If we can imagine it, we can build it: Developing Complexity Theory-Informed Methodologies

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Abstract
Seemingly intractable or ‘wicked’ problems are often characterised by the complexity and uncertainty involved. However, these characteristics are not always accounted for within research design. How health care systems may effectively respond to intimate partner violence presents a complex research problem. Researchers have been challenged to account for contextual influences when responding to intimate partner violence. However, theoretical perspectives and methodologies have not sufficiently evolved to account for the multi-layered complexity and uncertainty involved. Recognising and responding to this challenge offers opportunities to innovate methodologies and methods capable of evolving alongside learning. We present a complexity-led research design to study improving primary care service delivery to those impacted by intimate partner violence in Aotearoa New Zealand.

Keywords
complexity theory, complex adaptive systems, health, methodology, qualitative, design

Introduction
Seemingly intractable or ‘wicked’ problems are often characterised by the complexity and uncertainty involved. However, these characteristics are not always accounted for within research design (McDaniel et al., 2009). Recognising and responding to complexity and fundamental uncertainty offers opportunities to innovate research methodologies and methods capable of evolving as we learn more about the problem (McDaniel et al., 2009). This paper presents implementing sustainable responses to intimate partner violence (IPV) within primary health care settings as an example of a particularly complex problem whose solution continues to elude scholars. A complex problem such as IPV is highly unique. It never presents, or is responded to, in the same way (Clark, 2013). This unpredictability raises significant problems for standardised interventions, as cause and effect will always be uncertain. This paper presents methodology and guidance for designing research responsive to this complexity. While the challenge is to develop congruency between research design and the problem under study, this paper offers learning for developing research design applicable to other complex public service delivery problems.

A system is complex when there is a high level of interrelatedness among many system elements, making it impossible to predict what outcomes will occur. Though complicated systems may be difficult to understand, their mechanistic nature means we are able to predict what will happen (Braithwaite et al., 2017). Use of complexity theory is now commonly used to understand health systems and organisations (Olsson et al., 2020; Thompson et al., 2016). Complexity theory offers a way to conduct research that privileges the relationships between system elements, including the seemingly insignificant, and how this influences
what emerges from the system. Complexity theory is often used to reconceptualise health care organisations as complex adaptive systems (CAS), the principles of which are now widely published within health services research literature (Braithwaite et al., 2017). This paper draws on the complexity principles of interaction, co-evolution, self-organisation and emergence (see Table 1). To briefly demonstrate these principles in action, as the reader interacts with this paper their thinking is changing in response (co-evolution). If the reader is interested, they may begin to engage in the wider work of the paper and perhaps share it with others (self-organisation). Over time, a collegial relationship may develop between the reader and others working in the field (emergence). However, given the number and diversity of interactions possible over time, what emerges is uncertain and may deliver positive or negative outcomes for the author and reader. A small system intervention may elicit big system changes (high leverage), or large system interventions small effects (low leverage). McDaniel et al. (2009) argue a CAS theoretical perspective calls for a different way of approaching research design, focused on how different methodologies and methods might work together. Understanding health care as CAS means system elements are continually shifting and changing as we study them. Research can be designed to shift and change as we observe and learn from what is in front of us (McDaniel et al., 2009).

Using the example of improving primary care service delivery to those impacted by IPV, we demonstrate the design of research responsive to complexity. We first set the scene by providing an overview of primary care responsiveness to IPV. Next, we present our complexity-led methodology and

| Table 1. Description of common complexity theory concepts (adapted from Gear et al. (2018a)). |
| Concept | Description |
| --- | --- |
| Agent | An individual, collective or process capable of responding to other agent actions and information. Responses may include learning and adaptation |
| Non-linearity | A characteristic of agent interaction generated by unpredictable agent responses to the actions of others |
| Feedback loops | Recursive mechanisms arising from multiple agent interactions over time that either reinforce (positive) or undermine (negative) each other. Positive feedback loops support a change trajectory while negative feedback loops tend to undermine or negate change |
| Co-evolution | An ongoing process in which agents are influenced by, and mutually adapt to, changes generated by agent interaction |
| Self-organisation | The spontaneous emergence of new relationships, forms, or patterns of behaviour arising from repeated agent interactions over time |
| Emergence | New system properties or levels of complex organisation generated by agent self-organisation |
| Boundaries | An artificial frame, or socially constructed reference point which connects (not separates) a system with its environment. System fluidity means boundaries cannot be defined objectively |
| Far-from-equilibrium | A dynamic state in which complex systems maintain a stable appearance by balancing multiple interactions between diverse agents and feedback loops |
| Leverage point | Where a small amount of change can disproportionately affects system behaviour |
| Path-dependency | The influence of system history on current system behaviour and events |
| Uncertainty | Unpredictability of agent interaction generates uncertainty of what might happen |
| Surprise | An unexpected occurrence, due to unpredictability. A novel combination of people and their reactions |
| Unintended consequences | Unintended effects of unpredictable agent interaction |
| Complex adaptive system (CAS) | A type of system characterised by endogenous non-linear dynamism generated by interaction between diverse agents which makes adaptation and spontaneous self-organization possible, but unpredictable |

Braithwaite et al. (2017); Cilliers (2001); McDaniel and Driebe (2010); Meadows (1999).

| Table 2. Overview of Methodology. |
| Theoretical lens | Post-structural complexity theory |
| Methodology | Tikanga Māori |
| Method | Participatory health research |
| Methods | Deliberative dialogue workshops, Rapporteur, Tests of change (participant survey and clinical audit) |
| Analysis | Social network analysis |
| Impact | Social network analysis informed dissemination |
| Emphasises the dynamism of elements involved | Emphasises the layers of relationships within Māori worldview |
| Works with end-users who hold the knowledge needed | Unites different knowledge sources for problem-solving |
| Captures participant interactions and the development of response pathways and tools | Measures influence of workshops on participants and their organisation |
| Understands the implementation environment | Applies network data as a tool for system intervention |
methods of participatory health research, deliberative dialogue workshops and social network analysis (see Table 2). We conclude with discussion about what we have learned and what we are uncertain about in building complexity-led methodologies.

**Intimate Partner Violence and Primary Health Care**

Primary care is considered a priority setting where a disproportionate number of people impacted by IPV may present (World Health Organisation, 2013). Gender-based violence is deeply rooted in social and structural inequities and resonates within everyday social norms such as gender roles and expectations (Wathen & Varcoe, 2019; World Health Organisation, 2017). Primary care is designed to connect with the socioeconomic, cultural and political characteristics of communities to disrupt future threats to health and wellbeing (International Conference on Primary Health Care, 1978). Yet often, health care interventions to address violence against women and children are disconnected from the context violence occurs within, limiting the responsiveness of health professionals to those experiencing violence (Gear et al., 2019; O’Campo et al., 2011). Further, other sector services designed to provide support are often fragmented, responsive only to parts of the system, such as criminal justice, or statutory child protection (Family Violence Death Review Committee, 2016; World Health Organisation, 2016). To be effective, interventions must address the systemic and structural violence that entrap people within their circumstances (Family Violence Death Review Committee, 2016; Wathen & Varcoe, 2019). Primary health care, in responding to the needs of communities, is unique in facilitating access to a wide range of services across different systems, such as women’s refuge, budgeting services and counselling. As an initial point of contact with the health system, primary health care is, often a first, and consistent, source of help in the wider pursuit toward health and wellbeing (International Conference on Primary Health Care, 1978; World Health Organisation, 2013).

Internationally, health systems have a critical role within a multidisciplinary response to IPV (World Health Organisation, 2016). However, integrating sustainable responses to IPV within clinical practice has proven challenging and the best evidence-based practice is still insufficient (Garcia-Moreno et al., 2015). Along with political leadership, funding, sector coordination and monitoring and assessment, international guidelines strongly recommend health systems establish system infrastructure to support a ‘first-line’ response (Garcia-Moreno et al., 2015). This involves providing practical care that is responsive to emotional, physical, safety and support needs and that does not intrude on privacy (World Health Organisation, 2013, 2014). System infrastructure should include institutional support, effective screening protocols, health professional training and immediate access to referral options (O’Campo et al., 2011; World Health Organisation, 2013). However, studies testing the effectiveness of health care interventions to reduce IPV cite a lack of context appreciation for small effect sizes (Decker et al., 2012; Garcia-Moreno et al., 2015; O’Campo et al., 2011). Specific individual elements of a health response such as health professional characteristics, individual circumstances, social norms that tolerate violence and the dynamics of abuse can impact the effectiveness of an intervention yet are commonly disregarded with use of positivist methods (Garcia-Moreno et al., 2015; Ghandour et al., 2015; Goicolea et al., 2015). Although system infrastructure is critical to support effective health care responses, prescriptive approaches and methods that assume a direct relationship between cause and effect are at odds with the complexity of the problem as they obscure context influencing intervention outcomes (Clark, 2013). As understanding of health systems as CAS increases, scholars are advocating for new approaches to system intervention reflective of the adaptive behaviour of health systems (Braithwaite, 2018; Castelnovo & Sorrentino, 2018; Greenhalgh & Papoutsi, 2018).

In Aotearoa New Zealand, the high rates of violence within families or whānau are well known (Family Violence Death Review Committee, 2016). One in three Aotearoa New Zealand women and one in two Māori (Aotearoa Indigenous) women will experience physical and/or sexual IPV in their lifetime (Fanslow et al., 2021). (Whānau is an Indigenous Māori family collective based on connection, ancestry, spirituality and responsibility, different to the Western concept of family (Walker, 2006)). Similar to other colonised Indigenous peoples globally, the overrepresentation of Māori whānau in family violence statistics stems from historical and colonial trauma, with intergenerational impacts and ongoing socioeconomic deprivation (Dobbs & Eruera, 2014; Pihama et al., 2019; Wilson et al., 2016). This is perpetuated by systems and services which reinforce inequities through racist behaviour (Came, 2014; Wilson, 2016; Wilson et al., 2016). These layers of social entrapment must be understood to disrupt patterns of violence for both Māori and tāuiwi (non-Māori) (Dobbs & Eruera, 2014; Kruger et al., 2004; Tolmie et al., 2018).

Despite high prevalence of IPV in Aotearoa New Zealand, the impacts of violence on health and wellbeing are not well recognised within health policy or practice, meaning health professionals are often responding to this complex problem with limited support (Gear et al., 2019). Within the primary care sector, a lack of policy directive and key system supports mean health professionals can be often unsure of what to do, or how to help (Gear et al., 2018b; Gear et al., 2019). The complexity of primary care responses to intimate partner violence arises from the interaction between two complex adaptive systems; families or whānau impacted by IPV and the health care delivery system. In prior research, we conceptualised a sustainable health care response as an emergent phenomenon, stemming from the initial interaction between patient and health professional (Gear et al., 2017). We argued the generation of a sustainable response begins with an interaction that leads towards positive outcomes for both the health professional (e.g., increased confidence and capability to direct toward effective responses) and patient (e.g., reduced...
inequity, improved wellbeing). This theoretical view means a sustainable response is not something that can be achieved in perpetuity, but a continuous evolving process dependent on the interactions between different systems at different levels, points in time and settings (Gear et al., 2017). Future research directed toward the other side of the ‘equation’, that is, the experience of families or whānau interacting with primary care services, will be necessary to further inform this theory.

Working on the primary care professional side of the equation, our complexity-led approach calls attention to the ability to make small changes within existing system structures that have potential for transformative system change (McDaniel et al., 2013). This approach does not prohibit also undertaking larger system changes, such as a policy directive. Primary care professionals hold a pivotal role in establishing a trajectory toward positive outcomes e.g., reduced violence. They also are holders of general knowledge of what contributes to positive or negative clinical interactions. It is therefore critical that primary care professionals themselves contribute to the development of a response effective for the setting.

### Building Complexity-Led Methodology and Methods

We utilise complexity theory to view health care service delivery as a CAS to (1) identify where system interactions are blocking a trajectory toward positive outcomes and (2) alter the interaction by creating different system pathways, or tools to strengthen the interaction. For example, a pathway may include the use of a job aid (a visual tool that conveys user instruction) (Sarma et al., 2019) to advance the use of peer support when dealing with uncertainty related to a concern about IPV. Rather than trying to implement something new in an overburdened sector, we alter existing system structures toward the desired outcomes using the embedded knowledge and experience of primary care professionals working at the frontline.

Our bicultural research team are working to weave together two theoretical perspectives, Tikanga Māori that supports an Indigenous worldview (Paki & Peters, 2015; Smith, 2005) and post-structural complexity theory (see Table 2). The Tikanga Māori framework will be explicated in a separate publication authored by Māori research team members. For the purposes of this paper, the post-structural paradigm provides a view of the continuous knowledge construction that occurs as system agents interact and shape others (Cheek, 2000; Cilliers, 1998).

We access the full complexity of patient, professional interaction by examining primary care professional inter-subjective dialogue about how effective responses are formed and reinforced or blocked (Luhmann, 1984). This post-structuralist complexity theory perspective aligns well with the research problem, calling attention to the influence of the many changing inputs, relationships, outcomes and consequences involved in responding to IPV within health care settings (Brainard & Hunter, 2016).

### The Methodology

Given the pivotal role primary care professionals hold in responding effectively to those impacted by IPV, we work with them in the development of a response utilising participatory health research methods (Phelps & Hase, 2007). Participatory health research involves systematic co-creation of knowledge through equitable partnerships with those who are affected by, or will benefit from, the issue under study (Andersson, 2018; Di Ruggiero & Edwards, 2018; Wright et al., 2010). It is useful in addressing the gaps between national policies and local ‘fit’ and exploring the mechanisms that bring about change (Palmer et al., 2018). Knowledge transfer is an integral part of participatory health research as it engages end-users from the outset of the research, mobilising and motivating people and resources, establishing the conditions for change (Abma et al., 2017).

Our study ‘Atawhai’ (moving with care), aims to recruit approximately 16 primary care professionals (such as general practitioners, nurses, social workers, community health advocate, managers) associated with any of the general practice clinics or hauora (Māori health care providers) within one Aotearoa New Zealand region. We will promote recruitment through the Atawhai website (www.atawhaitia.co.nz) and by word-of-mouth through existing research relationships. Potential participants may contact the research team directly or register their interest via the website. A member of the research team will contact the participant to discuss research aims and assess eligibility. We aim to recruit those committed to improving IPV responsiveness, those that broker or bridge professions and groups and who are from a diverse range of disciplines, communities, and practice settings. During our three-year project, our participants will be encouraged to build capability to act as change agents for IPV responsiveness across their networks and communities. We avoid recruiting participants who are interconnected or represent a similar group (e.g., two nurses representing similar communities). Power balances between different perspectives (e.g., community and management) will also be considered. Recruited participants will be offered reimbursement to offset the cost of workshop attendance. In addition to the individual participant, consent will also be sought from their organisation to promote workplace support and allow for clinical audit (see methods).

We aim to recruit eight Māori and eight tauwi (non-Māori) primary care professionals who will work together in the development of a primary care response to family violence. Opportunities to caucus separately will offset power imbalances between general population health and Māori health philosophies of care. As advised by Māori research team members, space for Māori to discuss matters of importance to them without tauwi interference will protect Māori participant mana motuhake (Māori self-determination). 16 individuals mean the full participant group will not be unwieldy but allows ideal caucus group size (7–12) for creating a supportive environment and optimal communication. This recruitment
method aims to generate a participant sample reflective of the region under study, bringing together a range of voices, networks, knowledge, and experience. In complexity theory language, we may study the interaction, co-evolution, and self-organisation of multiple unique CAS in real-time by capturing the narration of it constructed by our participants. This maximises our ability to capture new and relevant information from a range of sources within the region under study. Participants will attend a series of deliberative dialogue workshops to build mutual understanding of the problem and create real world and contextually relevant responses to violence within families or whānau impacted by violence.

The Methods

To observe and capture the development of a primary care response to IPV, we use methods of deliberative dialogue, rapporteur data collection, pre and post participant survey and clinical audit of IPV identification.

Deliberative Dialogue

Deliberative dialogue is a participatory method that creates opportunities for discussion amongst people who have interest in and are committed to engaging with a complex issue (Boyko et al., 2016; Hegarty et al., 2017; Lorenzini et al., 2017). Using synthesised research and co-produced contextual knowledge, engagement in deliberative dialogue increases participant capability and capacity to visualise the complexity involved and sensemake remedies with others across system boundaries (Boyko et al., 2016). Deliberative dialogue is a shared approach to change and transformative action, strengthening organisational capacity to address the issue (Lorenzini et al., 2017). It also allows for constructive tension between participants that has potential to generate new questions and novel sense-making.

We apply deliberative dialogue within a series of facilitated one-day workshops (approximately seven over 18 months). Participants will be supported by the research team to draw on their contextual knowledge and practice to critically reflect on what information is required for responsiveness to IPV in primary care, how it may be integrated into practice and what action is required to do so. Workshop aims and formats will be decided by the participant group. The research team will facilitate workshop sessions to work toward participant aims and provide needed resources and expertise. For example, participants may receive a research evidence brief on service user experience of engaging with primary care collated by the research team, or they may request to speak with a specialist community provider to understand the services they provide. Similarly, we will engage a service user group of persons with lived experience to support client- and whānau-centred pathways and mitigate harm. Evidence will be synthesised peer-reviewed literature, prioritising local research, selected by research team members who are leading scholars in the fields of family violence, complexity theory and Māori health (for example see (Centre for Research Excellence Safer Families, 2021; New Zealand Family Violence Clearinghouse, 2021) during the workshops, participants will design system pathways and supporting tools to influence key system interactions they identify as challenging or promoting primary care sustainable IPV responses. For example, a pathway might elucidate the connections between a general practice, a community service and patient needs using digital story (Hegarty et al., 2017). Another pathway may make use of professional peer support groups to disseminate information on IPV as a key determinant of ill-health. Participants will be encouraged to continue to engage and learn from their interactions with colleagues, families and whānau. They will share and test workshop learning within their practice setting and contribute findings back to the participant group for discussion.

Two members of the research team (Māori and tauiwi), trained in facilitation skills, will manage workshop discussion to ensure all participant voices are heard. The deliberative dialogue process acts as knowledge translation amongst our participant group, their networks and the regional community (Boyko et al., 2012). This approach allows for co-evolution between participant workshops and our research design, as participants learn from and respond to one another and we adapt methods in response to what we observe and learn from participants (McDaniel et al., 2009).

Specialist Rapporteur, Kaihopu Kōrero

We model the United Nations conference rapporteur role (United Nations General Assembly, 2019), to collect data during the deliberative dialogue workshops. Reflecting our Indigenous research partnership, this role was named as ‘Kaihopu Kōrero’ (catching the discussion) by our Māori research team members. Two doctorally prepared research team members, supporting either Māori or tauiwi caucuses will act as Kaihopu Kōrero during workshops and record information as it occurs using a semi-structured observation protocol. The Kaihopu Kōrero will be tasked with (1) ensuring deliberative dialogue workshop discussions are of value in addressing our research aims informed by complexity theory (2) capturing participant interactions and decisions, (3) reporting observations and decisions to participants for validation and (4) informing subsequent workshop directions and diffusion strategies.

As participants narrate their knowledge and experience, Kaihopu Kōrero will collect data to map patterns of interaction and capture the co-created pathways to responsiveness. For example, a participant may narrate their experience of raising IPV responsiveness with practice management and what effect the conversation had amongst colleagues. Planned points of Kaihopu Kōrero data collection include 1) during an initial workshop ‘check in’ session to record change occurring within participants, between participants, within participant
organisations and with community service providers and 2) at chosen strategic points during workshops to conduct interactive sessions with participants to seek consensus and validate findings. Kaipou Kōrero and facilitators will debrief post-workshop and provide a written report capturing participant narratives about primary care IPV responsiveness. This will be summarised for participants ahead of subsequent workshops, contributing to ongoing co-evolution of workshops and research design (see Table 3).

### Anticipating Change

Given the non-linear and unpredictable nature of CAS, it is likely there will be events that change the course of the study (McDaniel et al., 2009). In Aotearoa, New Zealand, there is much uncertainty around the impact of COVID-19 and impending health system restructure (Health and Disability System Review, 2020). Our evolving, adaptive research design is responsive to these events while also capturing the impact on the research through a diverse set of observation methods. Our complexity theory-informed approach focuses on the relationship between elements, including the relationship between data sources, providing greater insight into how change occurs within a dynamic and uncertain environment (McDaniel et al., 2009). As change within complex systems is emergent our research design incorporates multiple indicators of change and improved service delivery. In the following, we explicate how our use of social network analysis, participant surveys and clinical audits captures change during and post deliberative dialogue workshops. We anticipate immediate benefit from participant advocacy of IPV amongst their networks and communities, and in the longer term, renewed engagement between the primary care organisations and the Ministry of Health to address IPV as a key determinant of ill-health. Future research will be needed to monitor the trajectory of change beyond the research location, including monitoring unintended consequences and system gaps generated by change.

### Social Network Analysis

We combine social network analysis with complexity theory to view how network structure influences what outcomes emerge and how we may influence those interactions to support the emergence of the desired change (Thompson et al., 2016). Our multiple data sources provide a narrative of the changes occurring within and across participants, their organisations and with other service providers. Triangulating mixed methods for social network analysis provides greater insight into the context of networks and the complexities involved, increasing the explanatory power of the research (Glegg et al., 2019). Evidence suggests understanding the multi-level and multi-actor networks involved in an intervention can substantially improve the implementation process (Glegg et al., 2019; Shelton et al., 2018; Valente et al., 2015). Social network analysis is also increasingly recognised as a key tool in informing dissemination and implementation of policy and interventions. For example, understanding how a network works allows particular parts to be manipulated, accelerating diffusion, enhancing uptake or adjusting for impact (Shelton et al., 2018). A network approach to implementation is cost effective, often achieved using existing network relationships and resources (Shelton et al., 2018). Using Kumu relationship mapping software (Kumu, 2021), we capture existing and emerging primary care network relationships that support IPV responsiveness as narrated by participants during the deliberative dialogue workshops. We apply qualitative and quantitative social network analytical techniques (such as network metrics and visualisations), to explore system interactions that block IPV responsiveness, (e.g., where biases affect information flow), or trigger breaks in negative patterns (e.g., identifying ‘work-arounds’). Findings will be used to strategically amplify or diminish specific system interactions, strengthening multiple and alternative pathways to IPV responsiveness. For example, a social network visualisation may depict the relationships between primary, secondary, tertiary and community service use, calling attention to the implications of breaks in system connectivity. A referral map could connect professionals to different formal (e.g., health pathways) or informal (e.g., food bank, emergency housing) system supports depending on patient needs at the point of consultation. Awareness of women’s refuge as a site of both crisis intervention and community advocacy may be improved by onsite visibility of advocates at a general practice. Our social network analysis findings will be an indicator of change, elucidating a growing network of relationships, social context, communication methods and key agents responsive to IPV (Lazega, 2020; Shelton et al., 2018). Following each workshop, we will build upon the baseline network developed with participants at the first workshop, illustrating how the network evolves over time.

### Table 3. Summary of workshop processes (modified from Boyko et al. (2016))

| Preparation | Workshop | Debriefing |
|-------------|----------|------------|
| Compile and distribute workshop brief to participants | Participant ‘check in’ session | Facilitators and rapporteurs review process and decisions |
| Facilitators and rapporteurs plan logistics of dialogue process | Review workshop priority | Complete workshop report with social network analysis |
| | Caucus dialogue | Identify resources needed for next workshop |
| | Rapporteurs verify findings with participants | |
| | Plan forward | |
| | Kaitiakitanga (safety) | |

| Preparation | Workshop | Debriefing |
|-------------|----------|------------|
| Identify resources needed for next workshop | Complete workshop report with social network analysis | Identify resources needed for next workshop |
Participant Survey. To capture the emergence of change, we administer a six-item GP readiness scale using Qualtrics software (Qualtrics, 2020). The items assess the readiness of participants to identify and respond to IPV. The items approximate the readiness themes reported by Leung et al. (2017); Po-Yan Leung et al. (2018): self-efficacy and motivational, emotional, organisational and global readiness. Post-workshop survey results will indicate if participant responsiveness to IPV improved.

Clinical Audit. Clinic-based participants with access to patient medical files within their organisation will be assisted to conduct an audit of IPV case identification, our third indicator of change. Our research evidence suggests low or non-existent documentation of IPV will be likely in the baseline pre-workshop samples. However, within hospitals, we have found baseline low or zero disclosure rates provide important feedback to staff ahead of instituting change actions (Gear et al., 2020). This audit does not intend to assess performance, rather asks for reflection on results and potential barriers to improvement. Recognising documentation of IPV is a narrow indicator of change, the findings intend to contribute to participant discussion within the workshops and the overall understanding of the study impact.

Discussion
Research seeking to understanding complex problems requires design able to capture the complexity involved (McDaniel et al., 2009; Young-Wolff et al., 2016). This paper outlines a research design proposed to study the complex problem of improving primary care service delivery to those impacted by IPV. It demonstrates weaving together alternative methodologies and methods in a congruent way, responsive to the complexity of the problem and that can evolve alongside understanding (summarised in Table 2).

Internationally, it is recommended that health systems establish system infrastructure to support health professionals to provide a ‘first-line’ response to those experiencing IPV. While this infrastructural support is critical in enabling health professionals to be responsive, we argue for a more pragmatic approach that allows for reflexive engagement with the sociological contexts, systems and structures that contribute to and sustain violence in people’s lives (Gear et al., 2021). In contrast to other paradigmatic perspectives, use of complexity theory as a methodology is an ethical and efficacious choice to seek out and be responsive to the full complexity involved in responding to IPV.

With initial application of this research design, we have learned research design itself may be conceptualised as a CAS, bringing together data that reflects the interaction between multiple system elements (McDaniel et al., 2009). Conceptualising a sustainable and effective response to IPV as an emergent phenomenon, co-created through interaction between patient and professional, calls attention to the patient side of the equation, that is, how the patient creates their own health and wellbeing. Often dominant biomedical discourses ask health professionals to ‘fix’ the problem. In contrast, working as a facilitator of change and building patient autonomy and resiliency recognises the full equation of interaction between the patient’s world, the health professional’s world and the complexity involved in generating a health response to IPV (Hegarty et al., 2020; Thygeson, 2013).

Similarly, at a wider cross-sectoral systems level, a complexity theory-informed methodology views a national IPV response as emergent phenomenon, co-created through the interaction of the many different service agents involved. For example, while agents are working toward what is perceived to be the same goal, that is, reduced violence, their ontology and epistemology (e.g., as a criminal justice and/or human rights issue) shape the problem frame in a different way, and in turn shape the way they respond. Conflicting ontological and epistemological positions are negotiated as agents interact, self-organising into something more than the sum of the parts (Gear et al., 2019). Whereas a realist methodology may seek to identify patterns of interaction that lead to particular outcomes, a post-structural complexity theory methodology appreciates that outcomes are continually emergent from the sheer number, dynamism and uncertainty of interacting agents involved in this complex problem (Gear et al., 2018a, 2021).

We are shifting our attention from traditional implementation approaches to a focus on making small changes in existing systems that have potential for big impact (Braithwaite et al., 2018). Social network analysis is often used to inform intervention design, but not implementation or advancement (Shelton et al., 2018). The combination of a complexity theoretical perspective and the practical application of social network analysis gives potential to intervene in system interactions in real-time, capture the effect and adjust the intervention based on results (Gesell et al., 2013). Our participant workshops offer this opportunity. Participants will be able to highlight a problematic system interaction, theorise a possible solution, test it within their organisation and report results to the wider participant group for consideration.

The challenge for scale-up and spread of the developed response beyond the study region remains. Each CAS is unique due to its non-linear system interactions, limiting the ability to generalise intervention effects across health systems and settings (McDaniel et al., 2009). Our methodology and methods allow observation of the problem from multiple standpoints. We anticipate findings to indicate high-level principles that may be applicable across settings. For example, strengthening the interaction between common primary care relationships such as general practitioner and practice nurse. We anticipate use of system pathways and tools will differ from setting to setting and require continuous improvement. This will include monitoring unintended consequences and system gaps generated by change (McDaniel & Driebe, 2010). The learning from this study will be used to adjust the potential influence of pathways, support knowledge transferability and scale up within and between regions and advocate for policy changes.
Conclusion

Seemingly intractable complex issues, such as improving primary care service delivery to those impacted by IPV, present unique challenges for research. To date, the best evidence-based practice for responding to IPV within health care settings is insufficient. Other methodological approaches have tended to obscure or ignore context that influences what emerges from the system. We adopted a new approach to understanding this complex problem that seeks to be inclusive of the myriad of system elements involved. Conceptualising research design as a CAS, calls attention to how different methodologies and methods might work together. We described the congruency between our theoretical perspective, methodology, methods, analysis, and dissemination. We are yet to test the design through all its phases and look forward to learning from its application in the field and how this may inform our future research. Researching complex problems means becoming comfortable with uncertainty and constant change. Developing research design based on CAS principles is not ‘anything goes’ but making systematic decisions in response to what is being learnt in the field (McDaniel et al., 2009). In short, do not fall in love with ‘The Plan’.

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