Mapping pandemic responses in urban Indigenous Australia: Reflections on systems thinking and pandemic preparedness

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Abstract

Objectives: We investigate some of the strengths and challenges associated with Covid-19 responses in urban Indigenous communities in Brisbane, Australia. Our research reflects on the interconnected dynamics that impact health outcomes and mitigate or exacerbate the risk of Covid-19 spreading within urban Indigenous communities.

Methods: Three systems thinking workshops were held in 2021 with Indigenous and non-Indigenous stakeholders (N15/workshop) from State and Federal services, along with Aboriginal Community Controlled Health Organisations. All worked in the urban Indigenous health sector. Stakeholders produced a Causal Loop Diagram (CLD) incorporating the critical feedbacks determining the dynamics influencing health outcomes. The aim of the research was to help stakeholders' build awareness of how the structure of the system influences health outcomes.

Results: Stakeholders identified 6 key dynamics which have a negative or positive impact on mitigating risks of Covid-19 infection. By mapping these dynamics within a CLD, 7 intervention points were identified.

Conclusions: Systems thinking provides a useful tool in identifying the complexities associated with navigating health challenges, but further research is needed to develop frameworks that work in conjunction with Indigenous Australian methodologies.

Implications for public health: Indigenous voices and communities must lie central to health responses/policies for Indigenous peoples. When systems thinking is done by or in collaboration with stakeholders it provides a visual language that can help design public health policy. What can be ascertained is that their effectiveness is predicated on systems thinking's integration with Indigenous methodologies that acknowledges Indigenous self-determination and challenges Eurocentric representations of health and Indigeneity.

Keywords: COVID-19, Urban Indigenous Australia, Urban Health, Pandemic Preparedness, Aboriginal and Torres Strait Islander Health

Introduction

Covid-19 has presented a monumental risk to Indigenous[1] communities both in Australia and globally. It is well documented that colonisation and colonialism, via the prioritisation of western systems and ontologies deaf to Indigenous ways of knowing, doing, and being, have contributed to higher rates of immunocompromised health (Thurber et al., 2021a),[1] inferior socioeconomic conditions,[2,3,4] and other social determinants of health that disproportionately affect First Nations people. In settler-colonial settings such as Australia, risks to Indigenous health and wellbeing are not only exacerbated by pre-existing health inequities but also from the concequences of having to navigate an array of western "systems" — including heath, law enforcement, housing, and

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[1]The authors note the rich cultural diversity of Indigenous peoples in Australia. Whilst we recognise the culture distinction between Aboriginal people who live on Australia's mainland and its adjacent islands and the Indigenous people of the Torres Strait Islands, unless otherwise stated, the term "Indigenous" is used in reference to both Aboriginal and Torres Strait Islanders.

employment — that do not always align with Indigenous socio-cultural standpoints.

During the pandemic, all Indigenous people in Australia were classified by the government as "vulnerable" and were, therefore, considered a 'priority group' in state and federal policies and the responses enacted through measures such as lockdowns or granting first access to vaccinations.[5] Whilst this classification was somewhat justified — as history has shown the devastating impact colonisation and introduced diseases have had on Indigenous peoples — it is important to situate this 'vulnerability' within an ongoing context of colonialism. As many of the risks associated with pandemics have stemmed from power imbalances that centralise Eurocentric paternalism, it is important that responses to pandemics and health crises refrain from reinforcing or replicating them.

Contemporary Indigenous health and the challenges faced by Indigenous peoples necessitate the confrontation of colonisation and the power imbalances that continue to drive health inequities.[6] As colonisation led to the disempowerment and "othering" of Indigenous people through the centralisation of Eurocentric systems and attempted displacement of Indigenous cultures and knowledges,[7] responses to Covid-19 must acknowledge its embedding within colonial contexts whilst engaging in Indigenous self-determination at "individual, organizational, and policy levels".[8] Gumbaynggirr scholars Aunty Shaa Smith, Neeyan Smith et al. (Smith et al., 2021) observe how Covid-19 has exposed systems that have become out of balance since colonisation. With the upheaval that has accompanied Covid-19, however, has come an opportunity to slow down, listen, and reflect on its impact, causes, and the actions needed to restore healthy relationships (Smith et al., 2021).

In this paper, we discuss some of the risk and mitigating factors that influence Covid-19 outcomes for Indigenous people in urban communities as they navigated complex health and social systems during the pandemic. Additionally, we consider how Indigenous-led responses that empowered Indigenous organisations and community leaders contributed to culturally appropriate (and hence more effective) responses that helped keep Indigenous communities safe. Drawing on the findings of three systems workshops held with Indigenous and non-Indigenous stakeholders who work in the urban Indigenous health sector, we document (a) the benefits of applying a Participatory Systems Dynamics (PSD) methodology to help identify and disseminate some of the challenges, successes, and reforms needed in the urban Indigenous heath system and (b) the limitations of applying a western methodology within an Indigenous context. Our aim is twofold; first, to demonstrate the strength and capability of Indigenous-led responses to pandemics, and second, to highlight the need for additional and sustained support, resourcing, and funding to promote Indigenous responses that counter Eurocentricity within public health systems and policy.

Background

Since the outbreak of Covid-19, most policy responses and literature have focused on addressing the challenges associated with healthcare provision and protective strategies within remote and rural Indigenous settings[9]; Moodie et al., 2021. Whilst concerns relating to locality and service provision/access in remote locations are justified, it should be noted that 80% of Australia's Indigenous population live in urban or peri-urban locations.[10] Indigenous people in Queensland comprise 11% of the nation's total Indigenous population.[11] The high population density of Indigenous peoples in urban Brisbane, along with challenges relating but not limited to overcrowding, compromised health, and greater proclivity of encountering a larger public have created a perfect storm where Covid-19 cases and potential deaths were and still are in danger of rising significantly (Moodie et al., 2021).

Indigenous communities, health workers, and Aboriginal Community Controlled Health Organisations (ACCHOs) were fast to respond to Covid-19, in some cases enacting protective measures *before* the government declared a pandemic on the 18th of March 2020.[12] Indigenous peoples have long been aware of the threat of pandemics. A 2009 outbreak of influenza for example saw 16% of hospitalisations and 9.7% of Intensive Care Unit admittances coming from Indigenous people, despite the outbreak impacting 2.5% of Australia's population.[13] With such knowledge in mind, Indigenous communities mobilised and responded via strength-based approaches that were appropriate and relevant to their communities.[14]

This project sought to understand the ways that dynamics within existing systems were interconnected and how stakeholders apprehended, responded to, and navigated these dynamics in urban settings. The methodology we applied successfully mapped the public health system in which stakeholders worked and identified some of the levers that if pulled could potentially improve outcomes. Participants often expressed that the *system itself* was the main challenge to overcome. Whilst elements of the method did translate to an Indigenous context, including visual mapping and collaborative decision making, it mostly exposed existing challenges without translating to structural change in how public health is characterised and practiced. Our research, therefore, is best seen as the start of a conversation about wider healthcare reform through Indigenous empowerment and self-determination. The visual map produced as part of this study provides an avenue to open such discussions, but further evaluation is needed to assess how the interventions identified can be practically applied.[15–20]

Research Team

The study was led by [Deidentified] and [Deidentified], two leading Indigenous scholars at the [Deidentified] who specialise in education and public health/epidemiology, respectively. These scholars oversaw the workshops, advised on cultural protocols, and created a safe space for participants. [Deidentified], a non-Indigenous research fellow at the [Deidentified] was appointed to assist with applying and building capacity in systems thinking methodologies as it was a new field for some members of the research team. In collaboration with the research team, [Deidentified] devised the workshop activities, scripts, and provided foundational knowledge of systems thinking for both the research team and participants. With the aim of building capacity amongst Indigenous researchers, a PhD candidate whose doctorate has since been conferred, [Deidentified], contributed to the study whilst also conducting his own research on health messaging for Indigenous peoples during Covid-19. [Deidentified], a project manager with experience of working in community health from [Deidentified], and two non-Indigenous research assistants [Deidentified] and [Deidentified] also contributed to data collection and dissemination.

Objectives and aims

The targeted and focused qualitative research was conducted in 2021 during the height of the Covid-19 pandemic. It sought to understand and document how pandemic responses, including policy and service delivery, influence the behaviours and decisions that drive or mitigate risk of Covid-19 spreading.[21,22,23,24] Using a "systems thinking" approach, our research drew on the expertise of key stakeholders whose decisions were impacting the lives and health outcomes of Indigenous people in urban Brisbane, Australia. We sought to better understand how factors such as social and cultural determinants of health, socioeconomic conditions, and forms of discrimination or lack of cultural competency in the workplace, media, and community effected community members' experiences and decisions to access services or engage in protective behaviours to mitigate risk of further spread.

Methods

Conceptual framework

Systems thinking is a paradigm that seeks to unpack complex problems by identifying the behaviours or dynamics that determine outcomes, with the aim of implementing effective and responsive policy interventions. Senge (2006: 7) describes systems thinking as "a conceptual framework, a body of knowledge and tools that has been developed over the past fifty years, to make the full patterns clearer, and to help us see how to change them effectively". While systems thinking has not been used widely with Indigenous populations, it was chosen on account of its ability to collate diverse views and perspectives, whilst simultaneously mapping how decisions, behaviours, organisations, service delivery, communications, and policy are interconnected within a holistic "system". Our research was, therefore, able to focus on the consequences (both intentional and unintentional) of pandemic responses in an urban Indigenous community. In doing so, we identified some of the practices — particularly those led and controlled by Indigenous people and organisations — that have successfully prepared communities for pandemics, as well as the barriers that obstruct positive health outcomes.

By identifying what responses work best for Indigenous peoples, and what reforms are needed, more effective policies and practices may be implemented, improving health outcomes, and preparing urban Indigenous communities for future health crises and pandemics. Utilizing stakeholder input and expertise, PSD — a framework situated within the systems thinking paradigm — involves collaborative exercises that privilege the voices of those knowledgeable and invested in the outcomes sought. Stakeholders engage in Group Model Building [GMB][25,26] which is an iterative process where knowledge is built, collated, tested, debated, and visually mapped to produce a Causal Loop Diagram [CLD]. CLDs are visual maps or tools for eliciting and capturing mental models of individuals or teams to communicate the interconnections and feedbacks determining the dynamics (and their consequences) which influence and drive outcomes.[27] In our study, stakeholders produced a progressively built-up CLD that maps urban pandemic responses and how they both mitigate and generate risk of Covid-19 spread in urban Indigenous settings.

Following the study by Nakata,[28] Indigenous-led research is most impactful when it is positioned within a cultural interface that exposes and engages with the conditions of knowledge production. In our case, this means confronting how colonisation impacts health outcomes during pandemics so that measures which counter Eurocentric systems through centralising Indigenous standpoints — described by Martin[29] as Indigenous ways of knowing, doing and being — can be identified. For scholars such as Smith[30], Sherwood[31], and Tuck and Yang[32], health research is synonymous with decolonisation in that it is an act of resistance, reclamation, and survivance. Through acts of refusal[33] and prioritising Indigenous knowledges and methods, Indigenous peoples push back on hegemonic constructions of identity[34,35,36] offering pathways and solutions that are culturally appropriate and empower communities through self-determination.

As our research was Indigenous-led and focused, it is important to reflect on how PSD aligned and/or conflicted with an Indigenist conceptual framework. Whilst it is still an emerging discipline within Indigenous studies, systems thinking has been applied in several research projects relating to Indigenous people[37]; Browne et al., 2021,.[38,39] Browne and colleagues (2021) for example wrote on how Indigenous participants who took part in GMB projects praised the model on grounds that it aligned with Indigenous practices of storying and diseminating data visually. Similar to the concept of the cultural interface,[28] systems thinking was seen as having the potential to bridge western approaches to healthcare with Indigenous knowledges see also.[40] The authors however noted that the "Aboriginal health staff we interviewed were unanimous in the belief that future GMB workshops with aboriginal communities would ideally be led by Aboriginal facilitators". Despite our efforts to bridge Indigenous epistemologies with the western paradigm — e.g., through applying storytelling methods — in agreement with Browne and colleagues, more needed to be done to "develop a culturally adapted GMB methodology" (Browne et al., 2021: 6). This is something that needs to be developed and built into future systems research involving Indigenous communities.

Researchers from the University of Sydney's Brain and Mind Centre revised a Participatory Systems Model (PSM) they previously developed — aiming to help prevent suicide amongst Aboriginal and Torres Strait Islander youth — so that it better aligned with Indigenous Standpoint Theory.[41] The researchers highlight that evaluations of PSMs in Indigenous contexts are most effective when they are informed by Indigenous ontologies, axiologies, and methodologies. Indigenous participation, therefore, is needed at every stage of the evaluation process to empower communities and develop predictive planning frameworks in accordance with local needs.

Aboriginal scholars at Deakin University have established an Indigenous Knowledge Systems Lab to unpack complex issues from Indigenous standpoints that centralise relationality and connections to Country.[42] Embracing the concept of a "fire circle", the lab seeks to provide the time and space needed for Indigenous stakeholders and partnering organisations — such as the Australian Indigenous Mentoring Experience (AIME) — to develop "projects and processes that enable us [Indigenous communities] to apply Indigenous systems thinking to the wicked problems of our world"[42]: 87. The scholars embrace Indigenous language such as *mimburi ngin wanjaus* — the Kabi/Barrungam words for "flow" and the Barrungam words for "crossovers/exchanges." — to refer to the process of acquiring

systems knowledge through participatory reciprocal engagement within a *wanjau*, loosely translating to "embassy".

Other studies have documented how systems thinking has successfully been applied to Indigenous-focused research, globally. Anishinaabe/Ojibway systems scholar Melanie[43,44] has advocated for the application of "Relational Systems Thinking", which she situates in the third space or cultural interface between western and Indigenous knowledge systems. Relational systems thinking positions western frameworks within spaces that are informed by understandings of relationality and storying, allowing complex problems to be ethically navigated via a language that bridges Indigenous and non-Indigenous knowledges without replicating dominant Eurocentric worldviews. Relational systems thinking incorporates the voice of place — and all beings within it — embracing them as tools to uplift and empower communities as well as to push back on colonial structures that silence Indigenous voices.

Participants of a study investigating food environments in Hawke's Bay, New Zealand, commented on how systems thinking provided a visual language that complimented Mātauranga Māori knowledge systems.[39] Participants in other research projects have also praised systems thinking's ability to engage Indigenous knowledge holders and build wider networks amongst stakeholders with the aim of driving community-driven and culturally appropriate responses[38,40] and have used CLDs to map the social determinants of health and equity for Māori and Pacific communities in New Zealand, showing how "Western science principles and values" have impacted utilization and access to health services during COVID-19. Whilst researchers in Canada have documented the benefits of systems thinking when working with **Métis communities in** Saskatchewan, **emphasising the importance of centralising First Nations knowledge to** "challenge Euro-Western methods", lest it become an extension of **colonial epistemic** dominance.[37]

Participants

The CLD produced as part of our research was developed over three workshops held in 2021. Stakeholders were recruited from state, federal, and community-controlled organisations that work in or who are involved with the urban Indigenous health sector. Participants were recruited from the networks of its Chief Investigators, [Deidentified], and snowball recruiting via word of mouth. Approximately 15 stakeholders participated in each workshop, but numbers fluctuated due to lockdowns and the circulation of the virus. Stakeholders were both Indigenous and non-Indigenous. Participants would have ideally attended all three workshops; however, due to Covid-19 restrictions, infections, workload, and other disruptions, this was not always possible. Approximately one third of participants attended all three worktops.

There was greater representation of female stakeholders who accounted for approximately 70% of participants. Whilst having equal gender representation would have been beneficial, this percentage is comparable with the number of women working in healthcare both in Australia and globally. Whilst efforts were made to have representation across a range of fields and expertise (e.g., from ACCHOs, Public Health Networks, and academia), many perspectives were not directly represented in the workshops including elders, youth, housing representatives, representatives from corrective services, or those working in media. We recognise, however, that Indigenous health workers work across these sectors and were nonetheless able to provide valuable input into some of the challenges faced in these areas.

Data collection

Three full day workshops were held on campus at [Deidentified] in June, September, and October 2021 and were facilitated by [Deidentified], the research team, and a workshop conveyor. Ideally, stakeholders would have had sufficient time between workshops to review progress reports and the documents shared by the research team. We acknowledge that the time gap between Workshops 2 (September) and 3 (October) hindered this due to the forced cancelation of the original date for Workshop 2 because of Covid-19 restrictions. Despite this, stakeholders were engaged and informed of the progress made in the previous two workshops via progress reports. The workshops provided an opportunity for stakeholders to meet in person with healthcare workers and academics with shared interests and experiences. In some cases, it was an opportunity to meet with peers that stakeholders collaborate with or have done so in the past. In others, the workshops facilitated network and relationality building.

Workshop 1 centred on introducing stakeholders to systems thinking; defining the scope of the study; conceptualising the problem that needed unpacking. By facilitating a series of scripted activities, the research team encouraged stakeholders to discuss what outcomes they and the communities they work with wanted for urban Indigenous communities during pandemics, as well as the elements they believed aided and/or hindered these outcomes from manifesting. The second workshop began to unpack the relationships and feedback structures identified within the urban Indigenous pandemic responses. After collating the data gathered from Workshops 1 and 2, the research team presented stakeholders with the *Urban Indigenous Pandemic Response CLD* (see **Figure 1**) developed by [Deidentified] using Vensim software. Participants were supplied with diagrams in advance of each workshop via progress reports. Workshop 3 focused on unpacking the CLD and identifying areas where workable policy interventions could provoke outcomes that would mitigate risk of Covid-19 infections.

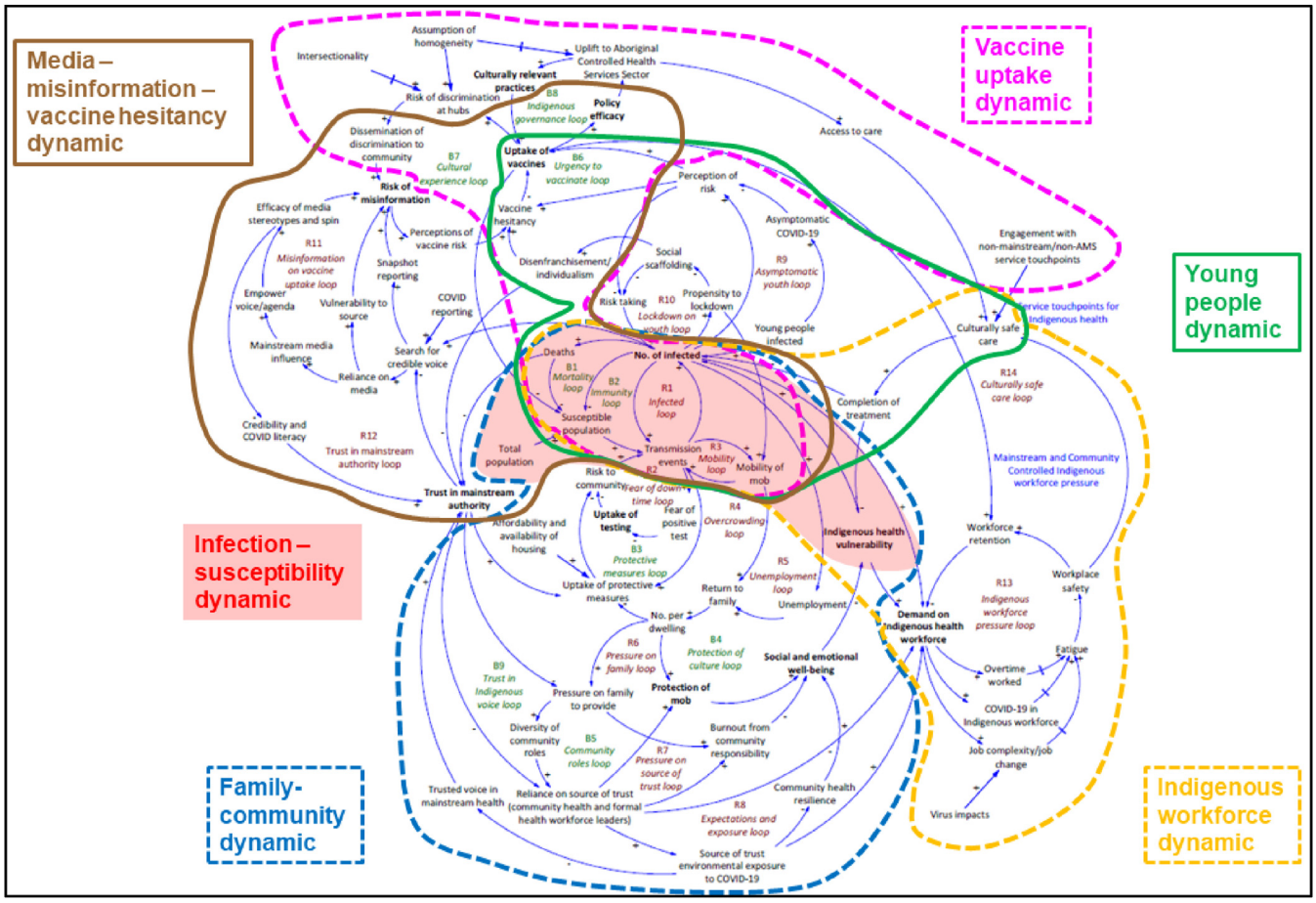
Results

During the first workshop, stakeholders identified 12 key dynamics that they saw as contributing to the risks and protective factors to the spread of Covid-19. Stakeholders considered how each element interacted and informed one another producing outcomes that either exacerbated or mitigated risk of Covid-19 infection.

In the second workshop, stakeholders produced six Interrelationship Diagrams (ID) that expanded on seed models (Vennix, 1996) that the research team presented to participants as stimulus for discussion [see **Figure 2**]. The theme of each seed model was based on the 12 dynamics identified in the first workshop [see Table 1] and included (1) communications; (2) family and households; (3) Indigenous health workforce; (4) health and wellbeing; (5) trust; (6) vaccines (see Table 2).

The research team combined each of the seed diagrams to produce a single CLD [see Figure 1]. Potential policy interventions were identified and discussed during the last workshop. Both the dynamics that stakeholders identified as key drivers/mitigators of Covid-19

Figure 1: Urban Indigenous Pandemic Response CLD. CLD, Causal Loop Diagram.



infection, as well as potential touchpoints for policy interventions, are discussed in greater detail below.

Identifying the dynamics that drive and mitigate Covid-19 infections

Stakeholders identified that mitigating infections should lie central to all pandemic responses (see infection susceptibility dynamic, Figure 2). Whilst short-term responses such as lockdowns were necessary, stakeholders consistently spoke to the need to address systemic issues relating to pre-existing health inequalities and vulnerabilities of Indigenous peoples, socioeconomic concerns, and the cultural competency of institutions and service delivery. Addressing these was thought to potentially have a significant impact on reducing risks associated with Covid-19 spread and other pandemics, long-term.

Stakeholders spoke in depth of Indigenous peoples' struggles to afford essentials such as rent, food, and electricity, and how this exacerbated hesitations to get tested out of fear of employment and financial repercussions (see family–community dynamic, Figure 2). As testing was the cornerstone of pandemic responses before a vaccine was readily available, socioeconomic concerns such as these were seen as major risk factors. Overcrowding and mobility were also raised by stakeholders as dynamics of concern. Living in in multigeneration households and in close proximation to others, placed the elderly at particular risk, and heightened probability of transmission flows between community and the household, and vice versa.

Young people were identified by stakeholders as having the potential to accelerate the spread of virus due to their having a more social lifestyle, high mobility, and in many cases their being asymptomatic (see young people dynamic, Figure 2). The impact that policies were having on the youths' mental health was also raised, as was a lack of trust of mainstream health messaging/authorities. Mistrust was seen as having the potential to lead some youth to ignore calls for protective behaviours. Youth, however, were also seen as sources of strength and protection, enforcing positive Indigenous led messaging.

The role of "trust" as a protective measure and mitigator of risk was raised in relation to all themes with Indigenous health workers and Aboriginal Community Controlled Health Organisations characterised as trusted sources of information and health delivery. Stakeholders, however, recognised that this placed additional demands on the Indigenous workforce which impacted Indigenous people's personal and professional lives (see Indigenous workforce dynamic, Figure 2). Increased workloads, responsibilities, and pressures — which often went unpaid and/or unrecognised within the mainstream health sector — as well as cultural unsafe work environments had the potential to hinder efforts to curb the spread of virus via burnout and impacts to staff retention.

Figure 2: CLD seed/interrelationship diagram. CLD, Causal Loop Diagram.

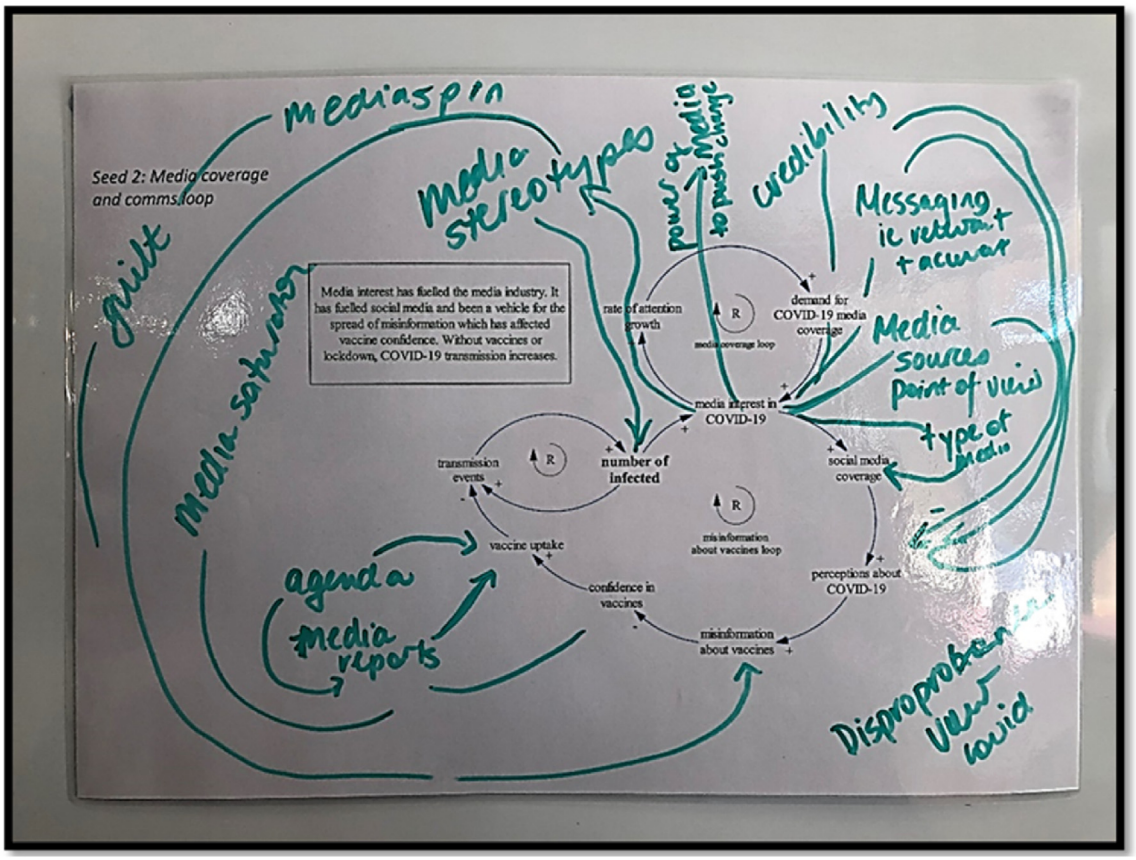


Table 1: Indigenous Urban Health Dynamics.

Indigenous Urban Health Dynamics	
Communications	Health and wellbeing
Family and household	Trust
Indigenous health workforce	Vaccines
Financial issues	Cost of delivery
Policy	Cultural business
Infection rates	Mental/social health

Throughout the pandemic, people have been dependent on media to receive necessary information and messaging about Covid-19. Stakeholders found that one-size-fits-all responses to the virus, and a lack of diversity in the media, compromised uptake of protective behaviours (see media and misinformation dynamic, Figure 2). Indigenous organisations took on the responsibility of targeting Indigenous communities in culturally appropriate ways, but this was often done with limited resources and funding. Some identified the stress of trying to do the best they could while worrying for community members at the same time. It was believed that the leadership of ACCHOs and community groups needed to translate to and for mainstream media platforms, and quickly to help Indigenous people best manage the situation. Negative media presentations and stereotypes that characterised certain ethnic and cultural groups as "problematic" were seen as detrimental to trust amongst Indigenous peoples. Whilst social media contributed to the circulation of positive messaging, it also spread conspiracy theories and misinformation that discouraged protective behaviours.

As vaccinations became readily available, they emerged as the main protective response to Covid-19 (see vaccine uptake dynamic, Figure 2). Vaccine hesitancy amongst Indigenous peoples, however, was a major concern to stakeholders. Classifications of Indigenous people as a "priority group" or "vulnerable group" fed into some peoples' mistrust towards what they perceived as an untested vaccination. Negative and racist experiences encountered by Indigenous people at the hands of culturally illiterate health service providers and vaccination hubs also fuelled hesitancy. ACCHOs were unanimously seen by stakeholders as pivotal to providing targeted responses to Covid-19, especially in encouraging and facilitating protective measures such as vaccinations.

Identifying intervention points to improve pandemic preparedness and outcomes

Having outlined the dynamics that stakeholders saw as contributing to the dynamics that shape the outcomes of Covid-19 responses, attention turned to how these insights could translate into practical interventions. Stakeholders identified 7 interventions with the potential to improve pandemic responses and encourage protective behaviours in urban Indigenous communities. This included minimising mobility; incentivising protective behaviours; generating coordinated responses; addressing burnout; developing a

Table 2: Touchpoints for minimizing Covid-19 risks.

Target	Intervention
Minimise mobility	As an airborne virus, minimising the mobility of those infected continues to be necessary despite the relaxing of self-isolation rules. Designated family members were seen as potentially playing an important role in running households' errands and liaising with service providers.
Incentivise protective behaviours	Whilst some stakeholders raised the idea of cash incentives or lotteries to encourage vaccinations, Indigenous-led responses and awareness campaigns led by ACCHOs were unanimously identified by as having the greatest potential to encourage protective behaviours.
Generate coordinated responses amongst service providers	Mainstream health providers too often silo information and healthcare within one-size-fits-all frameworks. A coordinated response amongst service providers, and community organisations including universities, government organisations, community clubs and others could help disseminate important information and increase exposure to protective messaging.
Address Burnout	In efforts to mitigate burnout and fatigue, policies need to recognise the demands and pressures associated with working in Indigenous healthcare, and the contributions made by the Indigenous workforce. Immediate action through the renumeration of overtime, implementation of flexible work arrangements, and recognising the cultural needs of both the workforce and patients are needed.
Develop a pandemic action plan	A streamlined step-by-step action plan to help guide communities in how best to respond to future health crises may assist in pandemic preparedness. This would include establishing meaningful partnerships with service providers, organisations, and industry, as well as building skills within the Indigenous workforce.
Overcrowding	Long-term solutions such as providing affordable social housing may reduce overcrowding and the spread of viruses in future pandemics. Immediate responses, however, include providing access to temporary housing where those infected can be provided with adequate accommodation, support, and culturally appropriate care.
Future proof Indigenous messaging and service delivery	Indigenous peoples and organisations such as ACCHOs are best positioned to respond to the challenges faced in their communities and deliver culturally appropriate health messaging. Long-term financial support and resourcing will ensure their longevity and continuing impact. However, attention must also turn towards building Indigenous peoples' trust in mainstream services thorough accurate reporting and increased Indigenous representation.

community-driven pandemic action plan; address overcrowding; future proofing Indigenous messaging and service delivery. These interventions are outlined in Table 1 below.

Reflections

In collaborating with stakeholders to develop the Urban Indigenous Pandemic Response CLD, we sought greater understanding of the dynamics that were driving and mitigating the spread of Covid-19 in urban Indigenous communities in Australia. Our research aimed to develop a framework that could improve decision-making and preparedness for future outbreaks. In effort to amplify stakeholders' voices, Participatory System Dynamics was used as the primary methodology. In a social setting that prioritises Eurocentric epistemologies, our research sought to understand the problem specifically from Indigenous perspectives. During the three workshops, stakeholders shared, debated, and challenged one another to reach consensual understandings of some of the dynamics that drive and mitigate risk of Covid-19. Bogdewic and Ramaswamy (2021: 6)[45] highlight that systems thinking aims "to help stakeholders consider where in a system it makes sense to intervene in order to disrupt dynamics that result in undesirable outcomes". Our use of systems thinking methods were beneficial in its capacity to provide a visual language that encouraged deeper consideration into the impact that policies and decisions were and are having on Indigenous peoples, as well as their positive and negative outcomes.

Whilst the CLD provides insight into where interventions can be made, many of the challenges relating to Indigenous preventative health and pandemic preparedness relates to pervasive systemic issues that are often rooted in racism and colonisation and continue to drive disparate social and health outcomes. Consistent with other systems thinking studies that have been led by or conducted with Indigenous scholars[41,42,43,44]; Browne et al., 2021,[40] systems interventions must address both micro and macro determinants of health informed and perpetuated by colonialism. Interventions, however, should not be one-size-fits-all but rather adaptive to local needs and delivered by trusted Indigenous sources.[46] Furthermore, as the dynamics in need of disruption as embedded within western structures, it is necessary to situate systems within a cultural interface where Indigenous lived experiences are understood in relation to how they are impacted by colonisation and resisted through self-determination.

During our study, some stakeholders expressed that the technical jargon about system thinking used in the workshops was at times difficult to follow and that the language did not always accurately reflect the discussions in the room. The use of seed models developed by the research team (from the input of stakeholders) was problematic due to its ability to lead or direct conversations in a certain direction — although data were consistently presented back to stakeholders for their input and changes were made to phrasing if needed. Whilst our study was led by experienced Indigenous scholars with extensive Indigenous public health experience, this approach to systems thinking was a new methodology to many, meaning that the research team was reliant on the expertise of its non-Indigenous systems thinking expert. Having an Indigenous workshop facilitator versed in both systems thinking and Indigenous cultural protocols would have helped break down some of the barriers associated with its frameworks and methodologies.

Albeit providing rich and valuable insight into pandemic preparedness in urban Indigenous settings, our study would have been advanced by further integrating systems thinking with Indigenous methodologies such as Indigenous Standpoint Theory,[41,42] Relational Systems Thinking (2022, 2021), or Mātauranga Māori[39] as other studies have done. Indigenist research methods are best placed to navigate the cultural interfaces where colonialism and Indigenous ways of knowing, doing, and being intersect. They provoke conversations not only about how interventions can improve outcomes within existing systems but challenge us to consider how the paradigm in which systems operate can be transformed. Considering this, we recognise the need to further build the capacity of Indigenous Systems Thinkers in Australia and acknowledge that this may take time. Addressing these challenges can elevate the discipline when applied to Indigenous led/focused research.

Systems thinking nonetheless was beneficial in its ability to help stakeholders and the research team identify the complexities associated with pandemic responses and make sense of a difficult situation. One stakeholder commented how the "visual tools to link cause and effect were valuable and enabled a deeper understanding of their complexity." As the workshops were held during the pandemic, and subsequent rules on social distancing, many participants had not seen their peers for an extended period. The workshops therefore allowed stakeholders to engage colleagues across difference areas of the urban health sector and gain what one stakeholder described as a "helicopter overview" of the challenges they were encountering in their professional and personal lives. When reflecting on the development of the CLD, a stakeholder expressed how it "is the first map I have seen that has some visibility of the fluidity and complexity of working in our communities and families, it's a collective, it's their voices, and it's recognised in this map".

PSD provides a tool to envision and articulate the complexities associated with pandemic responses in urban Indigenous communities. The CLD was the product of much debate, deliberation, and collaboration amongst stakeholder experts who experienced and responded to the triumphs and challenges associated with healthcare delivery during Covid-19. By mapping the interconnections between some of the dynamics that collectively shape the urban health system (and the causalities that drive or mitigate the spread of virus), stakeholders were equipped with the tools needed to further develop partnerships and strategies that have the potential to enhance targeted, coordinated, collaborative, and culturally appropriate pandemic policies.

The insights gained from this study primarily stem from it being Indigenous-led and through it privileging the voices of stakeholders who are invested and accountable to the communities to which they belong, and in which they work. Many of the challenges highlighted by stakeholders and discussed in this article correspond to the ongoing legacies and continuation of colonialism.[47] This raises the question of how system interventions can be made when it is the *system itself* — and not just the dynamics within it — that needs reform. Moana[7]; para 39) has observed that the problems caused by Covid, and the exclusionary view of healthcare that it has given rise to, will persist as long as the social, economic and constitutional systems established by colonisation are allowed to continue. Changing such systems will not be easy because power, and especially colonising power, always fiercely protects its unjust self.

Systems thinking research can help stakeholders articulate the areas where greater support, resourcing and investment in Indigenous-led solutions are needed. However, it must work in conjunction with and to benefit of Indigenous knowledges and standpoints.[28] As Indigenous people are the first systems thinkers, systems models within Indigenous research (especially in settler-colonial settings) should be first and foremost guided by Indigenous epistemologies — not vice versa. Embedding systems models within Indigenous knowledges demands the confrontation of coloniality and the implications of establishing, maintaining, and non-Indigenous profiteering from colonial systems. Rather than focusing on how interventions can help patients and service providers successfully navigate the current healthcare systems, Indigenous systems thinking should focus on how healthcare systems can be transformed into something new and inclusive of Indigenous ways of knowing, doing, and being.

Conclusion

PSD is best utilised as a tool that can be tailored in accordance with the methodologies and cultural protocols outlined by Indigenous peoples and communities. Following the work of Indigenous systems scholars at the Indigenous Knowledge Systems Lab,[41] the work of[43,44] on Relational Systems Thinking, or the integration of systems thinking and Mātauranga Māori,[39,38] more research on Indigenous Australian focused PSD is needed to build strategies that can help create the paradigm shifts needed to make meaningful and lasting change to public health and pandemic preparedness. Failing to do is to treat Indigenous health vulnerabilities as symptoms of their Indigeneity, rather than addressing its underlying cause — the inequity generated and maintained by colonialism. This research, however, is testament to Indigenous survivance and the fact that Indigenous peoples, organisations, and health workers (assisted by their non-Indigenous allies) are best equipped to face the health and social challenges that continue to present monumental risks to Indigenous communities.

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Conflict of interest

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