

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	The need for a complex systems approach in rural health research
AUTHORS	Hulme, Adam; Thompson, Jason; Brown, Andrew; Argus, Geoff

VERSION 1 – REVIEW

REVIEWER	Purohit, Neha Department of Community Medicine and School of Public Health, PGIMER
REVIEW RETURNED	01-Jul-2022

GENERAL COMMENTS	<p>The manuscript is an interesting read and summarizes the concept of systems thinking in health. The understanding of complex adaptive systems is essential for mapping as solving the public health problems. CAS, its characteristics are well-known to public health researchers and the field of implementation science has enhanced its uptake. Nonetheless, the manuscript is a good introduction to the concepts for students and budding researchers and a reminder for public health professionals. A few suggestions to the authors are:</p> <ol style="list-style-type: none">1. Since the authors have specifically selected rural health and provided adequate reasons. Can you explain how this approach will differ in rural and semi-urban or urban health?2. There is literature where the focussed approaches have been used and yielded positive population health outcomes and sustainability of outcomes. The authors may consider mentioning few of such examples to depict applicability and enhance the utility of the approach.3. The search terms to assess the availability of articles pertaining to ABM and SDM are too limited and may be removed from the text. It is also strange that the authors mention a systematic review of 301 articles on SDM but could not find any relevant article through PubMed search.4. Presenting limitations of these models might give the communication a balanced perspective.
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REVIEWER	Karim, Ali Mehryar Bill & Melinda Gates Foundation, Global Development
REVIEW RETURNED	14-Jul-2022

GENERAL COMMENTS	<p>What is missing from the paper is the politics of health policy making. For example, the proposed approach to rural health research may reveal that some of the most impactful solution to a particular health problem is addressing the broader ecosystem beyond the control of the health system. If the health sector had commissioned the research how would it implement the solution?</p>
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REVIEWER	Karan, Anup Indian Institute of Public Health, Delhi (IIPHD), Public Health Foundation of India, HHealth Economics
REVIEW RETURNED	25-Jul-2022

GENERAL COMMENTS	<p>The need for a complex systems approach in rural health research</p> <p>Comments: This is a communication article aiming at theoretically highlighting the role of 'complex systems approach' in public health in general and rural health research in particular. The article by briefly providing a background to the complexity sciences argues that familiarity with complex systems approaches as methods of research will greatly help dealing with complex and multidimensional public health issues such as rural health research.</p> <p>While I find the article well-articulated presenting a case of using of complex systems approach as a method, I only have a few minor queries and probably a couple of points to make this piece more relevant for rural health research as follows:</p> <p>1. In the system research framework there is also a lot of literature Which talk about 'Whole System Research' (WSR). See for instance, Ijaz N. 2019. WSR too talks about considering system approach for researches on complex issues. Does this complex system approach have anything in overlap with WSR. I guess, authors could have made at least reference of WSR and how complex system approach provides additional advantage over WSR.</p> <p>2. Can the section (7.0) on "Towards a complex systems approach on rural health" be made a little more context specific with specific example of a research question and the solution provided in the framework of complex systems approach. For instance the last paragraph of section 7.0 is only of generic discussion.</p>
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VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Dr. Neha Purohit, Department of Community Medicine and School of Public Health, PGIMER

Comments to the Author:

The manuscript is an interesting read and summarizes the concept of systems thinking in health. The understanding of complex adaptive systems is essential for mapping as solving the public health problems. CAS, its characteristics are well-known to public health researchers and the field of implementation science has enhanced its uptake. Nonetheless, the manuscript is a good introduction to the concepts for students and budding researchers and a reminder for public health professionals.

Author response: *We thank the reviewer for the feedback. We have taken on board the points raised and have revised the manuscript accordingly as indicated. The word limit is extremely limited with BMJ Open Communication articles, and so our changes are relatively brief.*

A few suggestions to the authors are:

1. Since the authors have specifically selected rural health and provided adequate reasons. Can you explain how this approach will differ in rural and semi-urban or urban health?

Author response: Under section 2.1 'From reductionism to complexity', we have inserted a new line in the second paragraph referring to the example of rural health workforce maldistribution and shortage. We have also added a sentence at the end of this same paragraph:

"Whilst the use of a complex systems approach may not necessarily differ methodologically between urban, semi-urban and rural health contexts, the contribution of the complexity sciences in rural health specifically lies in the generation of new evidence and knowledge to complement traditional scientific inquiry.

2. There is literature where the focused approaches have been used and yielded positive population health outcomes and sustainability of outcomes. The authors may consider mentioning few of such examples to depict applicability and enhance the utility of the approach.

Author response: Under section 2.1 'From reductionism to complexity', we have modified the sentence by inserting the underline:

"There is mounting evidence to suggest that a complex systems approach can be of practical assistance in both explaining mechanisms driving adverse health outcomes and system behaviour and also determining where and how to intervene to achieve positive population health outcomes (18, 23-25, 27)".

We also recognize the utility of the approach and positive impact that the complex systems approach has had in other contexts and health systems, hence the inclusion of citations [18, 23-25, 27]. The reader can access the material corresponding to the citations listed, of which citations 23 and 24 are systematic reviews of complexity science approaches in the health literature. The space requirements prevent elaborations.

3. The search terms to assess the availability of articles pertaining to ABM and SDM are too limited and may be removed from the text. It is also strange that the authors mention a systematic review of 301 articles on SDM but could not find any relevant article through PubMed search.

Author response: *We have removed these search terms and inferences as suggested; though, it is not uncommon to see in similar articles, a broad approach taken to the search (i.e., title/abstract) as a type of 'first-pass' to understand the number of possible articles through approximation. The reason why a lack of studies were identified is due to the filters that were used (title and abstract only) and the use of only Medline (PubMed). Alongside the removal of the search, we have also cited a small number of papers that have used complexity approaches in regional/semi-urban and in one case, rural health. The manuscript is more balanced as a result, and we appreciate the comment.*

4. Presenting limitations of these models might give the communication a balanced perspective.

Author response: *Section 6.0 explains that complex systems approaches are not intended to act as a replacement for traditional scientific methods well-suited to simpler problems. Figure 3 includes various radar graphs that indicate the differences between traditional approaches and complex systems methods. The limitations of complex systems approach, as visually indicated by Figure 3, are that they may lack fit and precision depending on the approach taken.*

We would like to thank Dr Purohit for their time, feedback, and suggestions.

Reviewer: 2

Dr. Ali Mehryar Karim, Bill & Melinda Gates Foundation

Comments to the Author:

What is missing from the paper is the politics of health policy making. For example, the proposed approach to rural health research may reveal that some of the most impactful solution to a particular

health problem is addressing the broader ecosystem beyond the control of the health system. If the health sector had commissioned the research how would it implement the solution?

Author response: *We appreciate the reviewer's point about wider system factors, beyond the health system itself, and have made minor modifications to the manuscript. Specifically, we have added into Table 1 (under 'Open boundaries'), the following new text:*

"The most impactful solution to T2DM may equally reside outside of the immediate health system in other global and political systems. Exogenous influences, such as global conflicts, climate change and food insecurity, may impact endogenous system dynamics. Complex systems approaches may begin to examine the effects of global dynamics on internal behaviours".

We would like to thank Dr Karim for their time and feedback.

Reviewer: 3

Dr. Anup Karan, Indian Institute of Public Health, Delhi (IIPHD), Public Health Foundation of India

Comments to the Author:

The need for a complex systems approach in rural health research

Comments:

This is a communication article aiming at theoretically highlighting the role of 'complex systems approach' in public health in general and rural health research in particular. The article by briefly providing a background to the complexity sciences argues that familiarity with complex systems approaches as methods of research will greatly help dealing with complex and multidimensional public health issues such as rural health research.

While I find the article well-articulated presenting a case of using of complex systems approach as a method, I only have a few minor queries and probably a couple of points to make this piece more relevant for rural health research as follows:

Author response: *Thank you Dr Karan. We are glad to receive the positive impression. As with our responses to the other reviewers, we are noting here the extremely limited word count available for Communication articles, and the fact that we are currently exceeding the advised limits.*

1. In the system research framework there is also a lot of literature Which talk about 'Whole System Research' (WSR). See for instance, Ijaz N. 2019. WSR too talks about considering system approach for research on complex issues. Does this complex system approach have anything in overlap with WSR? I guess, authors could have made at least reference of WSR and how complex system approach provides additional advantage over WSR.

Author response: *We appreciate this direction to an emerging body of work – WSR – that is making great strides in fit-for-purpose clinical research designs to enhance patient centred care through better diagnostic and therapeutic frameworks. On this occasion, the complex systems approach discussed (i.e., System Dynamics modelling and Agent-Based Modelling for complex social systems – with many referenced citations) is not related to WSR which is more to do with scrutinizing the capacity of RCTs to evaluate individual-level interventions through a lens of traditional and complementary and alternative medicine modalities.*

2. Can the section (7.0) on "Towards a complex systems approach on rural health" be made a little more context specific with specific example of a research question and the solution provided in the framework of complex systems approach. For instance, the last paragraph of section 7.0 is only of generic discussion.

Author response: Thank you for this feedback. We have inserted two new sentences into section 7.0 to make this component of the manuscript more relevant to rural health specifically:

“Indeed, a particularly important issue in rural health that the complex systems approach could be applied to includes the widespread maldistribution and shortage of medical and allied health professionals (8, 9). Understanding the complex interrelationships between various system wide factors that are driving this problem with the aim of identifying optimal systemic leverage given the presence of counterintuitive behaviour is a major future research opportunity for the systems-based computational modelling community”.

We would like to thank Dr Karan for their time and feedback in evaluating the manuscript.

VERSION 2 – REVIEW

REVIEWER	Purohit, Neha Department of Community Medicine and School of Public Health, PGIMER
REVIEW RETURNED	08-Sep-2022
GENERAL COMMENTS	The authors have satisfactorily addressed my comments. I would again appreciate the authors for the well-articulated communication.