

Evidence Brief #219

Network Science & Clinical Networks in BC – A Perspective



BC AHSN

British Columbia
Academic Health Science Network

BC SUPPORT Unit
Advancing Patient-Oriented Research

Clinical Trials BC

Research Ethics BC

Contents

Overview	3
Introduction	3
What is a network?	4
Network science to inform network development	5
Dearth of research	5
Need for a standardized approach to network development	6
Facilitators and barriers	6
Recognizing and managing inherent paradoxes	7
The special case of power and influence	8
Networks as ‘bundles of different types of boundaries’ – Shifting our thinking	8
Aim, key elements, and functions of clinical networks	10
Connectivity to Learning Health Systems	12
Measuring and monitoring progress	14
Summary and considerations	15
References	17

Report Prepared by: Ronald Lindstrom and Tom Noseworthy, December 2019

*Special thanks to Jim Christenson, Riyad Abu-laban and Sharla Drebit
for their editing assistance while authoring this document.*

NETWORK SCIENCE & CLINICAL NETWORKS IN BC – A PERSPECTIVE

Overview

This brief examines the case for networks, specifically clinical networks in British Columbia (BC). Networks are defined, followed by the role that emerging network science can play to inform network development. A case is made for an evidence-informed, standardized approach to clinical network development in BC, with particular attention to the facilitators, barriers, inherent paradoxes, and power dynamics that need to be more deeply acknowledged and understood especially during the fragile early stages. Networks can be conceptualized as ‘bundles of different types of boundaries’; consequently, the underrated roles of boundaries and boundary objects are outlined. The overall aim, key elements, and typical functions of clinical networks are described. The recent concept of learning health systems is introduced, including its relevance to clinical networks in the context of continuous learning and innovation. While not commonly undertaken, the need for continuous measuring and monitoring of progress is described. In closing, potential actions are outlined for consideration.

Introduction

Networks have been described as *the* organizational form of the 21st century (Chisholm, 1998) despite scarce evidence that networks are more effective than hierarchical organizational structures (Provan & Milward, 2001; Provan & Lemaire, 2012). Networks are not a panacea for ways to organize (Chisholm, 1998; Goodwin, 2008; Popp, Milward, MacKean, Casebeer, & Lindstrom, 2014). Nonetheless, there is growing interest in collaborative models of organizing to include and empower more relevant voices, particularly in the public sector. Network structure and function have been variously interpreted, planned, and implemented contingent on how the network developers envision them. This is not always aligned with scholarly evidence or best practices. A decision to proceed with a network structure often precedes a fulsome analysis of the anticipated function which has led to a myriad of highly differentiated networks particularly in the health sector and, increasingly, in the clinical domain. This has led to obfuscation on what is the ‘right’ approach to clinical network development. Paradoxically, while evidence-based practice in clinical care is the accepted behavioural norm, it is frequently absent in organizing how that care is best delivered.

Networks are not a panacea for ways to organize. Nonetheless, there is growing interest in collaborative models of organizing to include and empower more relevant voices, particularly in the public sector.

Thus, consideration of a common or standardized approach, particularly for clinical networks, is timely to enable the translation and mobilization of the growing, yet disparate, body of network science to inform best practices.

What is a network?

Networks, in the inter-organizational sense, are defined in many ways, but the common thread is that they are autonomous organizations and individuals who come together, work across boundaries, and accomplish goals that they cannot undertake individually (Chisholm, 1998; Huerta, Casebeer, & VanderPlaat, 2006; CHSRF, n.d.). Networks in the public sector take several forms depending on their purpose including, for example: service implementation; information diffusion; problem solving; and, community capacity building (Milward & Provan, 2006).

Similarly, clinical networks take several forms depending on their purpose (Brown, et al, 2016). While seen to be synonymous with integrated care, networks are more accurately viewed as a means to achieve the goal of integrated care (Goodwin, 2008). Clinical networks are also variously defined with a common theme of being structures that enable clinicians and key stakeholders to work collaboratively across boundaries, employ best practices, and improve access to and quality of care (Brown, et al, 2016; Alberta Health Services, 2019; Centre for Clinical Governance Research, 2010).

Clinical networks are also variously defined with a common theme of being structures that enable clinicians and key stakeholders to work collaboratively across boundaries, employ best practices, and improve access to and quality of care.

Networks can be created voluntarily or mandated into existence and they can be purpose- designed or form organically. All of these forms and various hybrids exist; however, there is little empirical evidence to support which form works best under what circumstances. Consequently, there are many networks acting in name only which adds to the confusion around what a network really is in practice.

Network science to inform network development

The field of network science is still formative, including a very broad range of disciplines such as: information science; computer science; mathematics; communication; engineering; management; economics; political science; psychology; public health; medicine; statistics; and, sociology (Brandes, Robins, McCranie, & Wasserman, 2013). Given the wide range of these disciplines, these authors underscore the daunting challenge to find the common ground to create a unified science of networks. Additionally, and from which to draw even more key principles, is the complex field of ecology characterized by networks as the basic pattern of life (Capra, 1996, 2002) in all living systems from cells to ecosystems.

By way of example, mycorrhizal networks (the 'wood wide web') connects root systems in all major terrestrial ecosystems (complex adaptive systems). Recent research underscores their importance in how plants grow, survive, and defend themselves particularly through the transfer of resources such as carbon, nutrients and water cycling in a community of plants (Simard, et al, 2012; Wohlleben, 2016). Similar, is the network behaviour of slime mold such as *Fuligo septica* (otherwise known as 'dog vomit' mold) which lives on dead logs. Generally, this mold exists as brainless, uni-cellular amoeba which, when food is in short supply, coalesce via pheromones to mobilize and seek new sources of food after which they disband again into single cells (Science Thursday, 2012; Westley, Zimmerman, & Patton, 2006). Numerous replicated studies have demonstrated that nature can create efficient networks faster than humans (Science Thursday, 2012). At the other end of the size spectrum, there is recent evidence that the largest known structures in the universe link galaxies into a network ('cosmic web') suggesting a role in the evolution and movement of galaxies (Ferreira, 2019). And, there are many other disciplinary examples in network science that collectively support the need for a multi-disciplined approach to more deeply understanding and applying the basic tenets of network form and function to socially constructed networks.

Dearth of research

Despite all we know about networks, there is a relative scarcity of research as it applies to the social construct of networks, especially empirically based studies. Provan and Lemaire (2012) reviewed two decades of research focusing primarily on whole, goal-directed, public service delivery networks. They found little research on: whether networks should be mandated or emergent; how relationships are formed, strengthened, and sustained; network effectiveness; network outcomes; network design; optimal integration; network governance; and, network evolution over time. Moreover, Popp, Milward, MacKean, Casebeer and Lindstrom (2014) summarized several research and evidence gaps, including: expanding beyond a structural lens; multi-lateral relationships; network leadership and management; power and its use; dynamic

capability and absorptive capacity; information diffusion and knowledge exchange; network learning and innovation; longitudinal and comparative analyses of network effectiveness; comparative case study research over longer periods of time; cross-sectoral and cross-disciplinary research; and, developmental evaluation as a means to foster continuous learning. With the current propensity to adopt network models, this research-practice gap is profound. It is incumbent upon network researchers and practitioners to close this gap. As Cunningham, Morris, and Braithwaite (2012, p. 693) caution, it is time for stakeholders to “assist with distinguishing the facts from rhetoric and to avoid wasting valuable resources and time.” Clinical network development in BC could take a leadership role in contributing to the scholarly literature and practice environments and help close the research-practice gap, particularly through empirical research evaluative methodologies.

Need for a standardized approach to network development

The research-practice gap also means that without sufficient evidence of what constitutes best practices network developers have been more inclined to preferentially approach their initiatives in ways that may not be supported by or consistent with undergirding principles. And, given that few networks undertake rigorous evaluation, it is difficult to ascertain whether they are, in fact, working well or as planned. Thus, it is beneficial and timely to develop a standardized, systems approach to network development.

Facilitators and barriers

Despite the paucity of research, there is evidence regarding the facilitators and barriers to successful networks in general which have been compiled from both theory and practice (Brown, et al, 2016; Milward, Networks Leadership Symposium 2018; Provan & Lemaire, 2012; Randall, 2013; Smith, 1978; Varda & Retrum, 2015). Contributors to network success include:

- shared purpose/goal congruence
- compatible behavioural norms and values
- effective governance and leadership
- focusing on relationships
- securing resources
- optimal membership and integration
- meeting members’ needs
- internal and external legitimacy
- stable core/flexible periphery
- evidence-informed practice

Contributors to network failure include:

- failing to reach common understanding of purpose and/or goals
- under-resourcing (financial, human, data, technology, time)
- culture clashes
- toxic nodes
- reduced accountability
- over-management and coordination fatigue/costs
- failing to attend to initial design and/or evolution
- missing key members
- unrealistic expectations of members' ability to collaborate
- inequitable prioritization of members' interests
- failing to acknowledge different kinds of knowledge brought by diverse members

Recognizing and managing inherent paradoxes

Networks are engulfed in many inherent tensions or paradoxes that must be first recognized in order to be managed effectively. To highlight this importance, the theme of Networks Leadership Symposium 2018 held in Vancouver, BC was – “Networks as Balancing Acts: Managing Inherent Tensions?” Four specific network tensions were identified (Saz-Carranza, Networks Leadership Symposium 2018): unity/diversity; inclusiveness/efficiency; broker subordination/broker autonomy; and, member control v. network efficiency. Several other paradoxes are identified in the literature. Our tendency is to reduce serious issues to solve problems whereas a holistic, systems understanding is required to manage them (Bohm, 1996). In terms of funding networks, a time cycle is typically used in terms of annual or time-limited project budgets; whereas, networks typically exist in an eco-cycle timeframe and require much longer developmental timeframes to demonstrate efficacy. A ‘goal diversity versus goal unity’ paradox arises when there are tensions between the goals of the networks and the goals of the member organizations (Vangen, Networks Leadership Symposium 2013). The paradox of network leaders and members being trained and working in traditional, hierarchical organizational models literally intersects at right angles with the ‘nebulosity’ of a network (Popp, et al, 2005). Finally, Capra (2002) describes the paradox of balancing design (holding and articulating the vision) with emergence (creating enabling conditions).

The special case of power and influence

Much has been written about the importance of the use, overuse, misuse, and abuse of power. In highly participatory and collaborative settings such as networks, the potential for power to control and influence decision-making in ways contrary to the ethos of networks is a major concern. In networks that are represented by some members who have specialized knowledge and are self-regulated (e.g., professionals), there is a propensity for power to be institutionalized. This prevents learning (by both the member and the network) which creates 'distance' (between the member and the network through physical, organizational, social and cognitive means) (Chambers 1997). To mitigate this potentiality, power in networks needs to shift from 'power over others' to distributing 'power with others' and to 'power-from-within each other' through collaboration (Smith, 1997). Otherwise, collective learning, one of the hallmarks of effective networks, cannot not occur.

Power in networks needs to shift from 'power over others' to distributing 'power with others' and to 'power-from-within each other' through collaboration.

Misdirected power and influence (conscious or subconscious) can deeply affect the collaborative milieu of networks through activating the reward or threat brain circuitry in participants. Social neuroscience is instructive in terms of ensuring adequate attention is paid to the collaborative and cooperative culture particularly during the nurturing of early fragile relationships. Rock and Cox (2012) have developed a model (SCARF) comprised of five domains that activate the reward or threat circuitry of participants and, hence, their ability to function well and learn:

- Status (our sense of importance relative to others)
- Certainty (our sense of clarity of future events)
- Autonomy (our sense of control over what's happening)
- Relatedness (our sense of connectivity to others)
- Fairness (our sense of being treated fairly)

For learning to occur, much more attention needs to be paid to fostering a rewarding, non-threatening culture in which network members can thrive. The rest will follow.

Networks as 'bundles of different types of boundaries' – Shifting our thinking

Capra (2002) advances the need for leadership to balance design with the to-be-expected emergence of novelty. As with complex systems, this is especially relevant in organizations

which have been described as “a bundle of different types of boundaries” (Barney, 1991, as cited in Carlile, 2004, p. 566). Boundaries can be categorized as physical; social; and, mental (Hernes, 2003 in Paulsen & Hernes, ch. 2). These boundaries can also be constraining. The conceptualization of boundaries and their paradoxical enabling and constraining properties (serving simultaneously as bridges and barriers) needs to be re-imagined in the context of network structure and function to address the challenges that accompany multi-stakeholder relationships, knowledge flow, learning, and application in collaborative network environments. This is critical when innovation is the goal of organizations – “most innovation occurs at the boundaries between specialized domains.” (Leonard-Barton, 1995, as cited in Carlile, 2004, p. 566).

The related notion of boundary objects is also germane. Boundary objects are “objects that are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites...a boundary object ‘sits in the middle’ of a group of actors with divergent viewpoints.” (Star, 1989, p. 46). They are of many forms – abstract and concrete; specific and general; conventional and custom; anchors and bridges. (Star & Griesemer, 1989). “The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social worlds.” (Star & Griesemer, 1989, p. 393).

This brings us to the relevance of boundaries and boundary objects in the management knowledge when the pursuit of innovation is a goal (Carlile, 2002, 2004). Conceptually, this involves three boundary levels of increasing complexity (that is, from known to novel environmental conditions) – syntactic, semantic, and pragmatic – similarly involving three increasingly complex processes using boundary objects to manage knowledge at each level – transfer, translation, and transformation. The salient point here is that the capabilities of actors must match increasing levels of novelty which can be effectively impaired by collaborative mismatches including practical, political, knowledge, and power imbalances (Carlile, 2002, 2004).

This conceptual framework was further expanded through an empirical study of a community-based approach to planning in which the concept of boundaries and boundary objects were germane to the introduction of a higher level of boundary (phronetic) and boundary object (praxis) management. This occurred in the context of uncertain conditions where multi-stakeholder, boundary-crossing, collaborative, dynamic, and locally-situated action is essential, specifically, when innovation in health services is the goal (Lindstrom, 2006). “This attribute of boundary objects – to help us understand boundaries that separate world-views – is one of their most important properties.” (p. 212). In the context of clinical networks, this notion of separate world-views becomes important to specifically addressing clinicians’ professional

perspectives within and across different clinical content areas, in addition to the world-views of other stakeholders in and supporting such networks.

Wenger-Trayner and Wenger-Trayner (2015) in the context of creating new learning partnerships in complex environments have pinpointed the need to respect and challenge boundaries. In particular, they emphasize the need for “careful design of activities that enable productive cross-boundary encounters [as] an integral part of reconfiguring partnerships in the landscape.” (p. 107). Moreover, they promote the use of boundaries as “learning assets to combine multiple voices and perspectives” toward support of transformative practices (p. 108). These different perspectives come with different world-views that don’t necessarily align well. World-views (or mindsets), especially subconscious ones, are the root of mismatches between reality and how that reality is perceived.

In the context of systems thinking to addressing complex issues (akin to network thinking), Cabrera and Cabrera (2015) propose four principles that underpin organizational design and leadership:

- Vision (a concise future goal)
- Mission (repeated steps needed to achieve the vision)
- Culture (sharing the same mental models to support the mission)
- Learning (continuously developing and testing mental models against reality)

In particular, for culture and learning to thrive, this framing is especially important in terms of how Ferlie, et al, 2005 (as cited by Cunningham, Morris, and Braithwaite, 2012) suggest “that social and cognitive boundaries between different professions retard spread [of implementation and leveraging of change]”. McInnes, et al (2015), in their study of the reasons for clinical network success, including effective leadership, highlight the importance of spanning disciplinary and sector boundaries to spread innovations. Goodwin (2008), for example, purports that clinician-management conflicts in clinical networks create inertia and inhibit progress due to competing values and interests. Again, attention to the boundaries will help mitigate competition and foster cooperation. This requires a much deeper recognition and understanding of the boundaries in a network and the role of boundary objects that transcend them.

Aim, key elements, and functions of clinical networks

There is little evidence in the literature to guide achievement of clinical network goals and expected benefits (Lega & Sartirana, 2011). As with networks in general, there are four basic elements/levels comprising a clinical network: purpose, structure, process, and service delivery

(Popp, et al, 2005). These lead logically to four key questions: What is the clinical network trying to do? Is the clinical network organized appropriately to do this? Are the clinical network members working well together? Are the network members supported in their work?

The aim of clinical networks is encapsulated by Brown, et al (2016, n.p.) in a systematic review: “Clinical networks provide structure for clinicians to work more closely across institutional and professional boundaries, and allow for continuous working relationships and flow of knowledge about best practice between individuals and organizations, thereby improving the quality of and access to care for patients, including those who require coordination across a range of settings.” The essential characteristics of clinical networks highlighted in this description include:

- structure
- boundaries
- relationships
- knowledge flow

Carswell, Manning, Long, and Braithwaite (2014) provide guidance for successful clinical network development using an evidence-informed framework.

The key elements of development are: partner selection (ensuring compatibility; commitment; complementarity); network design (facilitating engagement and alignment of key members to support network purpose); and, network management (developing trust and coordination amongst members). It is of critical importance to engage patient voices to ensure that on-the-ground needs are also being met from the perspective of the patient, not just the providers or decision-makers.

However, research conducted by Guthrie, et al (2010), as cited in Cunningham, et al (2012, n.p.), determined that “...there was no one-size-fits-all model for clinical network creators to follow, because local context, including the nature of the condition on which the network focuses, will influence what is best.”

Edwards (2002) notes that clinical networks can be grouped by function (e.g., emergency medicine); client type (e.g., children); or, specialty type (vascular surgery). He observes several theoretical advantages to clinical networks (e.g., flexibility, strength, speed, and focus), although some observers are skeptical. Nonetheless, clinical networks can be seen as catalysts

for health reform and have been used in a number of ways to improve care (Cunningham & Braithwaite, 2010), including:

- reviewing current status
- creating specialized clinical databases
- developing clinical guidelines, models of care and pathways, and standards of care
- introducing service improvements and innovations
- developing business cases
- changing legislation
- educating, training and supporting
- lobbying
- awareness building
- creating effective communications
- collaboration
- encouraging consumer involvement

The key elements of structure, relationships, boundaries/boundary objects, and knowledge flow each represent a different but interconnected domain of knowledge and practice. It is imperative that, consistent with an evidence-informed approach, these domains be broadly and consistently understood and applied in clinical network development, and that a concerted effort is made to evaluate the effectiveness over time, learn from, and apply remedies to course-correct. Getting it right the first time is unlikely. Sharing and learning from real-time successes and failures is essential.

Connectivity to Learning Health Systems

“We believed that ways of seeing could change ways of doing, that influencing perspective could influence practice that in turn could influence progress.” (Young, 2006, p. xiii).

The concept of a Learning Health System (LHS) originated some 12 years ago by the U.S. Institute of Medicine (now known as the National Academy of Medicine) and has experienced global interest and uptake (Friedman, Rubin, & Sullivan, 2017). At its core, it is “a socio-technical system with the primary goal of significantly and safely improving health while reducing other harms.” (p. 18) comprised of a learning cycle with five attributes: data-to-knowledge; knowledge-to-performance; self-study and shared recognition for continuous improvement; infrastructures to enable multiple learning cycles; and, an organizational culture that supports continuous learning by its members. While there is a need to clarify the application and contributions of LHSs to value improvement and the Canadian context, LHSs

have much potential to optimize learning, improvement, and health system performance (Menear, Blanchette, Demers-Payette, and Roy, 2019).

Human organizations are complex adaptive systems, and human organizations are learning organizations (Cabrera & Cabrera, 2015, p. 187-188). This includes networks. These authors suggest that the task is not how to create a learning organization (that is part of our social evolution) but, rather, our task is learn how to survive and adapt in response to a dynamic environment. The importance of the concept of learning networks is summarized by Ehrlichman and Sawyer (2018, n.p.): "...learning networks are one of the most effective ways to accelerate learning and strengthen coordination across the social sector." Their work on learning networks has demonstrated four key traits: dedicated network coordination; gathering information from the field; disseminating information to the field; and, enabling information to flow across the field. Consistent with the findings noted earlier by Brown, et al (2016), this coordination and knowledge mobilization are essential to effective clinical networks. Malby (2017) observes that organizations comprising contemporary health networks, such as integrated care, "will have at minimum learning partners working together in learning networks."

Alberta's diverse family of Strategic Clinical Networks (SCNs) has collectively demonstrated over the past six years a highly collaborative experience in, learning about, and spread of solutions, innovation, teamwork, and outcomes which have been effectively scaled-up to the provincial level (Alberta Health Services, 2019). Their success is premised on a "collaborative spirit and partnership model" (p. 14), a hallmark of successful networks globally. The critical factor contributing to expedited scale-up of learning and innovation is that the SCNs are embedded within Alberta Health Services (AHS), the single health authority for the province. Two recent reports cited in Alberta's Strategic Clinical Networks 2012-2018 retrospective (Alberta Health Services, 2019) highlight the roles that SCNs play in achieving: a learning health system through mitigating health system fragmentation; and, rapid learning to support health system transformation.

Learning and innovation are critical to achieving the outcomes desired by clinical networks, so it is important to underscore the role of leadership. Horth and Vehar (2015) suggest five practices that underpin innovation leadership:

- Incorporate skills offered by leaders working at different levels of the organization
- Collectively focus on innovation as a goal
- Leverage diverse contributions by members
- Collaborate and work across boundaries
- Manage paradoxes

Real world problems do not present themselves in “neat disciplinary packages” (Greenwood & Levin, 2005, p. 52). A transdisciplinary approach to solutions is required. It is important here to clarify some confusing terminology. Multidisciplinarity uses disciplinary knowledge, but stays within the boundaries of the discipline. Interdisciplinarity connects knowledge between disciplines towards a coherent whole. Transdisciplinarity integrates different knowledge domains by transecting the disciplinary boundaries and using a shared conceptual model (Choi & Pak, 2006). To overcome terminological obfuscation, they propose using the term “multiple disciplinary” (p. 359) as the approach to solving complex, real world issues. Because clinical networks at their core are designed to address such complex, real world issues, a consistent multiple disciplinary approach would be desirable irrespective of the clinical content area.

A LHS needs a system-wide reach to be effective. In the BC health system, the Academic Health Science Network (AHSN) is comprised of an emerging ecosystem in service of the socio-technical LHS. It has three Operating Units: Clinical Trials BC; Research Ethics BC; and, BC SUPPORT Unit, each supporting the generation and integration of new knowledge. Moreover, it is the umbrella organization for three developing clinical networks: BC Emergency Medicine Network; Rural and Remote Network; and, Seniors’ Health & Frailty Network. The AHSN’s mission is to connect and catalyze collective expertise and resources, and it is a well-situated boundary spanning organization to enable LHS development in the BC health ecosystem.

Measuring and monitoring progress

There is a considerable body of literature on and evidence-informed practical approaches to network evaluation (Carswell, Manning, Long, & Braithwaite, 2014; Cunningham, Morris, & Braithwaite, 2012; Cunningham, Ranmuthugala, Westbrook, & Braithwaite, 2012; McInnes, et al, 2012; Popp, et al, 2005; Popp, Milward, MacKean, Casebeer, & Lindstrom, 2014; Provan & Milward, 2001; Taylor, Whatley, & Coffman, 2014). The findings strongly suggest the need to evaluate whole network effectiveness with a focus on ‘how’, not just ‘what’, results are being achieved (Popp, Milward, MacKean, Casebeer, & Lindstrom, 2014). The ‘what’ is subject to a multi-pronged evaluative approach that more specifically addresses the work of the network, including outputs, outcomes and impact. The ‘how’ should ideally take a developmental evaluation approach using mixed methods consisting of a quantitative component (e.g., social network analysis such as PARTNER¹ tool) and a qualitative component (e.g., semi-structured interviews and/or focus groups). The PARTNER tool measures, maps, and monitors relationships which helps to identify strengths, gaps, and strategies to improve the network.

¹ See www.visiblenetworklabs.com/partnertool

The interviews and/or focus groups provides a deeper dive into four key aspects as described earlier: purpose; structure; process; and, service delivery.

Conducting formal evaluations at regular intervals, for example every 12-15 months, is key to measuring and monitoring network performance, particularly in the development and growth stages. Consistent with a developmental evaluation approach is using the findings to inform change in real-time, which is consistent with the goals of LHSs. Ideally, multi-level analyses are undertaken, including at the individual, organizational, network, and community levels (Popp, Milward, MacKean, Casebeer, & Lindstrom, 2014; Provan & Milward, 2001).

Specific to clinical networks, using a developmental evaluation approach, and consistent with a mixed methods approach, Carswell, Manning, Long and Braithwaite (2014) have created an evaluation framework based on scholarly and empirical findings to assist in evaluating formal clinical networks and to support evidence-informed decision-making and practice during development and growth.

Summary and considerations

A consistent approach to clinical network development in BC based on scholarly evidence and best practices is essential to success. A fulsome analysis of the anticipated functions must precede the development of network structure. There is a knowledge-practice gap and confusion around the 'right' approach. Network developers must be aware of and be supported by network science.

A consistent approach to clinical network development in BC based on scholarly evidence and best practices is essential to success.

For networks to succeed, it is critical that network developers explicitly anticipate, recognize and manage the antecedent factors that give rise to the known contributors to success and failure, the inherent paradoxes, and power imbalances that will impede progress if left unheeded.

It is beneficial and timely to introduce a province-wide, standardized, systems approach to clinical network development that respects, engages, and empowers local contexts through mutually reinforcing top-down and bottom-up perspectives. The evidence demands coordinated efforts to create optimal clinical network structures and processes and, equally

important, requires a special kind of leadership to guide and foster network development in complex environments.

Evidence-informed practice suggests that the notion of a Learning Health System (LHS) mitigates health system fragmentation and fosters rapid learning to support and scale-up health system transformation. To do this effectively, a LHS needs a system-wide reach. An entity such as the BC AHSN, which is comprised of an emerging ecosystem in service of the socio-technical LHS, is ideally situated to provide support and governance for a 'network of clinical networks'.

The need to continuously measure, monitor, and share progress is vital. Evidence-informed frameworks and tools are available to assist in evaluating and learning from the development and growth of formal clinical networks to guide best practices.

A clinical network development consensus conference would provide an opportunity to convene expertise from a broad array of theory and practice disciplines, clinicians, decision and policy-makers, patients, industry, funders, and communities. Ideally, this will help to standardize the key elements for success, share best practices, and provide exciting new insights and innovative approaches to developing clinical networks in ways not yet imagined.

References

- Alberta Health Services. (2019). *Alberta's strategic clinical networks: Improving health outcomes – Retrospective 2012-2018*. Edmonton, AB: Alberta Health Services.
- Brandes, U., Robins, G., McCranie, A., and Wasserman, S. (2013). What is network science? *Network Science* 1(1), 1-15.
- Brown, B.B., Patel, C., McInnes, E., Mays, N., Young, J., and Haines, M. (2016). The effectiveness of clinical networks in improving quality of care and patient outcomes: A systematic review of quantitative and qualitative studies. *BMC Health Services Research* 16:360 doi:10.1186/s12913-016-1615-z
- Cabrera, D. and Cabrera, L. (2015). *Systems thinking made simple: New hope for solving wicked problems*. Ithaca, NY: Odyssean Press.
- Canadian Health Services Research Foundation. (n.d.). *Bridging boundaries, creating knowledge: The power of good conversation*. Ottawa: Author. Retrieved March 26, 2007, from <http://www.fcrss.ca>
- Capra, F. (1996). *The web of life: A new scientific understanding of living systems*. New York: Doubleday.
- Capra, F. (2002). *The hidden connections: A science for sustainable living*. New York: Anchor Books.
- Carlile, P.R. (2002). A pragmatic view of knowledge and boundaries: Boundary objects in new product development. *Organization Science* 13, 442-455.
- Carlile, P.R. (2004). Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. *Organization Science* 15, 555-568.
- Carswell, P., Manning, B., Long, J., and Braithwaite, J. (2014). Building clinical networks: A developmental evaluation framework. *BMJ Quality & Safety* 23, 422-427.
- Chambers. R. (1997). *Whose reality counts?: Putting the first last*. London: Intermediate Technology Publications.

- Chisholm, R. F. (1998). *Developing network organizations: Learning from practice and theory*. Reading, MA: Addison-Wesley.
- Choi, B.C.K. and Pak, A.W.P. (2006). Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness. *Clinical Investigative Medicine* 29, 351-364.
- Cunningham, F.C. and Braithwaite, J. (2010). *Network by network: Transforming health care in Australasia – Lessons from ‘Network to Network 2010: The inaugural Australasian clinical networks conference’* Melbourne, Australia.
- Cunningham, F.C., Morris, A.D., and Braithwaite, J. (2012). Experimenting with clinical networks: The Australian experience. *Journal of Health Organization and Management* 26, 685-696.
- Cunningham, F.C., Ranmuthugala, G., Westbrook, J.I., and Braithwaite, J. (2012). Net benefits: Assessing the effectiveness of clinical networks in Australia through qualitative methods. *Implementation Science* 7:108 doi:10.1186/1748-5908-7-108
- Edwards, N. (2002). Clinical networks. *BMJ* 324, 63.
- Ehrlichman, D. and Sawyer, D. (2018). Learn before you leap: The catalytic power of a learning network. *Stanford Social Innovation Review*. Retrieved October 18, 2019 from <https://ssir.org/articles/>
- Ferreira, B. (2019). There’s growing evidence that the universe is connected by giant structures. Retrieved November 11, 2019 from https://www.vice.com/en_us/article/zmj7pw/theres-growing-evidence-that-the-universe-is-connected-by-giant-structures
- Friedman, C.P., Rubin, J.C., and Sullivan, K.J. (2017). Toward an information infrastructure for global health improvement. *IMIA Yearbook of Medical Informatics* 2017, 16-23.
- Goodwin, N. (2008). Are networks the answer to achieving integrated care? *Journal of Health Services Research & Policy* 13(2), 58-60.
- Greenwood, D.J. and Levin, M. (2005). *Reform of the Social Sciences and of Universities through Action Research*. In N.K. Denzin and Y.S. Lincoln, eds., *The Sage Handbook of Qualitative Research* (3rd ed.), 43-64. Thousand Oaks, CA: Sage.

- Hernes, T. (2003). Enabling and constraining properties of organizational boundaries. In N. Paulsen & T. Hernes (Eds.). *Managing boundaries in organizations: Multiple perspectives*. (pp. 35-54). Houndmills, Basingstoke, Hampshire, UK: Palgrave MacMillan.
- Horth, D.M. and Vehar, J. (2015). *Innovation: How leadership makes the difference*. Centre for Creative Leadership. Retrieved December 21, 2015 from <http://www.iedp.com/Blog/Why-Innovation-Efforts-Fall-Short>
- Huerta, T.R., Casebeer, A., & VanderPlaat, M. (2006). Using networks to enhance health services delivery: Perspectives, paradoxes and propositions. *HealthcarePapers*, 7(2), 10-26.
- Lega, F. and Sartirana, M. (2011). Managed clinical networks: Scope, evidence and feasibility. *International Journal of Clinical Practice* 65(7), n.p.
- Lindstrom, R.R. (2006). *A community-based participatory approach to planning child and youth health services in north west British Columbia: Finding common ground*. (Doctoral Dissertation, University of British Columbia). Theses Canada Portal. (Amicus No. 33507246).
- Malby, R. (2017). *Contemporary health networks*. Retrieved October 18, 2019 from <https://www.source4networks.org.uk/learning-space/>
- McInnes, E., Middleton, S., Gardner, G., Haines, M., Haertsch, M., Paul, C.L., and Castaldi, P. (2012). A qualitative study of stakeholder views of the conditions for and outcomes of successful clinical networks. *BMC Health Services Research* 12:49 doi:10.1186/1472-6963-12-49
- McInnes, E., Haines, M., Dominello, A., Kalucy, D., Jammali-Blasi, A., Middleton, S., and Klineberg, E. (2015). What are the reasons for clinical network success? A qualitative study. *BMC Health Services Research* 15:497 doi 10.1186/s12913-015-1096-5
- Meneer, M., Blanchette, M-A, Demers-Payette, O., and Roy, D. (2019). A framework for value-creating learning health systems. *Health Research Policy and Systems* 17, 79 doi:10.1186/s12961-019-0477-3
- Milward, H.B. and Provan, K.G. (2006). *A manager's guide to choosing and using collaborative networks*. IBM Center for the Business of Government. Washington, DC.
- Networks Leadership Symposium. (2013). *If networks are the answer, what is the question? Rethinking networks*. Symposium Proceedings. Victoria, BC.

- Networks Leadership Symposium. (2018). *Networks as balancing acts: Managing inherent tensions?* Symposium Proceedings. Vancouver, BC.
- Popp, J.K., L'Heureux, L.N., Dolinski, C.M., Adair, C.E., Tough, S.C., Casebeer, A.L., Douglas-England, K.L., and Morrison, C.C. (2005). How do you evaluate a network? A Canadian child and youth health network experience. *The Canadian Journal of Program Evaluation* 20(3), 123-150.
- Popp, J.K., Milward, B.M., MacKean, G., Casebeer, A., and Lindstrom, R. (2014). *Inter-organizational networks: A review of the literature to inform practice*. IBM Center for the Business of Government. Washington, DC.
- Provan, K.G. and Lemaire, R.H. (2012). Core concepts and key ideas for understanding public sector organizational networks: Using research to inform scholarship and practice. *Public Administration Review* 72(5), 638-648.
- Provan, K.G. and Milward, H.B. (2001). Do networks really work? A framework for evaluating public-sector organizational networks. *Public Administration Review* 61, 414-423.
- Rock, D. and Cox, C. (2012). SCARF[®] in 2012: Updating the social neuroscience of collaborating with others. *Neuroleadership Journal* 4, 129-142.
- Science Thursday. (2012). *Slime molds: No brains, no feet, no problem*. Retrieved 2019 from <https://www.pbs.org/newshour/science/the-sublime-slime-mold/>
- Simard, S.W., Beiler, K.J., Bingham, M.A., Deslippe, J.R., Philip, L.J., and Teste, F.P. (2012). Mycorrhizal networks: Mechanisms, ecology and modelling. *Fungal Biology Reviews* 26, 39-60.
- Smith, D.N. (1978). Inter-organizational networking. *Transnational Associations* 10-78. Retrieved September 26, 2019 from https://www.laetusinpraesens.org/pdfs/1978_10_1.pdf
- Smith, S. (1997). Deepening participatory action-research. In S.E. Smith & D.G. Willms, with N.A. Johnson (Eds.). *Nurtured by knowledge: Learning to do participatory action-research*. (pp. 173-263). New York: The Apex Press.
- Star, S.L. and Griesemer, J.R. (1989). Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology. *Social Studies of Science* 19, 387-420.

Taylor, M., Whatley, A., and Coffman, J. (2014). *Framing paper: The state of network evaluation*. Retrieved July 6, 2016 from <https://www.evaluationinnovation.org/resources/>

Varda, D.M. and Retrum, J.H. (2015). Collaborative performance as a function of network members' perceptions of success. *Public Performance & Management Review* 38, 632-653.

Wenger-Trayner, B. and Wenger-Trayner, E. (2015). Systems conveners in complex landscapes. In E. Wenger-Trayner, M. Fenton-O'Creery, S. Hutchinson, C. Kubiak, & B. Wenger-Trayner (Eds.). *Learning in landscapes of practice: Boundaries, identity, and knowledgeability in practice-based learning*. (pp. 99-118). Oxon, UK: Routledge.

Westley, F., Zimmerman, B., and Patton, M.Q. (2006). *Getting to maybe: How the world is changed*. Toronto, ON: Random House Canada.

Wohlleben, P. (2016). *The hidden life of trees*. Vancouver, BC: Greystone Books Ltd.

Young, E. (2006). Foreword. In, F. Westley, B. Zimmerman, and M.Q. Patton. (2006). *Getting to maybe: How the world is changed*. (p. xiii). Toronto, ON: Random House Canada.