed in the same format (i.e.  
254 'quantitized' or 'qualitized'). Comparable to JBI's convergent integrated approach and Sandelowski's  
255 *integrated* design is the *data-based convergent* design identified by Hong et al (2017), which typically  
256 involves a broad systematic review question (that can be answered by both quantitative studies and  
257 qualitative studies) and a synthesis that occurs following data extraction and data transformation.<sup>17</sup>  
258 On the other hand, the convergent segregated approach is analogous to Sandelowski's *segregated*  
259 design. In contrast to the *integrated* design which allows direct assimilation, the *segregated* design  
260 involves the integration of evidence through a method referred to as configuration. Configuration  
261 refers to the arrangement of complementary evidence into a line of argument.<sup>3,32</sup> According to  
262 Sandelowski, complementarity is based on the assumption that quantitative and qualitative evidence  
263 address different research questions that are related to the same phenomenon of interest.<sup>3,32</sup> In other  
264 words, quantitative and qualitative evidence address different aspects or dimensions of a  
265 phenomenon of interest and therefore they can neither corroborate nor refute each other but rather  
266 only complement each other. As such, the quantitative evidence and qualitative evidence cannot be  
267 directly combined and can only be organized into a coherent whole. This approach to synthesis

268 corresponds to Hong et al.'s<sup>17</sup> *results-based convergent* design that typically involves an overall  
269 systematic review question with sub-questions (some that can only be addressed by quantitative  
270 studies and others that can only be addressed by qualitative studies); there is a separate and  
271 simultaneous synthesis of quantitative data and qualitative data, followed by the integration of the  
272 resulting quantitative and qualitative evidence.

273 Mixed methods systematic reviews appears to be the most complex and the least developed of all  
274 systematic review methods. The updated JBI guidance provides foundational work to this rapidly  
275 evolving methodology, however it provides only a starting point for developing methods for combining  
276 quantitative and qualitative evidence in MMSR which may be conceived as a narrow  
277 conceptualization of mixed methods. However, it is hoped that in future iterations of the JBI guidance,  
278 more sophisticated methods for integrating evidence are developed and explored.

279 The methodological approach outlined in this paper **also** does come with some caveats. In the  
280 convergent segregated approach, the current JBI guidance specifically focuses on  
281 intervention/treatment or effectiveness questions for the quantitative component and on  
282 meaningfulness or experience questions for the qualitative component. However, the JBI MMSR  
283 Methodology Group acknowledges that there are other types of review questions that lend  
284 themselves to a segregated approach. For example, a MMSR may ask a prevalence question or  
285 patterns of use of a specific treatment (which is quantitative in nature) along with the experiences of  
286 patients regarding that treatment (qualitative component). While the group believes that a segregated  
287 approach is broad enough to be applied to other types of MMSR questions, future iterations of the JBI  
288 methodology will provide explicit guidance on how such questions can be synthesized and integrated  
289 in a MMSR.

290 One of the distinguishing features of a MMSR is the inclusion of not only primary quantitative and  
291 qualitative studies but also primary mixed methods studies. For primary mixed methods studies  
292 included in a JBI MMSR, data are extracted such that they can be classified as quantitative or  
293 qualitative. In the integrated approach, quantitative data are then 'qualitized' to allow synthesis  
294 whereas in a segregated approach, data are kept separate which then go through either meta-  
295 analysis or meta-aggregation (as appropriate) followed by the integration of the resulting evidence.  
296 This approach of categorizing data into quantitative or qualitative, particularly for the segregated  
297 approach, is ideal for primary mixed methods studies in which the quantitative component is  
298 published separately from the qualitative component. This is usually the case for mixed methods  
299 research that applies a sequential explanatory design<sup>33</sup> (i.e. where qualitative findings are used to  
300 interpret or explain quantitative results).<sup>34</sup> However, for primary mixed methods research where the  
301 results presented represent the actual integration of the quantitative data and qualitative data (such  
302 as those found in realist evaluation), categorizing data into quantitative or qualitative may not be ideal  
303 and philosophically would negate the strength of mixed methods studies. It would seem intuitive that  
304 in such instances, data are classified into three streams, i.e. quantitative, qualitative and mixed  
305 methods, followed by a configurative analysis to allow integration. This will be future work for the JBI  
306 MMSR Methodology Group.

307 In addition to those identified above, the JBI MMSR Methodology Group has identified a number of  
308 methodological projects that need to be undertaken in order to advance this field. First, as with other  
309 systematic reviews, critical appraisal is an essential component of MMSR and currently JBI advocates  
310 the use of the appropriate JBI quantitative tool/s (for quantitative studies and the quantitative  
311 component of mixed methods studies) and the JBI qualitative tool (for qualitative studies and the  
312 qualitative component of mixed methods studies). It may be necessary to develop a bespoke tool for  
313 mixed methods primary studies or perhaps identify an already existing critical appraisal tool for use in  
314 JBI MMSR.<sup>24,25,35,36</sup> Additionally, in regard to critical appraisal in the integrated approach, further  
315 investigation into how the appraisal results of quantitative studies (in which findings have been  
316 qualitized) are incorporated into the synthesis is needed.

317 One of the strengths of a systematic review, particularly JBI systematic reviews, is its ability to provide  
318 actionable and explicit practice recommendations. These recommendations are based on review  
319 findings that have been assessed using a structured approach; GRADE for systematic reviews of  
320 effectiveness<sup>37</sup> and ConQual<sup>38</sup> for systematic reviews of qualitative studies. Due to the complexities  
321 associated with recommendations being derived from both streams of evidence and the impact of  
322 data transformation and/or integration on the grading process, an assessment of the certainty of the  
323 evidence using either the GRADE or ConQual approach is currently not recommended for JBI MMSR  
324 following either the convergent integrated or convergent segregated approach. Modification to existing  
325 systems that assess the certainty of evidence may need to be investigated or alternatively a new  
326 system developed for evaluating results or findings from a MMSR. Finally although this paper has  
327 focused on the conduct of reviews and not their reporting, it is evident that there is a lack of  
328 consensus in terms of reporting standards for MMSR. This may be due to the lack of universally  
329 agreed and specific guideline for such reviews. As the demand for this type of review increases along  
330 with significant methodological advancements in MMSR, work can now be initiated to improve the  
331 standards for reporting of MMSR.

## 332 **Conclusion**

333 This paper outlines an exciting development in the field of mixed methods synthesis. The update of  
334 the JBI methodological guidance for conducting a MMSR recommends reviewers take a convergent  
335 approach to synthesis and integration whereby the specific method utilized is dictated by the  
336 nature/type of question(s) that is(are) posed in the systematic review. If the review question can be  
337 addressed by both quantitative and qualitative research designs the convergent integrated approach  
338 should be followed which involves data transformation and allows reviewers to combine quantitative  
339 and qualitative data. If the focus of the review is on different aspects or dimensions of a particular  
340 phenomenon of interest the convergent segregated approach is undertaken which involves  
341 independent synthesis of quantitative data and qualitative data leading to the generation of  
342 quantitative evidence and qualitative evidence which are then integrated together. Limitations to the  
343 current guidance are discussed as are a series of methodological projects the Methodology Group will  
344 undertake to allow for further refinement of this methodology.

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