

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Systems science and systems thinking for public health: a systematic review of the field
<b>AUTHORS</b>	CAREY, Gemma; Malbon, Eleanor; Carey, Nic; Joyce, Andrew; Crammond, Brad; Carey, Alan

### VERSION 1 - REVIEW

<b>REVIEWER</b>	Diane Finegood and Lee Johnston Simon Fraser University, British Columbia, Canada
<b>REVIEW RETURNED</b>	15-Jul-2015

<b>GENERAL COMMENTS</b>	<p>The authors have conducted a systematic literature review in order to examine the current state of systems science research in public health. They classified the articles according to four useful categories that describe the main ways in which researchers have formally engaged with systems thinking as an approach to public health problems. The resulting discussion is timely given the extent to which talk of systems science and its potential has entered into public health discourse.</p> <p>Comments:</p> <ol style="list-style-type: none"> <li>1. The article would have benefited from a more thorough edit for grammar, missing punctuation and other typos.</li> <li>2. The abstract is weak and does not reflect the strengths of the paper - there are several mistakes and the descriptions are vague.             <ol style="list-style-type: none"> <li>a. For example, your objectives are more accurately stated in the paper; we suggest the authors consider changing them in the abstract to match. You could also identify your methods in more detail.</li> <li>b. Line 16: "the remaining articles"; I assume the authors mean the articles remaining after exclusion criteria were applied but it's confusing as written.</li> <li>c. Line 21: "within each categories"; grammatically incorrect and vague - can you identify the categories or offer a general description?</li> <li>d. Line 25/26: "how systems concepts and approach" - please fix.</li> </ol> </li> <li>3. The method for data extraction identified (inductive qualitative content analysis) is attached to reference 16 (Dixon-Woods et al., 2005). We don't see this method mentioned in that article. Please correct me if we have missed it.</li> <li>4. The methodology appears appropriate though it seems like the</li> </ol>
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	<p>authors may have missed some important content in their search. There are two Oxford Bibliographies online that are relevant to this topic and a quick scan suggests relevant papers may have been missed. We appreciate that the authors have indicated their search may be incomplete and agree that even if it is not complete it may be representative.</p> <p>5. The categorization of the papers is helpful and the fact that such a high number of articles were classified as 'reviews or calls for action' provides an interesting reflection on the state of practice. You could draw more attention to this by acknowledging it in the discussion section.</p> <p>6. We commend the authors for drawing attention to the issue of quality control related to modelling though these comments don't fully align with the analysis presented. It could be helpful to provide a more detailed summary of the modeling papers and the features of a high quality approach they include/don't include to support the call for more quality control. A table in the results might be helpful in this regard.</p> <p>7. It would also help if the authors were to introduce the soft systems frame earlier in the analysis section of the paper, and consider how it relates to their four categories. This would also this framing to be introduced earlier in the discussion and given more prominence.</p>
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<b>REVIEWER</b>	<p>Cameron Norman Cense Research + Design, Canada and Dalla Lana School of Public Health, University of Toronto, Canada</p> <p>I have published extensively in the realm of systems science and thus would have work to be included in this review, but have no direct conflict of interests.</p>
<b>REVIEW RETURNED</b>	18-Oct-2015

<b>GENERAL COMMENTS</b>	<p>The recommendation of "Major Revision" was challenging to arrive to as the article is generally acceptable and may only require minor revisions. However, the rationale for choosing the former is based on a few simple issues, but ones that greatly shape the manuscript's relevance, importance and appropriateness for publication. These are issues that can be addressed, however.\</p> <p>Additional comments are provided in the attached annotated PDF of the original submission. The authors may take the comments as they see fit.</p> <p>The most salient three issues are related to the definition of systems science and the continuity of discussion in the manuscript, the inclusion or recognition of the breadth of concepts within systems science, and the findings of the systematic review itself. The three issues are not unrelated.</p> <p>On the matter of continuity of discussion, the authors sometimes struggle to maintain / preserve or appropriately distinguish the differences between the various terms used within systems science where some authors speak of theory, others method, and yet others blend the two together.</p>
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	<p>The authors may wish to consult a couple of works that do a good job of outlining some of the theoretical and / or methodological distinctions between the various approaches and methods within systems thinking and systems science:</p> <p>Williams, B., &amp; Hummelbrunner, R. (2010). <i>Systems Concepts in Action</i>. Stanford, CA: Stanford University Press or Jackson, M. C. (2007). <i>Systems Thinking</i>. New York: John Wiley &amp; Sons.</p> <p>The confusion or conflation is easy enough to do, but it makes for a substantive problem when attempting to provide a review of a field. An initial introduction to the various areas within systems science from an ontological and epistemological standpoint might be useful. For example, at the end of the manuscript there is a mention of the literature fitting to 'best practice' discussions, however there are branches of systems science like complexity science that wouldn't use that concept at all. Within this domain the concept of 'best' practice implies that one can evaluate and compare practices on equal footing, which is near impossible in an emergent condition. The authors might find the following paper useful to this end: Sturmborg, J. P., &amp; Martin, C. M. (2008). Knowing - in Medicine. <i>Journal of Evaluation in Clinical Practice</i>, 14(5), 767–770. <a href="http://doi.org/10.1111/j.1365-2753.2008.01011.x">http://doi.org/10.1111/j.1365-2753.2008.01011.x</a> or Snowden, D. J. (2005). Multi-ontology sense making: a new simplicity in decision making. <i>Informatics in Primary Care</i>, 13, 45–53.</p> <p>This ultimately gets to the second point about inclusion of perspectives. As the subject matter is indeed one that has multiple perspectives on evidence and the manner in which systems are organized, it is difficult to lump them into one category. This is a strength, weakness and challenge for the field and for using systems science and something the paper could do more to expand upon.</p> <p>Lastly, some further explication on the systematic review findings themselves would be useful as there appears to be many articles that I would have expected to have been included that were not (See comment in the attached PDF). Many leading authors were barely represented and that suggests to me that the scoping of the review, the search criteria or the search itself might have been problematic. If not, a better sense of how the decisions were made to exclude certain perspectives or papers needs to be made clear.</p> <p>The paper's potential contribution is substantial and may offer some clarity and direction to those looking to understand systems science and improve its use within public health.</p>
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**VERSION 1 – AUTHOR RESPONSE**

Reviewer 1	Action
<p>The abstract is weak and does not reflect the strengths of the paper - there are several mistakes and the descriptions are vague.</p> <p>a.For example, your objectives are more accurately stated in the paper; we suggest the authors consider changing them in the abstract to match. You could also identify your methods in more detail.</p> <p>b.Line 16: "the remaining articles"; I assume the authors mean the articles remaining after exclusion criteria were applied but it's confusing as written.</p> <p>c.Line 21: "within each categories"; grammatically incorrect and vague - can you identify the categories or offer a general description?</p> <p>d.Line 25/26: "how systems concepts and approach" - please fix.</p>	<p>The abstract has been reworked, taking in the reviewers' suggestions for strengthening it:</p> <p><b>Objectives:</b> <i>This paper reports on findings from a systematic review designed to investigate the state of systems science research in public health. The objectives were to: (a) explore how systems methodologies are being applied within public health and (b) identify fruitful areas of activity.</i></p> <p><b>Design:</b> <i>A systematic review was conducted existing literature that draws on or uses systems science (in its various forms) and key public health areas of action and concern, including tobacco, alcohol, obesity and the social determinants of health.</i></p> <p><b>Data analysis:</b> <i>116 articles were included in the review. An inductive qualitative content analysis was used for data extraction. The following was systematically extracted from the articles: approach, methodology, transparency, strengths and weaknesses. These were then organized according to theme (i.e. commonalities between studies within each category), in order to provide an overview of the state of the field as a whole. The assessment of data quality was intrinsic to the goals of the review itself, and therefore was carried out as part of the analysis.</i></p> <p><b>Results:</b> <i>Four categories of research were identified from the review, ranging from editorial and commentary pieces to complex system dynamic modelling. Our analysis of each of these categories of research highlighted areas of potential for systems science to strengthen public health efforts, whilst also revealing a number of limitations in the dynamic systems modelling being carried out in public health.</i></p> <p><b>Conclusions:</b> <i>There is a great deal of interest in how the application of systems concepts and approach might aid public health. Our analysis suggests that soft systems modelling techniques are likely to be the most useful addition to public health, and align well with current debate around knowledge transfer and policy. However, the full range of systems methodologies is yet to be engaged with by public health researchers and practitioners.</i></p>

<p>The method for data extraction identified (inductive qualitative content analysis) is attached to reference 16 (Dixon-Woods et al., 2005). We don't see this method mentioned in that article. Please correct me if we have missed it.</p>	<p>Discussion of inductive qualitative content analysis has been expanded, and additional references have been added. This now reads:</p> <p><i>“Articles were categorized by three of the authors (for inter-rater reliability). An inductive qualitative approach to analysis was used. As Dixon-woods et al note, systematic reviews can be integrative or interpretive [16]. With integrative reviews, the categories and concepts are set prior to conducting literature searches. With an interpretive approach, concepts and categories arise inductively from the content after the searches are conducted [16]. This approach to analysis is otherwise known as an inductive qualitative content analysis [19].”</i></p>
<p>The methodology appears appropriate though it seems like the authors may have missed some important content in their search. There are two Oxford Bibliographies online that are relevant to this topic and a quick scan suggests relevant papers may have been missed. We appreciate that the authors have indicated their search may be incomplete and agree that even if it is not complete it may be representative.</p>	<p>An appendix has been created with the full 117 articles, so that readers have a complete record of what was contained in the review.</p>
<p>The categorization of the papers is helpful and the fact that such a high number of articles were classified as 'reviews or calls for action' provides an interesting reflection on the state of practice. You could draw more attention to this by acknowledging it in the discussion section.</p>	<p>We agree that this should be noted in the discussion. The opening paragraph of the discussion now reads:</p> <p><i>In particular, the fact that a little over half of the papers identified by the review process are commentaries of calls for the application of systems methodologies but do not use systems methodologies. Based on this finding, we focus our discussion on areas that can be progressed. The review found two areas of public health-systems activity worth reflecting on more deeply: systems modelling and the use of systems science to benchmark best practice.</i></p>
<p>We commend the authors for drawing attention to the issue</p>	<p>In the section on modelling we have included references to papers which exhibit the traits described. We chose not to construct a table</p>

<p>of quality control related to modelling though these comments don't fully align with the analysis presented. It could be helpful to provide a more detailed summary of the modeling papers and the features of a high quality approach they include/don't include to support the call for more quality control. A table in the results might be helpful in this regard.</p>	<p>as our review aims to summarise the limitations of the field as a whole, rather than single out any particular authors.</p> <p>We also note, in the section on benchmarking best practice, that:</p> <p><i>"Research on the implementation of systems type interventions has shown that without training and clear guidelines on systems-based implementation then practitioners resort to their previous experience in delivering multi-component reductionist style interventions [41]."</i></p>
<p>If would also help if the authors were to introduce the soft systems frame earlier in the analysis section of the paper, and consider how it relates to their four categories. This would also allow this framing to be introduced earlier in the discussion and given more prominence.</p>	<p>We have inserted a description of soft systems earlier in the paper. The 'benchmarking' section now includes the following:</p> <p><i>"The papers in this category sought to benchmark or assess the likely efficacy of systems thinking in public health practice, using systems concepts and/or methodologies including soft systems methodology, to underpin intervention and/or evaluation efforts."</i></p> <p><i>"BeLue et al. described how a community-based participatory research (CBPR) approach was enhanced by applying the soft systems method causal loop diagramming to understand factors influencing underage drinking in their area."</i></p> <p><i>"These researchers conclude that more practical guidelines, training and partnership with experienced systems modellers is required if we are to see systems concepts applied more broadly in public health practice and evaluation."</i></p>
<p><b>Reviewer 2</b></p>	
<p>Reviewer 2 suggests the title does not accurately reflect the aims of the paper</p>	<p>We agree that the title could be clearer, and have changed it to:</p> <p>Systems science and systems thinking for public health: a systematic review of the field</p>

<p>On the matter of continuity of discussion, the authors sometimes struggle to maintain / preserve or appropriately distinguish the differences between the various terms used within systems science where some authors speak of theory, others method, and yet others blend the two together.</p>	<p>This observation made by reviewer 2 is of the field the systemic review seeks to provide an overview of. That is, the language within the papers we review is often muddled. Accordingly, we have been as consistent with our language as the materials we are reviewing allow us to be.</p>
<p>An initial introduction to the various areas within systems science from an ontological and epistemological standpoint might be useful.</p> <p>For example, at the end of the manuscript there is a mention of the literature fitting to 'best practice' discussions, however there are branches of systems science like complexity science that wouldn't use that concept at all.</p>	<p>The aim of the paper is not to provide an introduction to systems method or theories, given the great number of reviews and commentaries identified in the review that do exactly this. We have added a footnote to this effect and direct readers to the excellent texts the reviewer suggests.</p> <p>With regard to the discussion of best practice, we do not refer to best practice in the field of system science. Rather, the application of systems science within public health. We have made this distinction more explicit in our discussion of modelling.</p>
<p>This ultimately gets to the second point about inclusion of perspectives. As the subject matter is indeed one that has multiple perspectives on evidence and the manner in which systems are organized, it is difficult to lump them into one category. This is a strength, weakness and challenge for the field and for using systems science and something the</p>	<p>To expand on this point, we have added:</p> <p>Inserted into discussion: <i>"Within the 'softer' systems methodologies, such as soft systems methodology and the use of systems based methods for benchmarking good practice, a plurality of methods and applications were uncovered. The existence of this plurality poses a challenge for the field, which much strike a balance between allowing for inclusive and innovative uses of systems based approaches that are 'fit for purpose' while simultaneously maintaining scientific and methodological rigour."</i></p>



<p>paper could do more to expand upon.</p>	<p>We have also added in the results section that the literature exists across a continuum and some papers are categorised into more than one category (in reflection of this).</p>
<p>Lastly, some further explication on the systematic review findings themselves would be useful as there appears to be many articles that I would have expected to have been included that were not (See comment in the attached PDF). Many leading authors were barely represented and that suggests to me that the scoping of the review, the search criteria or the search itself might have been problematic. If not, a better sense of how the decisions were made to exclude certain perspectives or papers needs to be made clear.</p>	<p>We have included an appendix with all the articles included in the study. Within these, all the authors named by the reviewer can be found. However, as noted in several places in the paper, a systematic review requires us to draw boundaries for the sake of feasibility. In doing so, some studies can be missed.</p> <p>We note:</p> <p><i>“As Williams and Hummelbrunner [9] note, holism is “somewhat of an ideal. In reality, all situations, all inquiries are bounded in some way.”</i></p>

#### VERSION 2 – REVIEW

<b>REVIEWER</b>	Diane T. Finegood and Lee M. Johnston Simon Fraser University, Burnaby, British Columbia Canada
<b>REVIEW RETURNED</b>	11-Nov-2015

<b>GENERAL COMMENTS</b>	This is a very helpful review of an emerging relationship between systems science and systems thinking for public health. The authors have done a very thoughtful job of considering the state of this emerging relationship and have provided some advice worthy of further consideration.
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<b>REVIEWER</b>	Cameron D. Norman Cense Research + Design, Canada Dalla Lana School of Public Health, University of Toronto, Canada
<b>REVIEW RETURNED</b>	None outside of having studies included in this review. I am a researcher and practitioner in this field and do not perceive those qualities as a conflict. 01-Nov-2015

<b>GENERAL COMMENTS</b>	I believe the authors have addressed the major concerns posed by
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	<p>the editor and other reviewers. In particular, the notation about the potential for missed articles. The inclusion of the full list of sources in the appendix is also a helpful addition to the paper. The only issue I have is, without belabouring the point, that the matter of stating (simply and succinctly) some of the issues related to epistemological positions present within the field of systems science (as suggested in my initial review) are salient even if the intent of the paper is not to provide an introduction to the field. This can greatly influence how certain points are framed (e.g., 'best practice' etc..) and thus could be prone to be excluded from a review. This is a matter of opinion and one that, should the editor and authors agree to include mention of it or ignore it, I'll accept whatever is put forth. It's not something that needs to prevent the paper from moving forward.</p>
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