## PEER REVIEW HISTORY



## ARTICLE DETAILS

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| **TITLE (PROVISIONAL)** | Purchasing high-cost medical equipment in hospitals: A systematic review |
| **AUTHORS** | Hinrichs-Krapels, Saba; Ditewig, Bor; Boulding, Harriet; Chalkidou, Anastasia; Erskine, Jamie; Shokraneh, Farhad |

## VERSION 1 – REVIEW

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| **REVIEWER** | King, Natalie<br>University of Leeds, Leeds Institute of Health Sciences |
| **REVIEW RETURNED** | 19-Dec-2021 |

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| **GENERAL COMMENTS** | This study describes the different approaches hospitals from high income countries use to help make purchasing decisions for expensive ie high cost, medical equipment. The review is clear, well written and easy to follow and appears to address a need in hospital management to determine the processes used to acquire high cost equipment. The researchers have conducted a rigorous systematic review. Given due to the broad scope of the review and the expected heterogeneity of included studies, have you considered using a scoping review approach? [Z. Munn, M. D. J. Peters, C. Stern, C. Tufanaru, A. McArthur and E. Aromataris 2018 Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach BMC Med Res Methodol 18(1):143 https://www.ncbi.nlm.nih.gov/pubmed/30453902]. This approach may help address some of the limitations identified, such as the lack of quality assessment of included studies (as it was not appropriate here) and could provide a mechanism incorporate findings from some of the non-empirical work that may be useful to practitioners<br><br>minor edits:<br>Pg 5 line 26 –HB-HTA – please define as it's the first instance of this abbreviation and it took me a while to work out its meaning.<br>Pg 24 line 14: typo change 'included studied' to 'included studies'<br><br>Comments relating to 12: Study limitations<br>Methods: |

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| | Pg 4 Line 19: In line with guidance from the Cochrane Handbook, consider rerunning the search strategy as it is over 12mths old. Their recommendation is ideally 6 months from publication and less than 12 months . I appreciate that time and resources for the review may be limited but the team could highlight any new studies that have recently been published for future researchers or add to the study limitations<br><br>Results:<br>Pg 32-38 A wide and appropriate range of databases have been searched and its great to see the full strategies are available in the Appendix. I noticed two typos; appais* instead of Apprais* in line 3 of the searches in Econlit, Embase, HMIC, Medline, Proquest Dissertations, Scopus and WOS and suplies instead of supplies in the Google and Google Scholar searches. The strong mix of text words and Subject headings used may still have found any studies potentially missed, but rerunning the searches (as suggested earlier) may identify any potentially missing studies.<br><br>This is more a query to the authors than a suggested change but I am curious as to the structure of the strategy with some of the database subject headings. For example in Embase, the heading "Hospital Equipment/" is in line 1 (setting concept) and line 2 (Product concept) and the heading "Hospital Purchasing/" is in Line 1 (setting concept) and Line 3 (Process concept). This also occurs with similar headings in medline, HMIC and INAHTA strategies. This could be addressed by a brief explanation in Appendix 1 |

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| **REVIEWER** | Schroeck, FR<br>White River Junction VA Medical Center, Surgery / Urology |
| **REVIEW RETURNED** | 17-Jan-2022 |

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| **GENERAL COMMENTS** | This is a well done systematic review of the literature on best processes for purchasing high-cost hospital equipment in OECD countries. After an extensive search, the authors review 24 studies. Key take-home messages are: (1) importance of multi-disciplinary involvement; (2) a need for greater specificity in study reporting; and (3) need for more empirical research in this field. One of the major limitations is that it was hard for the authors to clearly define high-cost equipment. It would be great to make clear in the methods how this was done during the abstraction process. Overall, I believe this is a wortwhile contribution to the literature.<br><br>Detailed comments follow:<br>Introduction:<br>The introduction provides a good overview of the previous literature and clearly identifies the gap the current systematic review is poised to fill.<br><br>Methods:<br>1. The link to the previously published protocol (Ref #23) |

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| | did not work when tested by me. Please assure that the previously published protocol is available at the specified link.<br>2. Similarly, I could not find Ref #24 with the supplied DOI identifier. Please double check and correct or provide URL.<br>3. Eligibility criteria: please clarify how high-cost medical devices were defined during the abstraction process. For some examples in the selected manuscripts it is not clear why they would be high-cost devices, e.g., ultrasonic bladder scanners.<br><br>Results:<br>1. The abbreviation HB-HTA is used but not defined. Please define. After reading through the discussion, I believe it stands for hospital-based health technology assessment.<br>2. Table 1 appears to be sorted alphabetically by first author last name. However, it would make more sense to sort the studies into the categories identified in the results section: "descriptions of processes taking place within or across hospitals (n=14); empirical studies in which hospital records or participant data were analysed (n=8); and evaluations or pilots of proposed purchasing processes (n=2)."<br>3. Table 1 would benefit from some assessment or comment from the authors on the quality of the studies or potential limitations. The authors rely entirely on the limitations that the authors of the underlying studies listed, but in several instances there were "none listed", which is not helpful for the reader.<br>4. Table 2: I suggest considering whether the stakeholders can be put into certain groups while sorting them from left to right. For example: clinical team, hospital operations (including engineering, procurement, quality/safety, etc.), hospital leadership, etc.<br>5. The language in the first few sentences of the paragraph "Evaluating technical, financial, and clinical elements" is awkward and would benefit from some English language editing.<br><br>Discussion:<br>1. The discussion appropriately outlines the limitations of this review, of the reviewed studies / field, and provides lessons learned and recommendations for future research from the authors' perspective. |

**VERSION 1 – AUTHOR RESPONSE**

RESPONSE TO REVIEWER 1

Comment 1a: This study describes the different approaches hospitals from high income countries use to help make purchasing decisions for expensive ie high cost, medical equipment. The review is clear, well written and easy to follow and appears to address a need in hospital management to determine the processes used to acquire high cost equipment. The researchers have conducted a rigorous systematic review. Given due to

the broad scope of the review and the expected heterogeneity of included studies, have you considered using a scoping review approach? [Z. Munn, M. D. J. Peters, C. Stern, C. Tufanaru, A. McArthur and E. Aromataris 2018 Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach BMC Med Res Methodol 18(1):143 https://www.ncbi.nlm.nih.gov/pubmed/30453902]. This approach may help address some of the limitations identified, such as the lack of quality assessment of included studies (as it was not appropriate here) and could provide a mechanism incorporate findings from some of the non-empirical work that may be useful to practitioners

Response 1a: We are grateful for the positive review of our study, particularly for noting that it is clear, well-written, and rigorous. We are particularly grateful that this reviewer has taken time to examine the quality of the methods in our review and has the expertise to comment on systematic reviews, which we value.

The suggestion to name this a Scoping rather than Systematic review is welcome, and we have read the recommended publication by Munn et al 2018. However, on reading this, and going back to the nature and purpose of our review, we feel our review still is justified in being called a 'systematic' rather than 'scoping' review. We note that both systematic and scoping reviews follow a rigorous procedure, which we followed (i.e. huge variety in databases searched, and the double checking during data extraction and filtering). The main difference seems to be in the intended purpose and presentation of results. In our case, we set out to identify a very specific topic: empirical academic evidence for purchasing of high-cost equipment, and by doing this, we did not provide a full scoping of the various types of academic literature available on the topic, its historical perspectives, nor the various themes and types of studies included in the literature. We therefore do not feel that the presentation of our finding even justifies a scoping review, given its intended specificity. We do agree, however, that a scoping review on health technologies and equipment purchasing in general would provide a very useful resource and have included this as a recommendation for future research in our revised manuscript (page 21).

Further, while it is true that there was heterogeneity in our included studies, this was rather a finding and result of the review, and note that there are other systematic reviews that also demonstrate such heterogeneity. We also note that there have also been examples of scoping reviews that do contain quality appraisals, making this distinction less clear, such as: https://f1000research.com/articles/9-242/v2

Finally, we do not feel that there is a need to incorporate findings from the non-empirical work, since the focus of our review was specifically to identify the results from academic studies, regardless of their methodological constraints. We do feel a review of the non-academic literature would indeed be a very useful resource for practitioners which may require different eligibility criteria and search strategy and have added a line to propose this as further research in our Discussion as well (page 21).

Comment 1b: Pg 5 line 26 –HB-HTA – please define as it's the first instance of this abbreviation and it took me a while to work out its meaning.
Pg 24 line 14: typo change 'included studied' to 'included studies'

Response 1b: Thank you for pointing out these errors. We have removed all abbreviations 'HB-HTA' of this in the manuscript and written it out as hospital-based HTA to avoid the overuse of abbreviations. We changed 'studied' to 'studies' in above line.

Comment 1c: Pg 4 Line 19: In line with guidance from the Cochrane Handbook, consider rerunning the search strategy as it is over 12mths old. Their recommendation is ideally 6 months from publication and less than 12 months . I appreciate that time and resources for the review may be limited but the team could highlight any new studies that have recently been published for future researchers or add to the study limitations

Response 1c: We acknowledge that the Cochrane Handbook advises less than 12 months from the search to publication. However, we are mindful that the nature of publications in this field (based in health services research and policy disciplines) do not change as frequently as the types of clinical studies typically conducted under Cochrane guidelines. Since we do not have the resources to repeat the search at this time, as suggested by the reviewer we have stated in our limitations that indeed a limited number of studies may have emerged over the last year, and that any future search should take our end-date of the search in mind (page 20).

Comment 1d: Pg 32-38 A wide and appropriate range of databases have been searched and its great to see the full strategies are available in the Appendix. I noticed two typos; appais* instead of Apprais* in line 3 of the searches in Econlit, Embase, HMIC, Medline, Proquest Dissertations, Scopus and WOS and suplies instead of supplies in the Google and Google Scholar searches. The strong mix of text words and Subject headings used may still have found any studies potentially missed, but rerunning the searches (as suggested earlier) may identify any potentially missing studies.

This is more a query to the authors than a suggested change but I am curious as to the structure of the strategy with some of the database subject headings. For example in Embase, the heading "Hospital Equipment/" is in line 1 (setting concept) and line 2 (Product concept) and the heading "Hospital Purchasing/" is in Line 1 (setting concept) and Line 3 (Process concept). This also occurs with similar headings in medline, HMIC and INAHTA strategies. This could be addressed by a brief explanation in Appendix 1

Response 1d: Thank you for spotting this typo in the search strategies. We corrected it and ran a test search in MEDLINE to see if the correction retrieves any relevant papers. Fortunately, there was no change to the number of results. We corrected the typo in the new Appendix. The Appendix and the ran test are publicly available at https://osf.io/gtxn8/files/.

RESPONSES TO REVIEWER 2

Comment 2a: This is a well done systematic review of the literature on best processes for purchasing high-cost hospital equipment in OECD countries. After an extensive

search, the authors review 24 studies. Key take-home messages are: (1) importance of multi-disciplinary involvement; (2) a need for greater specificity in study reporting; and (3) need for more empirical research in this field. One of the major limitations is that it was hard for the authors to clearly define high-cost equipment. It would be great to make clear in the methods how this was done during the abstraction process. Overall, I believe this is a wortwhile contribution to the literature.
Response 2a: We thank the reviewer for the positive and encouraging response to our manuscript. We will address the specific point about our approach to identifying 'high-cost' equipment in the response relating to this below.

Comment 2b: The introduction provides a good overview of the previous literature and clearly identifies the gap the current systematic review is poised to fill.
Response 2b: We thank the reviewer for this comment.

Comment 2c: The link to the previously published protocol (Ref #23) did not work when tested by me. Please assure that the previously published protocol is available at the specified link.
Response 2c: We thank the reviewer for checking this and pointing it out. We created a short URL which has worked on different browsers from our team, and hope this is now sufficient. This is also included in the reference list. https://tinyurl.com/yc3upr87

Comment 2d: Similarly, I could not find Ref #24 with the supplied DOI identifier. Please double check and correct or provide URL.
Response 2d: We have added the URL for this link.

Comment 2e: Eligibility criteria: please clarify how high-cost medical devices were defined during the abstraction process. For some examples in the selected manuscripts it is not clear why they would be high-cost devices, e.g., ultrasonic bladder scanners.

Response 2e: We thank the reviewer for pointing this out. Referring to the specific case of the including the study on 'ultrasonic bladder scanners', we note this refers to the study by Greenwood et al (2014) in which the authors specify their study refers to 'capital equipment' which we interpreted across all studies to be higher-cost equipment. In line with our inclusion criteria, we note that while their study includes the purchase of lower-cost devices (such as ultrasonic bladder scanners), the process describes relates to capital equipment (even if this includes purchases of lower cost equipment within the whole cost). To address the reviewer's point generally of how we defined eligibility, we have added a more thorough description of how we reached these decisions in the methods section under Eligibility criteria on page 3 onwards. We added more text in the Discussion section on 'Limitations of this review' on this issue (page 19 and 20).

Comment 2f: The abbreviation HB-HTA is used but not defined. Please define. After reading through the discussion, I believe it stands for hospital-based health technology assessment.

Response 2f: We have removed all abbreviations 'HB-HTA' of this in the manuscript and written it out as hospital-based HTA to avoid the overuse of abbreviations.

Comment 2g: Table 1 appears to be sorted alphabetically by first author last name. However, it would make more sense to sort the studies into the categories identified in the results section: "descriptions of processes taking place within or across hospitals (n=14); empirical studies in which hospital records or participant data were analysed (n=8); and evaluations or pilots of proposed purchasing processes (n=2)."

Response 2g: We thank the reviewer for this suggestion and have taken it on board. The table is now separated into three parts matching the study types above. References have been updated accordingly.

Comment 2h: Table 1 would benefit from some assessment or comment from the authors on the quality of the studies or potential limitations. The authors rely entirely on the limitations that the authors of the underlying studies listed, but in several instances there were "none listed", which is not helpful for the reader.

Response 2h: We thank Reviewer 2 for this comment. As also noted by Reviewer 1, quality assessment of these studies was not applicable for this type of review, because of the heterogeneity in the methods used by the included studies. Indeed even looking at the first category of studies "descriptions of processes taking place within or across hospitals", which constituted most of the included studies (n=14), there are no formal evaluation methods on which we could draw to make and assessment. We agree this is a limitation of our study which we make explicit, but also note that we are not making recommendations for changing policy nor practice, but rather pointing readers to the lack of a true empirical base on this topic. We do advocate for more rigour in future empirical work, which would then be ready for future quality assessments and moving evidence to policy and practice.

Comment 2i: Table 2: I suggest considering whether the stakeholders can be put into certain groups while sorting them from left to right. For example: clinical team, hospital operations (including engineering, procurement, quality/safety, etc.), hospital leadership, etc.

Response 2i: Thank you for this suggestion. We have changed Table 2 accordingly, using broad categories.

Comment 2j: The language in the first few sentences of the paragraph "Evaluating technical, financial, and clinical elements" is awkward and would benefit from some English language editing.

Response 2j: This has been changed in the text to:
"The procurement of high-cost, often specialized, medical equipment requires balancing technical, financial and clinical factors."

Comment 2k: The discussion appropriately outlines the limitations of this review, of the reviewed studies / field, and provides lessons learned and recommendations for future research from the authors' perspective.

Reponse 2k: Thank you for this positive comment.

**VERSION 2 – REVIEW**

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| **REVIEWER** | King, Natalie<br>University of Leeds, Leeds Institute of Health Sciences |
| **REVIEW RETURNED** | 19-Apr-2022 |

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| **GENERAL COMMENTS** | Thank you to the authors for addressing my comments and their subsequent explanations in the review. With the addition of this one amendment I am happy to accept the corrections<br><br>With regards to the comment 1d regarding the typo with changing the term 'appais* ' to 'apprais*', I'm glad that the research team have checked this and found it did not alter the final number of results. However in line with best practice as stated in the PRISMA-S guidance the team should submit the actual search strategies they used (as submitted in the original manuscript) rather than correcting the typo in the appendix.<br>"It is important to document and report the search strategy exactly as run, typically by copying and pasting the search strategy directly as entered into the search platform. This is to ensure that information such as the fields searched, term truncation, and combinations of terms (i.e., Boolean logic or phrases) are accurately recorded." Rethlefsen, M. L., S. Kirtley, S. Waffenschmidt, A. P. Ayala, D. Moher, M. J. Page, J. B. Koffel and P.-S. Group (2021). "PRISMA-S: an extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews." Syst Rev 10(1): 39.https://www.ncbi.nlm.nih.gov/pubmed/33499930<br><br>As shown by the authors typo testing document, altering appais* to apprais* changes the number of records retrieved in these particular search lines so it would be inaccurate (and confusing to future researchers) if the line numbers are not an accurate representation of this. |

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| **REVIEWER** | Schroeck, FR<br>White River Junction VA Medical Center, Surgery / Urology |
| **REVIEW RETURNED** | 04-Apr-2022 |

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| **GENERAL COMMENTS** | The authors were very responsive to the reviewers' comments. They incorporated many suggestions and the manuscript is substantially improved. |

## VERSION 2 – AUTHOR RESPONSE

We are very grateful for these final comments from the reviewers, who on the whole are happy with the changes we have made to the manuscript. With this submission, we have only replaced the Appendix (our search strategy for the systematic review) as requested by Reviewer 1. We also added a small note to the Appendix to explain the error identified by the reviewer for full transparency.

No other files were substituted in this re-submission.