Author’s response to reviews

Title: How the study of networks informs knowledge translation and implementation: A scoping review

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Author’s response to reviews:

Response to reviewers: IMPS-D-18-00559:

Reviewer #1: Dear Stephanie Glegg and colleagues,

In your manuscript, you are covering a topic that is of great interest to me and - I believe - of great value to the field of KTI. I have a couple of comments that I hope will help to inform the next iteration of your work. Below I first list general recommendations for what I think needs to change for this to be ready for publication. Following these general comments, I have listed 'line-specific' comments.

REVIEWER #1 - GENERAL COMMENTS

1.1 The language used to write the article is at times highly abstract, and filled with SNA jargon, which makes it difficult to read this article. The field of SNA of course does not make this an easy job for you - the terminology is very technical - but you need to tackle this and work more with translating the knowledge in the article into plain language - unless you want this to be for the SNA scholars community only, which I don't think is the case.

Response: Language throughout the manuscript has been reviewed and revised where possible to improve the clarity of the content for non-SNA scholars. This was a very challenging task, as the reviewer suggests. We struggled with representing SNA concepts accurately while simplifying the terms within the text. By replacing all SNA terminology in the text, we believe that the article would become less useful as a reference for those using it to inform their own
SNA research methodology in part because they would not readily find the applications of different network properties (e.g. how has betweenness centrality been used?) if described only in lay terms. Although not all of the SNA language in the manuscript is immediately accessible, we have made efforts to contextualize the terms within a KT context using terminology familiar to a KT audience. In particular, we draw your attention to table 1, which defines each of the SNA terms used in the manuscript, as well as the implications for each term or network property with respect to KT applications. These implications were drawn from the included studies. In this way, the manuscript aims not to educate the reader as to the many intricacies of SNA, but rather to alert them to the ways in which SNA would benefit the field of KT, and to act as a resource for exploring the types of measures that might be useful in various contexts or for specific types of research questions.

Revised text: See text throughout, including table 1.

1.2. Your results section is very brief and left me with a question of 'Okay, what is the essence in all this?'. When I continued reading, I found a lot of information in the discussion section that belongs to the results section. On top of moving these parts to the results, I also think you will need to dig deeper into describing some of the 'trends' in the materials analysed - I am still in doubt about the key take aways from all the literature you have reviewed, which tells me that a key translational job has not been fully completed.

Response: Relevant content from the discussion has been moved to the results section as requested. To align with the purpose of the scoping review, which is to describe the way that SNA methodology has been used to study KT (as opposed to describing the findings of previous KT-related SNA research), the trends (e.g. common network properties examined, analysis methods, use of theory, etc.) have been summarized in the results section, and examined for their utility to KT, and gaps in the literature and limitations in the discussion section. While a typical scoping review would review the outcomes of the studies in detail (as Chambers et al. has done), such an analysis is peripheral to the current review’s scope. Key take-aways have been summarized in the revised conclusion section, as well as in the new bullet points we have added to meet the recent changes to the journal’s requirements (i.e. the addition of a Contributions to the Literature section (page 33).

Revised text: See changes to results, discussion sections within the text.
Conclusions section - addition:

Suitable for relatively small (e.g. a dozen) to larger networks of several hundred members or more, SNA can be used to describe or to evaluate groups within or across departments, organizations, countries, or beyond. Longitudinal research, a more representative range of populations, the use of interviews, document review and observation for data collection, greater depth of analysis, and the leveraging of network visualizations can augment the contributions of SNA to the KT science knowledge base.

Understanding how network properties can be used as proxies to measure social processes (e.g. information exchange, best practice adoption, decision-making, influence) can help KT scientists to apply SNA effectively to expand the range of measures that can be used to evaluate KT efforts. The approach can be used to describe a network as a precursor to a KT intervention, as a means of supporting planning (e.g. identifying target groups or individuals), as well as for testing hypotheses. Evaluate information sharing, positions of influence, relationships between network connection patterns and individual attributes (e.g. attitudes) or behaviours, and the effectiveness of KT interventions relying on or targeting networks are all feasible. Predicting or explaining patterns of connections, comparing groups, time points or contexts are also possible.

Finally, while this article did not present a comprehensive overview of the use of theory across the entire body of SNA-related KT literature, it does offer a starting point for conceptualizing theory-based SNA applications in KT research. In keeping with a systems or complexity theory approach, SNA can offer a wider spectrum of determinants to examine in evaluating KT processes by addressing social factors.

Contributions to the Literature section:

- This review synthesizes the KT literature employing a social network analysis (SNA) approach to the study health professionals, to demonstrate the utility of SNA for advancing KT science

- Also summarized is the use of theory in this SNA research to demonstrate the fit of SNA with theoretical approaches used in KT research, including diffusion of innovation and complexity theory

- This article acts as a reference tool for those considering applying a SNA lens to their KT research, to support the design of SNA-specific research questions, methodological approaches and measures
1.3. If you reorganise the article in this way, this should make it possible to also focus the discussion more - in its current version you spend a lot of time on reviewing the details in your materials still. I am missing a bigger discussion of how - if SNA's full potential was used - this method could help improve both the science and practice of KTI. I believe that will require you to include other KTI literature to a greater degree than you do at the moment and to embed your own piece more within broad discussions happening in the field right now (moving more to a systems-focused understanding of implementation processes etc., see e.g. Braithwaite et al., 2018).

Response: Added on page 26 is a discussion on complex adaptive systems and SNA’s potential role using this lens. Relevant revisions are also reflected in the more detailed feedback listed below.

Revised text: New paragraph: “This approach aligns closely with current discussion in the KT literature about complex health systems, and the need to use “complexity-informed approaches” to embed evidence-informed changes in the health care system (61-63). Such systems models assume that health care organizations are dynamic, interdependent, contain sub-systems with feedback loops and exhibit emergent properties. A combination of a complex adaptive system lens and SNA modelling to measure and explain features of networks and individuals, and most critically the relationship between networks, sub-networks (like cliques) and individuals as they change over time, is an underutilized approach to KT and implementation. The approach moves from a mechanical understanding of KT barriers and facilitators to a much more complex picture of what is required to introduce and sustain change in health care organizations.”

REVIEWER #1 - LINE-SPECIFIC COMMENTS

1.4. Line 59: You are using the term 'science of knowledge translation' here and 'implementation science' above. If you are assuming that these are totally identical concepts and you use them in this sense, then probably stick with just one of them (and it looks as if it should be KT). If these are used based on different meanings, then this needs to be commented on

Response: The term KT is being used to include implementation; reference to implementation has been removed as appropriate throughout the manuscript to reduce redundancy.

Revised text: See revisions throughout the text.
1.5. Line 70-72: This is a description of SNA that does not make it easy to understand its essence. What is social structure? What is position? And what does it mean to influence actors? You will need to flesh this out more and link it stronger to KT so it becomes clear why it is interesting to discuss them together.

Response: The definition of SNA has been refined to improve clarity (page 4). The paragraph on page 5 describes the link to KT, and has been expanded to include specific examples of KT processes whose study may benefit from a SNA lens (page 5).

Revised text: Social network analysis (SNA) is a research paradigm concerned with the patterns of connections (i.e. ties) between actors (i.e. people or entities) within an interconnected group or network, and how this ‘social structure’ impacts outcomes of interest.(7)

1.6. Line 83-84: Two things: This requires a reference (is it documented that planned behaviour theory is one of the most prevalent theories used? And: Why is this interesting? Where are the differences btw this and the SNA paradigm? This needs to be explained if this introduction is to remain relevant.

Response: A reference has been added to support this statement and additional discussion about the differences in these theoretical approaches has been added (page 5).

Revised text: SNA offers an alternate perspective to behaviour change theory-based approaches prevalent in KT science.(5)


1.7. Line 88: The section beginning in line 88 and ending in line 106 does require some work to ensure that it is clear to readers what has been done and why this piece is necessary. What I do not understand at this stage is:

- How exactly is this different from what has been produced already?
Response: This paragraph has been expanded to delineate the gaps in the existing reviews to highlight more effectively the focus of and justification for the current review, which is to examine on the ways in which SNA methodologies have been used to study KT, as opposed to summarizing the outcomes of those studies. The objective is to provide insights into ways to advance the science of KT by utilizing SNA methodologies, as opposed to informing specific KT strategies based on the findings SNA studies on their effectiveness or on the network-related factors at play in specific settings (page 5-6).

Revised text: Recent systematic reviews on SNA in health care have focused on quality and patient safety initiatives,(8,9) on a single profession (i.e. nursing).(10,11) or on only select network properties (e.g. the study of brokers).(14) Some reviews focus on conditions (e.g. obesity networks) (14) to explore possible network interactions for potential treatments. Given the complex and inter-professional nature of health care practice, a study of the full breadth of health professions and network properties is required. Furthermore, some of these reviews addressed included non-health care literature from television production and corporate business contexts,(13) or neglected to include social sciences databases in which most SNA journals are indexed. The existing broad reviews of health professional networks (6,12) do include some studies on KT-related phenomena (e.g. diffusion, knowledge transfer); however, the majority of their content centres on the study of social interactions that have implications for organizational functioning (e.g. friendships, work task assignments, staff recruitment, social support trust), but were not linked directly to the exchange or application of evidence to inform practice. Similarly, the emphasis on outcomes related to work satisfaction, leadership roles, professional behaviours, protocol efficiency, patient flow, operating room layout, technology adoption and workplace performance reduce the extent to which KT-specific outcomes can be explored. The review by Chambers et al.(6) described primarily the settings and outcomes of these studies, whereas the current study aims to describe in detail the nature of the application of SNA to the study of KT. Such an approach aims to advance the science of KT by providing insight into worthwhile methodological directions this literature can provide. Evidence for the effectiveness of specific KT interventions or for the identified relationships between network properties and other variables relevant to KT can be sought elsewhere. Furthermore, none of these reviews examined the use of theory in their included body of literature specifically, despite this focus being an identified gap.(6) Given the rapid growth of the use of SNA in the health care context over the past eight years (see figure 2), an updated and more directed search is warranted. A targeted examination of the research specific to SNA in KT and EIP is required to inform the application of SNA methodologies in this field, with attention paid to the insights offered by both the structural properties examined and the theoretical perspectives applied.
A SNA perspective can broaden our understanding of the mechanisms by which KT efforts are effective by examining the social structures and relationships that facilitate or hinder KT and EIP. This understanding will augment our knowledge base by expanding the range of KT determinants worthy of consideration. As researchers gain interest in the social drivers of KT and EIP, this review will provide a foundation for developing key research questions and SNA-driven methodological approaches for KT research that are based on established and relevant theories. Furthermore, this review will add to the current theorizing in the field related to a systems-focused understanding of knowledge translation and implementation processes. Specifically, implementation happens within a complex system, and network approaches have been used to study complex systems; the link between the two areas demands greater attention. Given these gaps, the purpose of this article is to synthesize the ways in which SNA methodology can be used to advance the science of KT.

1.8. Also note that there are other more 'recent' systematic reviews that should be mentioned here and seem to be missing in the list of references. E.g.: Sabot et al., 2017; Zhang et al., 2018 (obesity focus); McCurdie et al., 2018

Response: Reference to the Sabot and Zhang reviews has been added to the discussion about systematic reviews in the Background section. The McCurdie review could not be found.

Revised text: Some reviews focus on conditions (e.g. obesity networks)(14 - Sabot) to explore possible network interactions for potential treatments.

The existing broad reviews of health professional networks (6, 12, 15 - Zhang) do include some studies on KT-related phenomena (e.g. diffusion, knowledge transfer); however, the majority of their content centres on the study of social interactions that have implications for organizational functioning (e.g. friendships, work task assignments, staff recruitment, social support trust), but were not linked directly to the exchange or application of evidence to inform practice. Similarly, the emphasis on outcomes related to work satisfaction, leadership roles, professional behaviours, protocol efficiency, patient flow, operating room layout, technology adoption and workplace performance reduce the extent to which KT-specific outcomes can be explored. The review by Chambers et al.(6) described primarily the settings and outcomes of these studies, whereas the current study aims to describe in detail the nature of the application of SNA to the study of KT. Such an approach aims to advance the science of KT by providing insight into worthwhile methodological directions this literature can provide. Evidence for the effectiveness of specific
KT interventions or for the identified relationships between network properties and other variables relevant to KT can be sought elsewhere. Furthermore, none of these reviews examined the use of theory in their included body of literature specifically, despite this focus being an identified gap. Given the rapid growth of the use of SNA in the health care context over the past eight years (see figure 2), an updated and more directed search is warranted.

1.9. Line 112-115: In outlining these objectives, I am missing a reference to and specification of the areas within the health sector that you have covered. This also applies to research question 1 below.

Response: Reference to health professional networks has been added to objective 1 and research question 1 (page 7). No limitations to specific health sector contexts were established (as per inclusion/exclusion criteria)

Revised text: The specific objectives of this scoping review were: 1) to describe the literature on SNA as it has been applied to KT and EIP involving health care professionals, in terms of its research design, methodology and key findings; 2) to provide a critical analysis of the findings in the context of existing theory; and 3) to identify strengths and gaps to inform future research. The scoping methodology, as described by Levac, et al.’s modification of Arksey and O’Malley’s guidelines were applied. Step six in the methodology, consultation with key stakeholders, is optional and was not applied in the current review.

Step 1: Identify the research question

The specific research questions developed for this review were:

1. How has SNA been applied to health professional networks the field of KT/EIP with respect to study aims, data collection and analysis methods, and populations, context, variables and structural properties under study?

2. What are the primary theoretical underpinnings that explain the link between the network properties and KT/EIP?; and
3. What are the gaps in the literature that can inform future research directions?

1.10. Line 145-148: Does this mean that you only included studies that measured outcomes at the individual level? If not, then probably explain this in a slightly different way as it gives me the impression that your focus is the individual.

Response: A statement relating to the inclusion of all 3 levels of analysis used in SNA has been added to reflect the inclusion of more than simply individual-level outcomes (page 9).

Revised text: Dyadic (i.e. pair-level), ego-network (i.e. individuals’ networks) and whole network (e.g. departmental or organizational-level) properties and variables were of interest.

1.11. Line 189-193: With multiple 'of which' in one sentence, this sentence is rather complicated and should be simplified.

Response: This sentence (page 11) has been split in two and revised for clarity

Revised text: Physician-only networks were the most commonly studied (11, 52%), (23–25, 27–35) followed by interprofessional networks of researchers and clinicians (6, 29%). (36–41) Only one study (5%) examined the network of nurses and physicians (22), (22), and one a network of nurse practitioners. (42) Two of the interprofessional networks included public health officials, (36–38) one included leadership (i.e. directors, managers) and administrative support personnel, (36, 37) and one included leadership and knowledge brokers. (39)


Response: This sentence (page 12) was split into two, and revised to correct the grammar.

Revised text: Studies examined networks ranging in size from 13 to 784 participants, with a mean of 153. Just over half the studies (12, 57%) were conducted across organizational boundaries, (23–28, 30–35, 44). Eight (38%) were conducted within a single health care
organization,(21,22,29,36,37,39,42,45,46) one (5%) was conducted within a research-focused network(40,41), and one (5%) within a health-specific field at a national level.(38) Eight((5%)) was conducted .

1.13. Line 203/204: I have difficulties getting my head around these statistics for 'describing networks': Are the eight / two / fourteen studies totally different studies or is their overlap? Are you telling a story of "a majority of studies did this", or are you telling the reader sth different? This is hard to guess based on your description.

Response: This section (page 12) has been re-organized and simplified to improve clarity. The intention was to provide a general overview of the nature of the networks under study with respect to the actors of interest.

Revised text: Last paragraph of Networks and Actors section: Studies examined networks ranging in size from 13 to 784 participants, with a mean of 153. Just over half the studies (12, 57%) were conducted across organizational boundaries,(23–28,30–35,44). Eight (38%) were conducted within a single health care organization,(21,22,29,36,37,39,42,45,46) one (5%) was conducted within a research-focused network(40,41), and one (5%) within a health-specific field at a national level.(38)

Describing networks section:

Eight (29%) of the 27 articles described networks by deriving network properties from relational data.(21,22,30,36,39,40,42,48) Two articles (10%) used conventional descriptive statistics (e.g. frequency counts, proportions) to describe social network data.(34,38) Network visualizations illustrated the data in 13 (48%) articles.(22,30,32,34–37,40,42,44–46,48) Of these, ten articles presented whole network graphs (i.e., illustrations of the network structure), two presented network graphs of subgroups within the network, and one mapped whole networks within graphs that accounted for covariates. Network properties represented in the graphs included centrality (i.e. connectedness, brokers (i.e. bridgers), core versus periphery structure (i.e. central areas of high connectivity versus peripheral areas of lower connectivity) and tie strength (e.g. frequency of contact); and attributes, such as gender, professional role, size of clinical practice, and division, department or team, and organization or site. Visualizations were used to depict network property configurations (i.e. illustrated the definitions of network properties) in two articles. Conventional charts (e.g. boxplots, scatterplots and bar, line and area charts) were also used in six articles to visualize relationships between variables (e.g. network properties with one
another, diffusion or adoption over time, centrality versus adoption timing or receipt of useful information, percentage of ties by strength at different time points).

1.14. Line 212: I would like to see some examples here of what type of hypotheses the included studies examined: What was generally anticipated with regard to the association / correlation between actor / network attributes and the use of evidence / research findings in clinical practice?

Response: A new paragraph has been added that presents a sampling of tangible examples of the types of hypotheses tested, and refers the reader to table 3 for a detailed overview of the range of variables of interest (page 14-15).

Revised text: Sample hypotheses relating to tie formation included predictors, such as homophily, existing ties (leading to reciprocity) and having a formal mechanism within the organization for interacting. Further hypothesis examples included that higher professional status would be associated with more knowledge exchange, tie homophily (i.e. sharing the same profession with a connection) would be associated with greater knowledge transfer easier, the presence of brokers (bridgers) would be associated with an increase the receipt of useful information, particularly to managers, and that greater connectivity, frequency of contact, homophily, the presence of a highly connected clinical coordinator and being an opinion leader would be associated with an increase the use of best practices. For more information about the full array of correlational, dependent and independent variables and covariates (both relational variables and attributes) identified in the included studies, refer to table 3.

1.15. Line 233: Your table 3 is very complex, and may need more guiding text around it so readers have a chance to get the lay of the land. Your text is one step in that direction but the detail with which you describe the use of SNA and its different components in the table remains pretty much uncommented in the text, and I believe that needs to change so the essence of the table also is put forwards in the text.

Response: Additional text has been added to explain the table and its offerings in more detail (page 15-16). Key categories of attributes have now been reported on page 16. The analysis section on page 13-14 (subtitle: Testing hypotheses) discusses in detail the information from the Analysis Methods column of table 3. The most prominent network properties (column 5 of table 3) are highlighted on page 16. The findings (last column of table 3) are not the focus of this
Revised text: Table 3 summarizes the key variables under study, the network properties that were derived from relational data, and the relational parameters (i.e. the constructs for which the network properties were acting as proxies). For example, network density was used as a proxy for connectedness in one study, and for representing the number of shared patients in another. Attributes of interest (which included individual characteristics, such as profession and gender; environmental characteristics, such as organization; social attributes, such as perceived reputation; and KT-related measures, such as EIP attitude scores) are also presented to offer a summary of the nature of non-SNA variables that have been analyzed alongside network properties. Study findings are presented in the final column for interest.

Eleven articles explored only a single or pair of network properties. Although 28 network properties were identified during data extraction, the majority of authors examined centrality, tie characteristics (e.g. the directions of the interactions; similarity in characteristics among pairs of connected individuals) and density (i.e. the proportion of ties relative to all possible ties) as their network properties of interest. Tie homophily (i.e. similarity of connected individuals on a given attribute, such as gender), indegree centrality (i.e. the number of people naming an individual as being connected to them), whole network density, the presence of ties, and tie reciprocity (i.e. bidirectionality in reported interactions or connections) were the most prevalent structural properties studied. The study authors’ discussions about the influences of these network properties were clearly linked to prominent theoretical perspectives. Less emphasis was placed on the analysis of centralization (i.e. the evenness of the distribution of connections), subgroups (i.e. groups of connected individuals not connected to other groups within the network) and transitivity (i.e. patterns related to sets of three individuals and their tendencies to share connections with one another).

Page 23: For example, basic SNA can be used to identify key players with influence within the network; subsequent analyses can be used to explain how these individuals came to hold these positions. Knowledge of an individual’s structural position may also help to determine with whom they may seek evidence or KT support. This information can be used to develop KT interventions that target specific health professionals or groups individuals based on their network structure or key attributes to strengthen KT processes. For instance, influential individuals can be leveraged as champions or knowledge brokers to improve the efficiency of
information exchange or behavioural influence within a discipline group. Individuals with attributes in common with key players can be selected to lead KT interventions within an interprofessional health care team. Alternate paths for efficient information exchange or behavioural influence can be accessed if resistance by specific individuals is encountered.

An understanding of relational influences can also advance the science of KT by improving the specificity of KT interventions, and by supporting their evaluation. For instance, KT intervention fidelity (e.g. intended versus actual information flow) can be monitored using SNA, and the KT intervention can be adjusted accordingly over time to address gaps or barriers. Network-specific outcomes of a KT intervention (e.g. increased connectedness, access to information) can also be evaluated empirically based on relational data.

Page 25: Network properties

Further KT-related research that includes analyses of centralization, subgroups and transitivity may afford a more in-depth understanding of the network-related influences on KT among health professionals. Centralization (i.e. the unevenness of connectivity across the network) can be calculated for the whole network, or for departments or sectors within an organization for the purposes of comparison. Subgroups (e.g. smaller connected groups within a network) can be identified and addressed individually during a KT intervention. For example, isolated individuals can be engaged to form connections with colleagues to benefit from their knowledge or influence. Different subgroups may receive different KT interventions based on their characteristics and what evidence or theory suggests their influence might be. Efforts to link or to expand subgroups may precede implementation efforts to establish an environment more conducive to change.

Transitivity has been used to examine the tendency of individuals to exchange information with a small versus a large number of sources, and for the network to form highly connected hubs. This analysis can inform the design of KT interventions to improve the efficiency of information sharing or influence (e.g. identifying targets for the intervention and relying on transitive processes to spread the information rather than targeting all network members). Such a strategy can then be compared to alternatives, to test hypotheses about the influence of different network properties on the effectiveness of KT interventions. This evaluative work is critical to improve our understanding of network influences on KT processes and outcomes.

1.16. Line 234: You are very descriptive here and just list theories, which many will not - or only partly - familiar with, which makes it difficult to get a sense of trends in the use of theories. It is
clear which of these were most frequently used but how? I would suggest to provide the reader with more insights here.

Response: The first paragraph of this section has been expanded to include an overview of how theory was used in the included articles. Additional detail has been added to the second paragraph in this section to describe more clearly the nature of the research questions being examined through theory (page 17).

Revised text: Most commonly, theory was used to select network properties to examine and to develop hypotheses to test. In addition, theory was used to provide background information about SNA or the topic under study, to assist in the interpretation of findings, and to develop and test new analytical methods to advance the field of SNA.

Several other articles employed SNA-specific theoretical perspectives to exploratory analysis, including applying Granovetter’s strength of weak ties perspective(33), examining the association between structural holes (i.e. a lack of ties) and the establishment of brokers that bridge network gaps (27,28) or between a lack of ties and EIP attitudes,(32,43) examining the role of social pressure on tie formation,(24,25) exploring the influence of being within a highly connected core of the network versus a less connected peripheral area on attitudes toward EIP,(32) and evaluating network dynamics relative to the homophily principle (i.e. the tendency of people to form connections with similar others).(27,28,43) Seven articles employed a SNA paradigm without reference to a specific theory.(21,26,35,40,41,44,46)

1.17. Line 238: The name of this gentleman is Jürgen Habermas. Just call this Habermas’s theory of communicative power

Response: Thank you – this correction has been made (page 17, 30 and table 2).

Revised text: A model combining transactive memory theory and social exchange theory,(37) as well as Habermas’ theory of communicative power,(42) social capital theory(49), sociology of professions theory,(22) balance theory(27) and an epistemic differences perspective(39) were applied in one instance each
1.18. Line 242: This refers back to my above question - this means the above theories were not used for analyses but for sth different whereas what you list here is focused on approaches supporting analytical processes?

Response: We hope that the revisions in response to comment 1.16 have addressed this comment.

1.19. Line 266-269: For readers with no knowledge of SNA, this is a highly abstract sentence that does not sufficiently open up the potential of SNA to the reader. What could a network intervention be? How do you target network gaps? What does it mean to enhance KT processes or adherence? The mission of SNA - to examine the relationship between the qualities of social networks and the quality of KT processes - remains invisible here because of the highly abstract language - describe concrete network attributes and how they potentially could affect KT processes and aim to bring this article more to life through clear examples. This critique applies to the remainder of this chapter, which I would recommend to rewrite with a stronger focus on 'translating the knowledge for practice' - otherwise your article will only be accessible / understandable for SNA specialists who know the terminology by heart. See for example the sentence in lines 276-278 - this is another example of a highly abstract sentence that would gain from being simplified / operationalised.

Response: These sections have been re-written in more accessible language. Examples specific to KT have been added to help the reader understand the relevance of SNA to KT processes (e.g. page 17, 18, 19, 23 & 25 as described In response to comment 1.15, etc.).

Revised text: Addressing line 266-269: Such research would also enable the evaluation of changes in network connection patterns over time. This approach can be used to assess the impact of network interventions. Network interventions can use socially based strategies to identify and target network gaps(54) (e.g. interactive forums to help establish connections for isolated individuals or groups) to enhance KT processes, organizational capacity or adherence to desired behaviour (e.g. through social influence)(55). Network interventions may also harness strengths in a network(54,55) (e.g. engaging highly connected individuals to exert influence or to share resources) to better mobilize EIP attitudes, behaviours or information flow for sustained implementation.
Addressing lines 276-278: For example, a network intervention aimed at reducing isolation within the network, on or increasing the connectedness of individuals who are positioned well to influence many others, can be evaluated for its effectiveness using the SIENA framework. The evidence of these changes would serve as supporting mechanisms for new evidence-based interventions. Computational models, such as agent-based modeling, can also be used to represent individuals and their interactions. Multiple simulation experiments that are programmed based on attribute data and structural characteristics allow researchers to specify and to control the parameters of the computational algorithms in order to determine the effects of specific variables.(57)

Examples of refined language: Page 17 Several other articles employed SNA-specific theoretical perspectives to exploratory analysis, including applying Granovetter’s strength of weak ties perspective(33), examining the association between structural holes (i.e. areas lacking connections) and the establishment of brokers that bridge network gaps (27,28) or between a lack of ties and EIP attitudes,(32,43) examining the role of social pressure on tie formation,(24,25) exploring the influence of being within a highly connected core of the network versus a less connected peripheral area on attitudes toward EIP,(32) and evaluating network dynamics relative to the homophily principle (i.e. the tendency of people to form connections with similar others).(27,28,43) Seven articles employed a SNA paradigm without reference to a specific theory.(21,26,35,40,41,44,46)

Examples of network interventions – page 18-19:

Study design and data collection

More longitudinal research would allow us to determine the direction of the causal relationships between network structures and attribute variables, such as EIP attitudes and behaviours, for better prediction of implementation outcomes. Such research would also enable the evaluation of changes in network connection patterns over time. This approach can be used to assess the impact of network interventions. Network interventions can use socially based strategies to identify and target network gaps(54) (e.g. interactive forums to help establish connections for isolated individuals or groups) to enhance KT processes, organizational capacity or adherence to desired behaviour (e.g. through social influence)(55). Network interventions may also harness strengths in a network(54,55) (e.g. engaging highly connected individuals to exert influence or to share resources) to better mobilize EIP attitudes, behaviours or information flow for sustained implementation.
Example of network interventions: page 19

For example, a network intervention aimed at reducing isolation within the network, on or increasing the connectedness of individuals who are positioned well to influence many others, can be evaluated for its effectiveness using the SIENA framework. The evidence of these changes would serve as supporting mechanisms for new evidence-based interventions.

1.20. Line 294: I would suggest to also discuss the challenges implicit to self-reported data - especially when collected with a certain delay and relying on participants memory of who they interacted with when and how often. Not sure if there were any studies using technology that made it possible to build on data collected 'in real time' and / or observer based data collection was used?

Response: No electronic data was used in the included studies. Reference to this was added on page 20. Additional discussion about self-report limitations has been added on page 21. Observer-based data collection is discussed on page 20 as well.

Revised text: Limited use of document review was also observed, none of which involved electronic data.

Self-report data also presents potential bias related to recall, particularly when respondents are asked to think back to interactions in the past, or to report their frequencies.(7) While network rosters can be used to help mitigate this problem in clearly bounded networks (e.g. an organization), in larger networks this strategy can create excessive burden on respondents.(7) Careful attention to the way questions are worded, and consideration of the number of alters requested of respondents must be made to gather meaningful and accurate data.(7)

Observation is a fourth means of SNA data collection, which was absent from the reviewed studies. Although more resource-dependent and not without risk of observer-influenced behaviour change, observation may enable the identification of ties not captured through self-report.(7) For example, interpersonal dynamics during a meeting may be recorded by a third party more objectively than meeting participants may recall, while concurrently focusing on the content of the meeting.
1.21. Line 301-304: Okay this refers back to my above comment. Maybe go a bit deeper on the challenges inherent to self-report data.

Response: Additional discussion about self-report limitations has been added on page 21.

Revised text: See response to comment 1.20

1.22. Line 321-328: This is the type of understanding I am looking for - but to me this belongs to the result and not the discussion section. In general, I would suggest to move parts of the discussion - the sections where you provide an overview of what was on the material - to the result section, probably deepen your description of these sections and then focus on really 'discussing' different aspects of SNA use here instead.

Response: The Discussion section has been reviewed, and relevant sections have been moved to the Results section. An extension of the discussion on the types of KT processes under study has been provided on page 22-32.

Revised text: See text throughout Results and Discussion for segments shifted to the Results section.

1.23. Line 337-339: This refers to one of my comments above - so this is not because you only included studies reporting outcomes at the individual level?

Response: The search and screening process were not limited to individual level outcomes, as clarified in the response to comment 1.10 above. However, health professionals may not typically be carrying out the activity examples listed in this section. A sentence has been added to raise this limitation in the scope of the review (page 22).
Revised text: This limitation relates in part to the scope of the review, as well as the consideration that other actors (e.g. health leaders, researchers) rather than health professionals may typically manage many of the KT activities that were not represented.

1.24. Line 343-344: derivation of network properties from .... what? What is it exactly you are suggesting would be possible but is not done? Make this clearer. What exactly is it that I as a KTI person can learn from the properties of the networks in which I am operating? What is the potential for improving KTI practice?

Response: This sentence has been revised for clarity (page 22). A discussion of the utility for KTI of these unexamined analyses of network properties has been added (page 22 and 23).

Revised text: The limited number of network properties (i.e. three or fewer) examined in more than half of this body of literature suggests that the potential for greater SNA-related insights from these studies to inform future research and practice in KT remains largely untapped.

Simply describing networks or examining a single network property (e.g. tie homophily, centrality) and its association with attribute variables fails to leverage SNA’s full potential. As KT scientists, we are interested in not only what is happening, but why it occurs, and the processes involved. With this information, we are positioned more effectively to design network-based KT interventions.

For example, basic SNA can be used to identify key players with influence within the network; subsequent analyses can be used to explain how these individuals came to hold these positions. Knowledge of an individual’s structural position may also help to determine with whom they may seek evidence or KT support. This information can be used to develop KT interventions that target specific health professionals or groups individuals based on their network structure or key attributes to strengthen KT processes. For instance, influential individuals can be leveraged as champions or knowledge brokers to improve the efficiency of information exchange or behavioural influence within a discipline group. Individuals with attributes in common with key players can be selected to lead KT interventions within an interprofessional health care team. Alternate paths for efficient information exchange or behavioural influence can be accessed if resistance by specific individuals is encountered.
An understanding of relational influences can also advance the science of KT by improving the specificity of KT interventions, and by supporting their evaluation. For instance, KT intervention fidelity (e.g. intended versus actual information flow) can be monitored using SNA, and the KT intervention can be adjusted accordingly over time to address gaps or barriers. Network-specific outcomes of a KT intervention (e.g. increased connectedness, access to information) can also be evaluated empirically based on relational data. Collaboration between KT and SNA researchers may enable a more in-depth examination of the data available from KT research, to bring new insights from a network perspective.

See also changes through to page 26.

1.25. Line 354: QAP - acronym – explain

Response: This acronym has been written out in full (quadratic assignment procedure) (page 24).

Revised text: Techniques designed to account for interdependencies in the data, including quadratic assignment procedure (QAP) analysis and exponential random graph models are considered more robust for those analyses of specific hypotheses involving dyadic ties or network characteristics.

1.26. Line 356-358: And the value of this would be?

Response: Examples of the application of these analytical approaches to the KTI context have been added (page 24-25).

Revised text: These approaches enable the modelling of relationships between dyadic (i.e. relational) variables (e.g. information exchange) and attribute variables (e.g. gender), among dyadic variables (e.g. similarity in EIP attitudes, and engagement in research collaboration), or at the whole network level (e.g. density of communication ties relative to time to evidence adoption).
1.27. Line 362-365: Again, I think part of this belongs to the results and not the discussion section. Next, you need to explain what this means: With this trends in mind, what are the typical 'stories' that are told about the relationships between networks and KTI practice, and what is it that we seem to know too little of because certain analyses are not conducted?

Response: Lines 362-365 have been moved to the results section, and revisions were made there to reduce duplication. The implications of this relative research gap have now been described (page 25 and 26).

Revised text: Further KT-related research that includes analyses of centralization, subgroups and transitivity may afford a more in-depth understanding of the network-related influences on KT among health professionals. Centralization (i.e. the unevenness of connectivity across the network) can be calculated for the whole network, or for departments or sectors within an organization for the purposes of comparison. Subgroups (e.g. smaller connected groups within a network) can be identified and addressed individually during a KT intervention. For example, isolated individuals can be engaged to form connections with colleagues to benefit from their knowledge or influence. Different subgroups may receive different KT interventions based on their characteristics and what evidence or theory suggests their influence might be. Efforts to link or to expand subgroups may precede implementation efforts to establish an environment more conducive to change.

Transitivity has been used to examine the tendency of individuals to exchange information with a small versus a large number of sources, and for the network to form highly connected hubs. This analysis can inform the design of KT interventions to improve the efficiency of information sharing or influence (e.g. identifying targets for the intervention and relying on transitive processes to spread the information rather than targeting all network members). Such a strategy can then be compared to alternatives, to test hypotheses about the influence of different network properties on the effectiveness of KT interventions. This evaluative work is critical to improve our understanding of network influences on KT processes and outcomes.

1.28. Line 370-371: What does this mean?

Response: This sentence has been revised to improve clarity (page 26).
Revised text: The range of structural properties examined suggests that researchers consider multiple structural phenomena to be relevant to KT processes and outcomes.

1.29. Line 376: Belongs to result section

Response: This sentence has been removed from the discussion; its content was already represented in the results section.

1.30. Line 377 - 379: To the degree the more advanced analyses have been used elsewhere, you should add references to such studies and use them as a way to illustrate the potential of SNA for an area like KTI

Response: Reference to examples, as well as more detailed descriptions of the utility of ERGM and SOAC have been added on page 24 to 25.

Revised text: Techniques designed to account for interdependencies in the data, including quadratic assignment procedure (QAP) analysis and exponential random graph models (ERGM) are considered more robust for those analyses of specific hypotheses involving dyadic ties or network characteristics. These approaches enable the modelling of relationships between dyadic (i.e. relational) variables (e.g. information exchange) and attribute variables (e.g. gender), between dyadic variables (e.g. similarity in EIP attitudes, and engagement in research collaboration), or at the whole network level (e.g. density of communication ties relative to time to evidence adoption).(7) An example from the included literature is the use of ERGM to help determine whether particular individuals – say those with similar personal characteristics – are connecting for information sharing more than expected due to chance.(63)

With the inclusion of longitudinal designs, analysis approaches, such as stochastic actor-based network models that examine network change over time, can begin to be represented in this body of literature. Stochastic actor-based models (SABM) can represent both ties and individual attributes to examine network change. As an example, Yousefi-Nooraie et al. (64) used stochastic actor-oriented modeling to determine the effect of their intervention (evidence-based decision-making skills) on participants’ status as knowledge brokers.
Information seeking patterns varied across professions and networks, with health professionals from some disciplines having a tendency to form small, closed subgroups, while others demonstrated greater connectivity and reach within the network, increased hierarchy (e.g. reliance on ‘gatekeepers’ of information spreading it in a top-down approach), or relied more on sources of information or support external to the network (e.g. other organizations). Available information suggests that isolate individuals and those less connected at the periphery of the network may have more clinical experience and be more evidence-based in their practices than those at the network core.(29,32,43) In the absence of a core-periphery structure (i.e. a more highly connected centre with a less connected network periphery), degree centrality (i.e. the number of connections an individual has) may be a key factor associated with EIP use, at least for physicians.(33) A network-identified broker or opinion leader may increase access to useful knowledge,(12) improve practice performance,(26) and facilitate networking across professions.(49)

REVIEWER #2 – GENERAL COMMENT

This is a timely paper which scopes and synthesises useful characteristics of available evidence on SNA in KT research. Scoping review methodology is adhered to and is appropriate for the field. The description of study types, analyses and underpinning theories are useful together with valuable reflections upon the need to extend the application of SNA to broader organisational or processes, and use SNA for evaluative research not just descriptive. It is a very well written paper in terms of logic, structure and written language.

Response: We appreciate this positive feedback.

Reviewer #3 This paper is a scoping review of social network analytic methods used in one area of implementation science (knowledge translation)—namely applied to studies of health professional networks. The paper has a number of notable strengths: it is clearly written, well-structured, and the scoping review methods were conducted appropriately. The topic is timely,
and likely to be of interest to an implementation science audience. Both conceptually and methodologically, systems science approaches (of which network methods are a subset) hold the promise of advancing the implementation science field. Given the stated inclusion criteria, the selected studies make sense, and the authors demonstrate a good knowledge of network analytic tools and methods. However, the paper has a number of areas of concern that collectively weaken its potential interest and impact.

**REVIEWER #3 – GENERAL COMMENTS**

3.1. The most important issue, in my mind, is that of scope. The review focuses on studies of 'health professionals,' which is extremely narrow in scope. Scoping reviews can and should be used to provide perspective on or an overview of a broad field (Moher, et al., Systematic Reviews 2015). Other than one sentence about the inter-professional nature of healthcare practice, no rationale is really presented for focusing in this area. It's not clear whether or how the broader field of implementation science would learn from the small number of studies reviewed here. (It also doesn't help that a somewhat broader, but quite similar scoping review was published by Duncan Chambers and colleagues in 2012, which found over 50 studies to include.) Rather than type of setting, perhaps the review could focus on the type of D&I study (e.g., dissemination studies, or implementation studies). I really think that a broader scoping review could be of immense benefit to implementation science, but whatever focus is ultimately used there needs to be a clearer argument about how the review will benefit the field.

Response: The justification for the scoping review and its current scope and purpose has been expanded on pages 5 and 6. These additions delineate more clearly the limitations in existing reviews, as per the response to Reviewer 1 comment 1.7.

Revised text: SNA offers an alternate perspective to behaviour change theory-based approaches prevalent in KT science. These latter approaches focus on individual-level factors influencing behaviour change, often from a social cognition perspective. Conversely, SNA proposes a network-level perspective that examines how connections among individuals or entities, and the nature of the associated interactions, influence an outcome (e.g. accessing or sharing evidence, changing practice behaviours based on evidence). The paradigm respects the socially driven nature of innovation uptake, and the value inherent in examining not only the processes involved in KT, but also the social structure and characteristics of the relationships within which KT occurs. Examples of network-related KT processes that can be examined from a SNA lens include one-way versus two-way exchange of information, the timing and prediction of evidence uptake by different types of individuals, the influence of specific types of people on behaviour.
change, individuals’ capacity for change based on their positions in the network, gaps in the flow of or access to information or resources required for evidence use, and testing the effectiveness of strategies to address gaps or inefficiencies identified in the network.

Recent systematic reviews on SNA in health care have focused on quality and patient safety initiatives,(8,9) on a single profession (i.e. nursing).(10,11) or on only select network properties (e.g. the study of brokers).(14) Some reviews focus on conditions (e.g. obesity networks)(14) to explore possible network interactions for potential treatments. Given the complex and inter-professional nature of health care practice, a study of the full breadth of health professions and network properties is required. Furthermore, some of these reviews addressed included non-health care literature from television production and corporate business contexts,(13) or neglected to include social sciences databases in which most SNA journals are indexed. The existing broad reviews of health professional networks (6,12,15) do include some studies on KT-related phenomena (e.g. diffusion, knowledge transfer); however, the majority of their content centres on the study of social interactions that have implications for organizational functioning (e.g. friendships, work task assignments, staff recruitment, social support trust), but were not linked directly to the exchange or application of evidence to inform practice. Similarly, the emphasis on outcomes related to work satisfaction, leadership roles, professional behaviours, protocol efficiency, patient flow, operating room layout, technology adoption and workplace performance reduce the extent to which KT-specific outcomes can be explored. The review by Chambers et al.(6) described primarily the settings and outcomes of these studies, whereas the current study aims to describe in detail the nature of the application of SNA to the study of KT. Such an approach aims to advance the science of KT by providing insight into worthwhile methodological directions this literature can provide. Evidence for the effectiveness of specific KT interventions or for the identified relationships between network properties and other variables relevant to KT can be sought elsewhere. Furthermore, none of these reviews examined the use of theory in their included body of literature specifically, despite this focus being an identified gap.(6) Given the rapid growth of the use of SNA in the health care context over the past eight years (see figure 2), an updated and more directed search is warranted. A targeted examination of the research specific to SNA in KT and EIP is required to inform the application of SNA methodologies in this field, with attention paid to the insights offered by both the structural properties examined and the theoretical perspectives applied.

REVIEWER #3 - Other, less major concerns are the following:

3.2. The introduction does a nice job of setting up the type of network theories and methods that will be the focus of the review. I think the paper would benefit by including some discussion and framing that takes a systems science perspective. Network methods are used to map and study complex systems (such as those that are the focus of implementation science)—and thus we can see that network methods are appropriate when we want to study these types of systems.
Response: Additions have been made to the last paragraph of the Background section (page 7).

Revised text: Furthermore, this review will add to the current theorizing in the field related to a systems-focused understanding of knowledge translation and implementation processes. Specifically, implementation happens within a complex system, and network approaches have been used to study complex systems; the link between the two areas demands greater attention.

3.3. In addition to listing network visualization and descriptive statistics, I would explicitly include statistical and computational modeling as other relevant network methods in the 2nd paragraph (lines 70-82).

Response: Statistical and computational modeling have been added to this paragraph (page 5).

Revised text: Statistical and computational modeling can also be used to explain and to predict network-related phenomena, and to simulate the complexities inherent in network dynamics.

3.4. The end of the introduction (104-106) could be stronger. The review shouldn't just 'inform future research' but guide the field in certain specific ways. Whatever conclusions or recommendations you end up with in the discussion section should be set up here at the end of the intro.

Response: This last sentence, and the final paragraph of the background section has been re-written to more clearly reflect the purpose of the review and its contributions to the field of KT (page 7).

Revised text: A SNA perspective can broaden our understanding of the mechanisms by which KT efforts are effective by examining the social structures and relationships that facilitate or hinder KT and EIP. This understanding will augment our knowledge base by expanding the range of KT determinants worthy of consideration. As researchers gain interest in the social drivers of KT and EIP, this review will provide a foundation for developing key research questions and SNA-driven methodological approaches for KT research that are based on established and relevant theories. Furthermore, this review will add to the current theorizing in the field related to a systems-focused understanding of knowledge translation and
implementation processes. Specifically, implementation happens within a complex system, and network approaches have been used to study complex systems; the link between the two areas demands greater attention. Given these gaps, the purpose of this article is to synthesize the ways in which SNA methodology can be used to advance the science of KT.

3.5. Lines 132-133 - I didn't understand this.

Response: Focusing and exploding are strategies used to structure a targeted search in literature platforms, such as Ovid (e.g. Medline database) and EBSCO (e.g. CINAHL database). Exploding selects results that contain the subject heading as well as any more specific subheadings, resulting in a broader scope for the search. Focusing retrieves only those results for which the subject heading is considered a major topic (which narrows the scope of the search). Examples of subject headings for which each approach was used have been added to the text to clarify this for the reader (page 8).

Revised text: Wherever possible, keywords were mapped to subject headings, which were focused to narrow the search (e.g. SNA terms) and exploded to broaden the search’s scope (e.g. health care professional-related terms) to best capture relevant articles.

3.6. It's not clear why the various exclusion criteria (149-154) were used.

Response: Reasoning for the exclusion criteria has been added (page 9).

Revised text: The health professional context was selected to narrow the scope of the review while maintaining high relevance to KT, as health professionals are common knowledge users or subjects of implementation efforts. Outcomes of interest included, but were not limited to competencies (i.e. attitudes, knowledge or skills) and behaviours by health professionals related to their sharing or use of evidence to inform clinical decision-making. Dyadic (i.e. pair-level), ego-network (i.e. individuals’ networks) and whole network (e.g. departmental or organizational-level) properties and variables were of interest. Exclusion criteria included non-English articles for feasibility, and articles that did not quantify SNA data or network properties to focus on articles that described, predicted or explained network-related phenomena in the context of KT in quantitative terms specific to SNA (e.g. empirical studies whose analysis employed network data
and analysis methods, as opposed to discussion papers). To target the scope towards evidence use by health professionals (i.e. to maintain relevance to KT involving health professionals within health care organizations), articles were excluded if they focused on online or social media-based networks (e.g. virtual communities of practice), policy-level KT, use of research by patients, focusing on communication not explicitly involving research evidence or clinical decision-making about care based on evidence, or focusing on the implementation of non-clinical interventions (e.g. electronic medical records, non-research-related quality improvement initiatives).

3.7. I think it might be better to use the phrase 'modeling' or 'network modeling' to describe the information presented starting on line 212. Also, if none of the included studies used more sophisticated or newer modeling techniques such as ERGM (exponential random graph models) or SAOM (stochastic actor oriented models) you might want to mention that here or later in the discussion. (Actually you do mention these on p. 17, but could possibly set this up earlier.)

Response: ‘Network modeling’ has been added to the ‘Testing hypotheses’ subheading (page 10) as suggested. Only three studies used ERGM (as previously stated) and none used SAOM. Reference to this gap has been added to the results section on page 14 at the end of this network modeling section.

Revised text: Testing hypotheses (network modeling)

No studies employed stochastic actor-based network modeling to examine network change over time.

3.8. Given that many readers may not be that familiar with network methods, I thought that the Network Properties paragraph (228-232) could use a little more unpacking. You don't need to define everything, but introducing the broad types of network properties (actor prominence, subgroup identification, etc.) might help.

Response: These categories have now been defined in the text (page 15-16) to improve accessibility of the content. The main categories are also delineated and defined in table 1 for
those who would benefit from a visual scan of the network properties and how they fit within these categories.

Revised text: Table 3 summarizes the key variables under study, the network properties that were derived from relational data, and the relational parameters (i.e. the constructs for which the network properties were acting as proxies). For example, network density was used as a proxy for connectedness in one study, and for representing the number of shared patients in another. Attributes of interest (which included individual characteristics, such as profession and gender; environmental characteristics, such as organization; social attributes, such as perceived reputation; and KT-related measures, such as EIP attitude scores) are also presented to offer a summary of the nature of non-SNA variables that have been analyzed alongside network properties. Findings are presented in the final column for interest.

Eleven articles explored only a single or pair of network properties. Although 28 network properties were identified during data extraction, the majority of authors examined centrality, tie characteristics (e.g. the directions of the interactions; similarity in characteristics among pairs of connected individuals) and density (i.e. the proportion of ties relative to all possible ties) as their network properties of interest. Tie homophily (i.e. similarity of connected individuals on a given attribute, such as gender), indegree centrality (i.e. the number of people naming an individual as being connected to them), whole network density, the presence of ties, and tie reciprocity (i.e. bidirectionality in reported interactions or connections) were the most prevalent structural properties studied. The study authors’ discussions about the influences of these network properties were clearly linked to prominent theoretical perspectives. Less emphasis was placed on the analysis of centralization (i.e. the evenness of the distribution of connections), subgroups (i.e. groups of connected individuals not connected to other groups within the network) and transitivity (i.e. patterns related to sets of three individuals and their tendencies to share connections with one another).

Attributes, such as research versus clinical productivity, professional field or specialty, leadership role and organizational prestige,(29,30,35,38,45,48,50) as well as the presence of other types of ties (e.g. friendship, expertise recognition, previous collaborations)(30,36,48) appear to be predictive or explanatory factors for the formation of information seeking or research collaboration ties. Conflicting findings regarding the influence of EIP attitudes, experience, gender and geographical proximity on tie formation were identified.(27,30,35,37,46)

3.9. I really liked the inclusion and description of the theories used across the reviewed studies.
Response: Thank you for this feedback.

3.10. Given the importance of network visualization in network analysis, I would like to have seen greater discussion of the variety (or lack of variety) of visualizations used in the studies.

Response: Data about the visualizations employed in the included articles has been moved to, and further reported on, in the Results section on page 13. Discussion about the use of visualizations has been added on page 24.

Revised text: Results section addition: Of these, ten articles presented whole network graphs (i.e., illustrations of the network structure), two presented network graphs of subgroups within the network, and one mapped whole networks within graphs that accounted for covariates. Network properties represented in the graphs included centrality (i.e. connectedness, brokers (i.e. bridgers), core versus periphery structure (i.e. central areas of high connectivity versus peripheral areas of lower connectivity) and tie strength (e.g. frequency of contact); and attributes, such as gender, professional role, size of clinical practice, and division, department or team, and organization or site. Visualizations were used to depict network property configurations (i.e. illustrated the definitions of network properties) in two articles. Conventional charts (e.g. boxplots, scatterplots and bar, line and area charts) were also used in six articles to visualize relationships between variables (e.g. network properties with one another, diffusion or adoption over time, centrality versus adoption timing or receipt of useful information, percentage of ties by strength at different time points).

Discussion section addition: Surprisingly, fewer than half of the articles presented network maps, which suggests that researchers could do more to elucidate descriptive relational findings for readers. While more complex than descriptive analyses, graphing the results of p2 models can illustrate the relationship between binary network data and covariates, while factoring in network structure.(61) Stacked correspondence analysis of matrices representing different time periods can be used to visualize network data at different time points.(7) Supplemental graphing using conventional visualization methods (e.g. bar, scatterplot, line charts) is also available as an approach to visualize the relationships among network properties and attributes that has yet to be fully leveraged. Appropriate visualization methods and techniques must be selected to answer the research questions of interest, while preserving clarity.(7,62)(7,62)
3.11. The short historical overview at the beginning of the discussion section is welcome, although you might want to emphasize more how young KT/D&I is as a field relative to social network analysis. You also might want to mention the work of James Dearing and Ev Rogers—in many ways network thinking applied to the diffusion of innovations is just as important (and may predate) Valente's important work.

Response: We have noted the differences in the fields in the beginning of the discussion section (page 18). While the reviewer’s point is valid, we felt it was not essential to the manuscript.

Revised text: Increasing interest in the utility of SNA across a range of health care contexts, and the relative maturity of this field, may contribute to its continued use in the newer field of KT to embed new practices across settings.

3.12. In addition to discussing the utility of SIENA (270), you might want to mention how network dynamics can be explored within computational models such as agent-based modeling (e.g., El-Sayed, et al., Epidemiol Perspect Innov., 2012).

Response: An overview of computational modelling and its value has been added to this paragraph (page 19).

Revised text: Computational models, such as agent-based modeling, can also be used to represent individuals and their interactions. Multiple simulation experiments that are programmed based on attribute data and structural characteristics allow researchers to specify and to control the parameters of the computational algorithms in order to determine the effects of specific variables.(57)

3.13. Your point about the utility of administrative data for network studies (295-300) is important, and could be amplified a little further (possibly giving a specific healthcare example).

Response: An example highlighting the utility of document review for network analysis has been added (page 20).
Revised text: For example, data related to evidence sharing communication patterns and subsequent use of best practices by health professionals (e.g. intervention approaches, treatment intensity or dosage) within and across clinical teams can be leveraged to identify network strengths and gaps, and to monitor KT strategy effectiveness.

3.14. Be very careful about your conclusions on page 16, especially on what was missing in the reviewed articles. The fact that you didn't see studies focus on ’…adapting knowledge … assessing barriers to change… facilitating organizational practice…’, etc., may have been due to the narrow focus of review!

Response: The discussion has been modified to reflect the limitations of the scope of the review (page 22). The ‘conclusions’ referred to here were primarily results, which have been moved to the Results section in response to an earlier comment.

Revised text: However, because of its examination of information flow, predominantly, this body of research presents a narrow view of KT that focuses primarily at the individual level of evidence-based decision-making. This limitation relates in part to the scope of the review, as well as the consideration that other actors (e.g. health leaders, researchers) rather than health professionals may typically manage many of the KT activities that were not represented.

3.15. Again, the Theoretical Insights section was quite strong, I thought.

Response: Thank you for this feedback.

3.16. That being said, much of the interesting material in the discussion section is not very tightly tied to health professional in healthcare settings. This goes back to my initial comment, and further supports the possibility of broadening the focus of the review.

Response: Additional reference to health professionals and their role within KT processes in health care organizations has been added throughout the discussion section where appropriate. In some instances, the discussion aims to highlight the utility of SNA for the study of KT in general, based on a review of the literature studying health professionals’ networks. While the
outcomes of these studies may not be generalizable, the principles of SNA and their objectives can be applicable across networks and settings. For these sections of the discussion that focus on how SNA has been applied (e.g. methodology), we have retained the broader lens to support the reader in recognizing the scope of SNA’s utility. Please see earlier responses regarding the scope of the review.

3.17. The conclusion is fairly generic, and a stronger or more specific set of recommendations would be welcome here. Also, as suggested earlier, concluding something like "a small body of work focused preferentially on physician networks and restricted to information exchange patterns" begs the question of whether this is partially a methods artifact of the narrow inclusion/exclusion criteria.

Response: The conclusion has been rewritten (page 32-33). The new journal requirement – Contributions to the Literature section – presents summary bullet points to further highlight the contributions of the manuscript to the field (page 33).

Revised text: See comment 1.2 above.