

# Using evidence in healthcare systems

## Conditions and implications that support change and innovation

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**Matter of Focus**

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We work with organisations, projects and programmes to explore, map, analyse and assess the outcomes that matter to them, the people and populations they care about, and their funders. We provide tools and techniques to bring together evidence, data and evaluation to ensure that projects and programmes can meet their outcomes, are successful and adaptable, and can demonstrate that success to funders, service-users and other stakeholders.

We have created an innovative and easy to use software tool, OutNav, that enables public service organisations and funders to make effective use of their data and information to learn, improve and tell the story about the difference they make.

Matter of Focus is led by Dr Ailsa Cook and Dr Sarah Morton. Ailsa and Sarah are internationally renowned thinkers, both well known for their ability to develop practical tools backed by robust evidence-based approaches, with extensive experience of delivering solutions for public service organisations.

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# Summary

This review summarises the evidence to explore how healthcare systems can ensure evidence is used well to inform decision-making.

## Key Points:

- It is important to recognise change in healthcare systems as complex, and to act with this knowledge especially in relation to governance, innovation and the role of information and data.
- Ideas of a linear journey from research to practice are outdated, and instead a focus on relationship-building, collaborative leadership and thought leadership are more likely to be successful ways of spreading knowledge and innovation.
- A focus on processes is important when enabling the transfer of knowledge, including problem identification, knowledge creation, knowledge synthesis, implementation and evaluation.
- Relationship-building and knowledge exchange that embraces wider ideas about formal and experiential knowledge means more emphasis needs to be placed on co-creation and close partnership across traditional academic or clinical boundaries.
- It is not possible to rely on attribution models and ideas of direct cause and effect in complex systems. Instead processes of knowledge use are complex and contribute to change in complex and unpredictable ways.
- Whilst unpredictability and uncertainty are the norm in complex change processes, evidence suggests that relative advantage, compatibility with existing values, the ability to experiment and adapt to the setting are standard attributes that are necessary for successful diffusion of innovation.
- There are several evidence-based frameworks and reviews to help assess and understand implementation of change programmes. Overlapping themes emerge as contextual factors, organisational change readiness, motivation, knowledge and resource availability. These provide ways of assessing change initiatives prior to setting out on a change process.
- Attending to context emerges across the review as an important factor in change in complex health systems, with social processes particularly influential. This includes relational and individual components beyond the influence of any initiative, as well as norms and predominant values.
- Organisational cultures that are more responsive to evidence informed change are those that: have transformational leadership styles; actively engage knowledge users; create networks to share learning; phase the implementation of change; apply theoretical frameworks; disperse leadership; and identify change facilitator roles.

# Introduction

IHDP's vision is to use data and analytics to drive improvement in health outcomes.

To do this, the programme brings together expertise in clinical practice, data science and research. IHDP aims to deliver change by focusing innovation across many fronts and with a wide range of stakeholders.

The programme's initial focus has been developing and overseeing the implementation of a cancer intelligence framework for Scotland. It also has a remit to take learning to other clinical areas and support a Learning Healthcare Systems approach.

Matter of Focus were invited to review evidence to support the IHDP Toolkit ([ihdp.org.uk](http://ihdp.org.uk)), which IHDP has developed to support individuals/organisations to apply learning from the IHDP approach in their relevant domains. We completed this review in two phases. The detailed evidence review, reported here, builds on and develops the findings of our scoping review.

## Scoping review findings

The scoping review was designed to give a sense of the size and scope of the literature while keeping in mind practical, actionable outputs, resources and timescales. We scoped literature at this stage to respond to an agreed set of review questions.

### Key question

How can healthcare systems ensure evidence is well used to inform decision making?

### Sub questions

- A** What are the characteristics of healthcare systems that should be taken into account when implementing an evidence-informed approach?
- B** How is evidence to action understood within complex healthcare systems? What are the roles of technical and interpersonal elements of these systems?
- C** How can place be taken into account when working with evidence and data in complex healthcare systems?
- D** What change management processes are useful for this work?

Guided by these questions we found a rich body of literature that was relevant to the goals of IHDP and to the implementation of its toolkit, which was briefly summarised. Based on the literature we reviewed at this initial we also proposed that sub-question D be adapted. This was to better reflect our finding that healthcare literature was more focused on the construct of implementation, omitted from the original question set, over change management. Therefore, we agreed that question D should be adapted, as follows:

- D** What is the evidence for implementation of data driven innovation in complex healthcare systems?

Following agreement on the findings of the initial scoping review we reviewed the identified literature in more detail. In doing so we also identified additional sources which were included in the more detailed review, which is reported here.

# Results

## Recognising healthcare settings as complex adaptive systems

Conventional thinking is that change happens in healthcare systems when leaders and managers change the strategic vision, structure or procedures and then persuade others to rationally implement that strategy.

Recognising that healthcare settings are complex adaptive systems requires that we fundamentally rethink the processes which govern change and innovation in healthcare systems (Caffrey, Wolfe and McKeivitt, 2016).

In contemporary literature there is an increasing emphasis upon the inherent complexity of healthcare systems. This represents a shift from a more traditional focus on improving constituent elements within systems, where improvement is seen as best achieved through hierarchical and linear means and predominant paradigm is reductionist. While such thinking and methods do of course have merit they fail to adequately recognise the extent to which healthcare can and should be understood as complex adaptive systems which blend a multiplicity of different professional and disciplinary features and actors. In such systems performance and behaviours change over time and cannot be fully understood through evaluating or improving constituent elements (Martínez-García and Hernández-Lemus, 2013). Adaptations in one part of a complex healthcare system may or may not affect the overall system and those seeking change should be less concerned with the personal agendas of those involved and more by the dynamics of the complex systems itself.

Recognising and responding to complexity in healthcare, with its inherent self-organisation and emergent properties, is described as an important means of improving performance in seemingly stagnant systems (Braithwaite, 2018). Morton and Cook (forthcoming) describe four core components of complex systems which can be a helpful starting point for understanding and responding to change in healthcare (Table 1).



**Table 1. Core components of complex systems from Morton and Cook (2022 – forthcoming)**

Core component of complex systems	Implications
Many interactions between people and place	This leads to unpredictable outcomes and patterns. Just because something is effective in one place or at a specific time doesn't mean it will be the same next time. People are different in every place. It can be useful to think of any initiative as embedded in the system, rather than separate to it, and look for these interactions between people and place as they happen.
Interventions, programmes and approaches affect each other	No organisation or initiative is operating in a vacuum. This means consideration of how external services, policies and structures affect any work is important. Where are the synergies and challenges? What needs to be in place to ensure success, and what might cut across it? What can be done to steer the system towards the outcomes that matter?
Previous policies, ways of working, structures and processes resonate	Past policies, like de-industrialisation, housing programmes and child-care policies, are still influencing what is happening now. It can be hard to change direction if there has been a strong push for a particular approach and that has been embedded in the system. Sometimes it takes huge disruptions, like the COVID-19 pandemic, to shift to different ways of working. Acknowledging and looking out for these path dependencies can help navigate them.
Feedback loops – information and knowledge can have large system effects	Evaluation and direct data are essential feedback loops for learning and improvement, but they are not the only ones. Often there are stories about people and place, success and failure that affect how people think and act. It is good to try to be aware of these, and the effect they are having on what is being done now. System influencers also create stories and share case studies to exemplify and highlight the change they want to work towards.

## Epistemological implications for change in complex adaptive systems

What has been characterised as a 'pipeline' approach where information passes in a linear pathway from 'bench to bed' (or from research to practice) is largely outdated and has been replaced with an understanding that the knowledge exchange pathway is in fact not governed by solely rational and predictable processes.

Such top-down approaches, where there is an expectation that conveying the best knowledge and evidence will lead to desired behaviour change should be replaced with a tolerance for the uncertainty and dynamism that is inevitable in complex social systems (Braithwaite et al., 2018). An understanding of healthcare systems as complex systems fundamentally challenges this conception and asks that we consider the adoption (or non-adoption) of information as multiply influenced. For example, Gabbay and le May (2004) showed that "clinicians rarely accessed or processed research evidence from research or other sources directly, but relied on, what they described, "mindlines - collectively

reinforced, internalised, tacit guidelines." These mindlines are informed by typically limited reading, interactions with colleagues and the views of opinion leaders, mediated by organisational demands. A rich vein of literature on mindlines has continued to challenge the underpinning assumptions of evidence-based medicine and applying this thinking in practice suggests the need for relationship-building, collaborative learning opportunities and thought leadership (Wieringa and Greenhalgh, 2015).

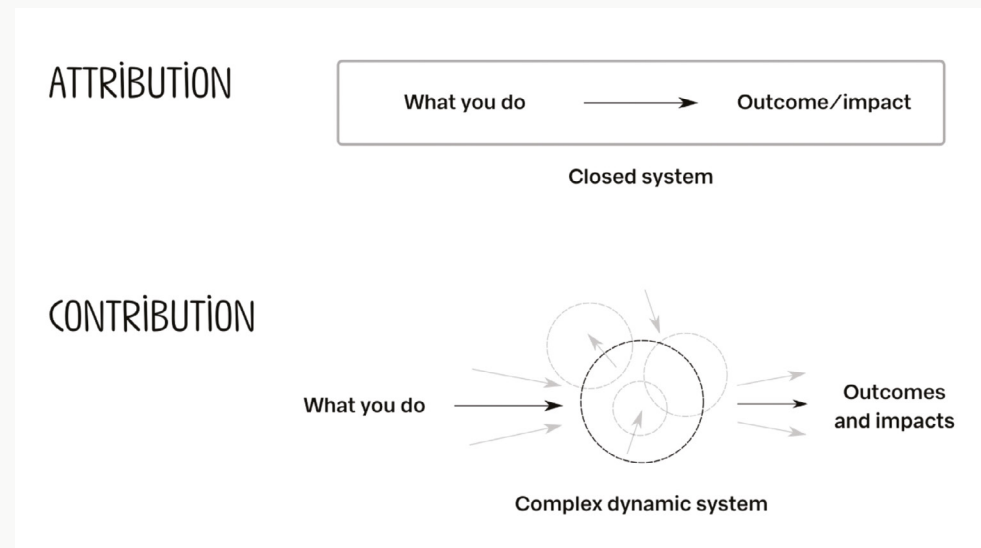
Kitson and colleagues argue that changing the way we think about the transfer of knowledge in complex healthcare settings will enhance both how we create knowledge and its impact (Kitson et al., 2018). They propose a model of knowledge transfer that comprises five core processes which are interdependent: problem identification; knowledge creation, knowledge synthesis, implementation and evaluation. While these are known processes, it is an awareness of their dynamic nature, and the consequent need to work across and between multiple processes, that is more novel. This model helps us understand why traditional linear models of knowledge transfer have severe limitations and can be used to inform the funding of research and approaches to knowledge transfer.

Complexity-informed approaches help to understand that the extent to which evidence is translated to practice may be as contingent upon process, relationships and context as



it is on the evidence itself. Consequently 'good relational practice' has been described as core competency of the 21st century public servant (Needham and Mangan, 2016). This represents a shift from knowledge transfer towards knowledge exchange. In this framing evidence is inclusive and informed both by formal research and experiential knowledge (Dryden-Palmer, Parshuram and Berta, 2020). An approach founded on relationships suggests that it is important to co-create research and to work in close partnership with stakeholders beyond the traditional academic or clinical boundaries (Ozanne et al., 2017).

Complexity also suggests we shift our evidential focus away from a reductionist paradigm which seeks to directly attribute outcomes to interventions through conducting carefully controlled research. Because complex systems are characterised by dynamic and emergent forces, rather than seeking to prove attribution we might more usefully seek to demonstrate a contribution to outcomes. Contribution analysis lends itself well to understanding and evaluating evidence to action in complex settings (Morton, 2015). It is primarily a developmental approach and is useful for learning and tracking progress against outputs, intermediate and final outcomes, whilst also being able to inform formative and summative evaluations (Mayne, 2008; Morton et al., 2018). Shifting from a cause-and-effect attribution model asks us to acknowledge that inputs, like the conveyance of knowledge, influences and contributes to change in complex ways. Traditional approaches to improving practice, which are based on the assumption that providing the right evidence to the right people will automatically lead to its integration into evidence based practices, are challenged as a result of nonlinear interactions and emergent, self-organised behaviours which characterise complex systems (Lipsitz, 2012). In sum, research and knowledge exchange doesn't directly cause change, it influences and contributes to change in complex ways.



**Figure 1 Contribution v's attribution (Morton and Cook 2022 forthcoming)**

A key element of contribution analysis is to assess the context within which a change process is placed. This involves examining elements which are not within the direct control of people seeking to introduce change and innovation. Contextual factors include relational and individual components as well as material and societal drivers, including norms and predominant values and tend to be downplayed in a reductionist attribution-oriented paradigm.



## Conditions for change and innovation in complex healthcare systems

It has been reported that it can take upwards of 17 years for evidence based practices to be assimilated into routine practice (Bauer et al., 2015).

While recognising healthcare as a complex adaptive system offers some indication as to why traditional top down or 'pipeline' approaches to change and improvement are ineffective it does not in itself make the process of change any easier. It does, however, inform how best to approach change and to assess the conditions that support change in complex systems. Braithwaite and colleagues (2018) suggest that an important precondition for change in complex health systems is to have some kind of triggering mechanism, for example new legislation or widespread stakeholder agreement on the urgency of change.

They also suggest:

- Feedback loops are crucial to maintaining momentum for change.
- Extended periods of time are needed for implementation, which are typically much longer than initially considered necessary.
- Taking an approach that is informed by complex-systems theory, with due regard for existing networks and socio-technical characteristics, can be beneficial.

They conclude that unpredictability and uncertainty are the norm in change processes, suggesting multiple forces and influences must be considered. An early and expansive systematic review in this area, by Greenhalgh and colleagues (2004), suggested a set of system antecedents for spreading and sustaining innovation in healthcare. The authors identified thirteen high level research areas of relevance to the diffusion of innovation in healthcare from sociological and marketing research to evidence-based medicine, organisational literature and complexity theory. The authors built a unifying conceptual model derived from their synthesis, which was designed to prompt thought when considering change in complex settings and the commonly interacting forces.

The review of evidence accompanying the conceptual model identified standard attributes, considered necessary but not sufficient in their own right for successful diffusion of innovation, as follows:

- **Relative advantage** of an innovation to what has gone before.
- **Compatibility** with existing values, needs and norms in receiving teams.
- **Complexity**: the less complex innovation is more likely to be adopted.
- **Trialability**: the ability to experiment with and try out innovations helps.
- **Reinvention**: innovation which can be tweaked or adapted to a setting.



Additional key attributes included the degree of risk involved with an innovation, its tendency to improve task performance and the knowledge required for its adoption.

Building on this work with detailed case study evidence from technology supported innovation in healthcare settings and additional literature reviewing, Greenhalgh and colleagues developed the Non-adoption, Abandonment, Scale-up, Spread and Sustainability (NASSS) framework (Greenhalgh et al., 2017). The systematic review identified seven interacting characteristics for successful implementation of technologically driven innovation in healthcare systems which were adopted into the framework.

- The health condition being addressed.
- Technology being applied.
- The value proposition (and who benefits).
- Adopter systems (staff, patients and carers and their acceptance of an innovation).
- Healthcare organisation (readiness, capacity for innovation and the general approach to adoption).
- Wider system (wider context, e.g., policy and regulation).
- Continuous embedding and adaption over time (contingent on a range of elements including ability for adaptation and evolution of innovations).

The empirical case study identified challenges across

these domains, which were classified as simple, complicated or complex. Programmes which faced challenges which were characterised as complex (dynamic and unpredictable) across several of the NASSS domains were rarely, if ever, mainstreamed. It is worth noting the particular role that case study-based approaches play in building the evidence base for approaches which blend implementation science with complexity science (Greenhalgh et al., 2004; Harvey and Kitson, 2016; Braithwaite et al., 2018). This is perhaps not surprising given change and innovation occur in real world settings. It does though suggest that those setting out on change programmes in complex healthcare settings should consider working with academic partners to rigorously record and review change processes against theoretical models. In doing so, their efforts and experiences could bring significant benefit to the wider healthcare community.

There is good evidence of the factors that help and hinder the implementation of change programmes which are underpinned by data or technological innovation in healthcare. One review of barriers and facilitators identified 77 barriers and 268 facilitators for implementation. Top barriers included limited exposure/knowledge and problems with financing while top facilitators included ease of use, motivation and ease integration into existing care and practices (Schreiweis et al., 2019). A previous review of systematic reviews reported multiple factors that were important for implementation (Ross et al., 2016). These were grouped by the technology being applied (e.g. its adaptability and interoperability), factors in the wider environment (e.g. having wider conducive policy), the inner setting (e.g. fit of the innovations with current workflow), individual factors (e.g. the knowledge required to be



involved) and also the process of implementation adopted (if any). While influences were heterogeneous and highly contingent upon the change being introduced the authors particularly emphasise the importance of attending to the internal and external context within which a change process is taking place.

In complex adaptive systems change cannot be divorced from the context within which it is expected to take place, with social processes particularly influential (Dryden-Palmer, Parshuram and Berta, 2020). Context is an important element in conceptual frameworks for implementation including the Promoting Action on Research Implementation in Health Service (PARIHS) framework (Harvey and Kitson, 2016). Assessing context is also a key element of the contribution analysis method (Mayne, 2008). This makes it a useful method for understanding research impact and translation (Morton, 2015) and for tracking and evaluating change in complex systems (Mayne, 2008; Morton et al., 2018).

An attention to context asks us to examine elements which are not within the direct control of people seeking to introduce change and innovation. Such contextual factors include relational and individual components as well as material and societal drivers, including norms and predominant values. However, it is important to note that context for innovation or change is not fixed. That is, the context is likely to be altered by new knowledge and innovations being introduced and by implementation processes (Dryden-Palmer, Parshuram and Berta, 2020).

## Supporting change in complex healthcare systems

As a minimum, anyone approaching change in complex healthcare systems should sensitise stakeholders to the nature of complex adaptive systems and respond accordingly.

That response might usefully include more distributed leadership for change and the development of networks, as well as and creating opportunities for sense-making and feedback loops (Braithwaite et al., 2018).

Efforts to introduce and evaluate innovation and change into complex healthcare settings should be informed by building from pre-existing theoretical frameworks. These provide a rationale for proposed approaches to change and innovation as well as a source of wider evidence of what works. Assessing proposed new change programmes against theoretical frameworks and models of implementation can also provide an early indication of their likely success, based for example on the assessed complexity of an intervention.

Implementation science has been described as “the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services” (Eccles and Mittman, 2006). As a discipline it has become increasingly focused on supporting change in complex systems and moving away from linear (top down) conceptions of implementing change (Braithwaite et al., 2018). Modern

implementation science literature is particularly important to data driven and digital innovation in healthcare, given the often-significant resources required to develop and test approaches and the associated potential to avoid costly mistakes.

Implementation frameworks can be used as both diagnostic and evaluative tools to support change. Commonly applied frameworks include Normalization Process Theory (May et al., 2018) and the PARIHS framework (Kitson et al., 2008). Notably, the PARIHS was updated based on new evidence about the importance of having skilled facilitators to support change processes in complex systems (Harvey and Kitson, 2016), which was a response to the increased understanding that change and innovation are fundamentally contingent upon relationships and their facilitation. As technology and data driven innovation have become increasingly important, implementation science has responded with the development of tailored frameworks. The NASSS framework is based on evidence of what works in relation to technologically driven change programmes in healthcare (Greenhalgh et al., 2017), which makes it a potentially useful diagnostic and evaluative tool.

Concurrent to developments in implementation science, Learning Health Systems (LHS) have also emerged as a model aimed at overcoming barriers to scaling data driven innovation. Concerned with delivering improvements in healthcare through improved access to, and use of, data, they typically employ locally owned, iterative cycles of knowledge generation and integration. A systematic review of LHS found medium to high quality evidence of impact across health

systems internationally (Enticott, Johnson and Teede, 2021). However, given the consistent identification of the primacy of relationships and context to change processes in complex systems, an over-reliance upon the improved use of data as a change mechanism may have limitations.

The need to create organisational cultures which are responsive to evidence informed change should be highlighted (Dryden-Palmer, Parshuram and Berta, 2020). Such cultures are supported by:

- Certain leadership styles. Both 'transformational' leadership style (having an inspiring vision and empowering people to put it into place) and the more directive 'transactional' leadership style can encourage the adoption of evidence based practices (Chor et al., 2015)
- A recognition that change leaders are needed at different levels. This can include more dispersed leadership and an emphasis upon specific change facilitator roles.
- The active engagement of knowledge users in change processes to build a sense of shared ownership for outcomes.
- Informal opportunities and networks are available for the sharing learning and experience.
- Implementation of change is developed in phases.
- The application of theoretical frameworks guide implementation and an awareness of context.



# Conclusions and Recommendations

This review was designed to consider how healthcare systems can ensure evidence is well used to inform decision making.

To inform our approach we initially scoped literature against a series of exploratory questions. We found that realising change and innovation in healthcare systems must be informed by the developing understanding of the inherent complexity of such systems. This requires we shift from what has been characterised as a 'pipeline' approach to change, which is founded on the expectation that passing evidence and knowledge through organisations and systems will lead to its adoption in practice. Complexity science shows us that change is typically characterised by nonlinear interactions and that behaviours are often emergent and consequently unpredictable. It also shows us that understanding the context in which change takes place is vital and that change in complex systems is fundamentally relational.

While understanding the characteristics of complex systems is important it does not in its own right offer solutions. There is indeed a risk that in emphasising complexity we may inhibit innovation rather than usefully inform it (an obvious appeal of a pipeline approach is its inherent simplicity). One reasonable response to complexity as a determinant of successful implementation is to try and reduce that complexity but how, and if that can even be achieved, is not clear from

the literature. Similarly unclear are the mechanisms by which complexity affects implementation (Dryden-Palmer, Parshuram and Berta, 2020). However, despite these limitations, there is a significant body of literature which does indeed offer practical suggestions for improved uptake of innovation, which can be applied at different points in innovation. For example, people at the start of a change process can assess the characteristics and complexity of proposed innovations we can alter our approach and avoid potentially costly errors. For those in the midst of delivering change an awareness that complex systems are characterised by non-linear interactions might suggest the need for networks of shared learning, diffuse leadership approaches or the addition of change facilitators. If change has emergent and unpredictable properties then the response might be to build structures that create feedback loops, allowing for iterative and flexible approaches to change.

We have seen that as an absolute minimum those considering or leading change in complex healthcare systems should have a healthy interest in the characteristics of such systems and share that knowledge with the range of stakeholders involved in that programme. We believe that there is a trick to finding the middle ground in this domain and that is understanding complexity and its implications but not being overwhelmed by it.

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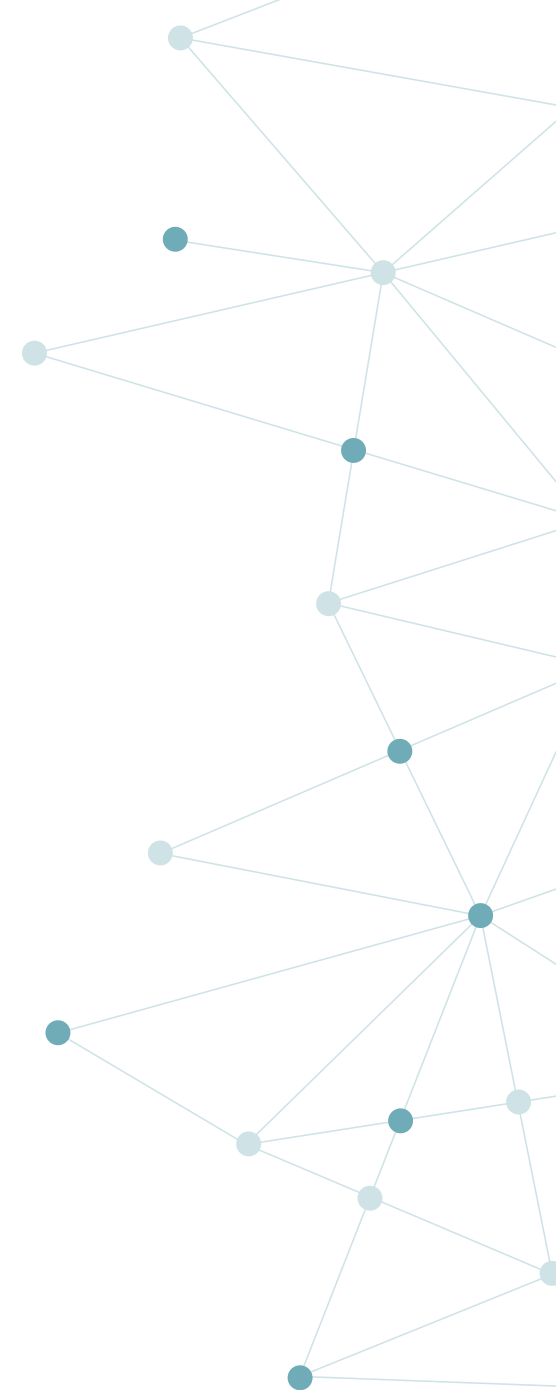
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