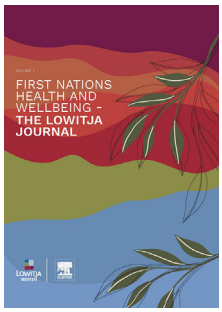

Original Research

‘We know what our communities need’: What the Indigenous health sector reveals about pandemic preparedness in urban Indigenous communities in Australia

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Abstract

Purpose In 2021, during the height of the COVID-19 pandemic, researchers from the University of Queensland sought greater understanding of how responses to the pandemic impacted the spread or mitigation of virus in Indigenous communities in southeast Queensland, Australia. This article used a systems thinking methodology to critically unpack the strengths and challenges associated with pandemic responses during COVID-19 in urban Brisbane, Australia.

Methods The findings from three Indigenous-led workshops held in 2020 with Indigenous and non-Indigenous stakeholders from the urban health sector were documented. By visually mapping the dynamics that influence the outcomes of health responses, this study found that holistic understandings of complex problems such as COVID-19 can be gained, and more effective policy implemented. Drawing on the insights provided by stakeholders from state, federal and community representative bodies, it discussed how infection rates, socioeconomic conditions, age-specific responses, Indigenous participation and treatment in the workforce, media and communications, and vaccinations are key determinants that shape positive or adverse outcomes during pandemics.

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https://doi.org/10.1016/j.fnhli.2024.100019

Main findings This research found by addressing issues relating to mobility; incentivising protective behaviours; engaging in coordinated responses; improving cultural literacy; and limiting overcrowding that preparedness and responses to COVID-19 and future pandemics may improve.

Principal conclusion This study, led by Indigenous scholars at the University of Queensland, examines the health and social outcomes of Indigenous peoples and health workers during pandemics in urban settings. The study incorporates systems thinking, emphasising new approaches to complex problems. The research highlighted systemic challenges in pandemic responses, emphasising the need for policy reform, particularly in areas like housing. However, applying these insights into practice remains challenging, and further investigation into the practical application of systems thinking in Indigenous health is needed.

Keywords: COVID-19; Pandemic preparedness; Epidemiology; Indigenous Australia; Indigenous health; Systems thinking

Highlights

- The benefit of systems thinking lies in its capacity not to 'fix the problem' but in its ability to provoke new ways of thinking and approaching complex problems to find common solutions.
- Applying this approach to complex problems like COVID-19 reveals the complex dynamics that influence the outcome of health responses in Indigenous communities, such as infection rates, socioeconomic conditions, age-specific responses, Indigenous participation in the workforce, media and communications, and vaccinations.
- Addressing issues relating to mobility, incentivising protective behaviours, engaging in coordinated responses, improving cultural literacy, and limiting overcrowding may increase preparedness and responses to COVID-19 and future pandemics.

Introduction

In 2021, researchers from the University of Queensland conducted a rapid study to better understand pandemic preparedness and the impact COVID-19 policies were having on health outcomes in urban Indigenous communities in Brisbane, Australia (Fredericks et al. 2021b; Fredericks et al. 2022b; Fredericks et al. 2021a; Fredericks et al. 2022a). The research was led by Professor Bronwyn Fredericks and Professor James Ward, two leading Aboriginal scholars in the fields of public health, education and epidemiology. They worked with a team of Indigenous and non-Indigenous researchers from a range of fields to develop and implement the research project. In recognition of the complexity of the diverse and interlocking social and political consequences of pandemic responses, which influence health outcomes, a 'systems thinking' methodology was applied, which was led by a systems thinking scholar: Sue McAvoy.

This article draws on some of the findings from this research and considers what the stakeholders who directly responded to COVID-19 in urban Indigenous settings could teach others about pandemic responses and preparedness. It begins by providing an overview of systems thinking methodology, discussing how it has been applied to health in a range of contexts, and more specifically within Indigenous settings and with Indigenous peoples. Systems thinking presents a visual model that may assist in gaining holistic understandings

of complex problems. While concepts of holistic health and Indigenous ways of thinking, being and doing have been understood to be within Indigenous societies (McPhail-Bell et al., 2013; World Health Organization, 1997; Houston, 1989), the application of systems thinking as defined within a disciplinary context is still emerging within the field of Indigenous studies. This research disseminated some of the benefits and challenges associated with implementing systems thinking in Indigenous-led research.

This article reflects how systems thinking might benefit pandemic preparedness by encouraging a shared understanding of health crises from a local grass-roots level. As a collaborative exercise that embraces the knowledge and expertise of Indigenous and non-Indigenous frontline respondents, it identifies a number of the key dynamics believed to drive and mitigate COVID-19 infection rates. Additionally, it highlights the consequences of policies, both intended and unintended, enacted to curb its spread. Informed by stakeholder input, it identifies seven key areas that when targeted have the potential to produce positive health and social outcomes for Indigenous peoples in urban settings. Systems thinking provides a visual language that provokes deeper consideration into the impact that policies and decisions have on Indigenous peoples – both positive and negative. In mapping the challenges associated with COVID-19 responses for Indigenous peoples in urban settings, it advocates for holistic approaches to health policies to be developed, which privilege the voices of Indigenous peoples and the needs of communities.

Methods

In 2021, three workshops were held on campus at the University of Queensland, Australia, with the aim of gaining a holistic understanding of the responses to COVID-19 in urban Indigenous communities. Each workshop had approximately 15 stakeholder participants from state, federal and community-controlled organisations. Participants were both Indigenous and non-Indigenous, and all worked in the public health sector. Participants were recruited from the networks of the project's two chief investigators (CIs), both who identify as Aboriginal. Most participants (70%) were female and, whilst the benefit of having a diversity of gendered perspectives is acknowledged, this number aligns with healthcare workers both in Australia and globally. Due to COVID-19 restrictions, and other disruptions and responsibilities, some representatives could not attend all three full-day workshops; in such instances, a representative was sent in their place. The workshops provided an opportunity for stakeholders to meet in person with healthcare workers and academics who had shared interests and experiences of the pandemic. As this research sought to identify and map the diverse responses to the pandemic in urban Indigenous communities, it was decided that structuring the workshops around a 'systems thinking methodology' would be an innovative approach to the topic, which is discussed in further detail below.

Systems thinking methodology

Systems thinking is a paradigm that embraces stakeholder input to document and collate diverse views, experiences and expertise with the aim of responding to complex problems (Arnold and Wade, 2015). Senge, 2006, described 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'. There are different qualitative and quantitative approaches and tools within systems thinking that may help its users gain a holistic understanding of the interplay between the elements, or dynamics, that collectively shape and determine the behaviour of a 'system'.

Participatory system dynamics

Participatory system dynamics has been used to study how system structures drive the overall behaviour of systems (Forrester, 1969; Sterman, 2002). Participatory system dynamics were used in this study and involved three qualitative participatory workshops where stakeholders collaborated and shared their experiences and knowledge of working in the urban Indigenous health sector. The aim was to arrive at a shared understanding of the system structure and to improve understanding, acceptance, performance and outcomes of urban health policy. A diverse stakeholder group included Indigenous and non-Indigenous health workers, academics, doctors, nurses and other representatives from state, federal and community-based organisations who were involved in pandemic responses in the Brisbane metropolitan area. Representatives were recruited via the CIs' existing networks and the Poche Centre for Indigenous Health at the University of Queensland.

Each workshop followed the group model building (GMB) method, which is a participatory process dependent on stakeholder collaboration to facilitate co-design and generate collective knowledge (Andersen and Richardson, 1997; Hovmand et al. 2012). Over the course of three workshops, a series of scripted activities, facilitated by a non-Indigenous CI systems thinking practitioner, encouraged rigorous discussion and debate that contributed to the development of a number of causal loop diagrams (CLD).

- Communications
- Family and households
- Indigenous workforce
- Financial issues
- Vaccines
- Cost of service delivery
- Policy
- Number of infections
- Health and wellbeing
- Trust
- Cultural business
- Mental and social health

Causal loop diagrams

Causal loop diagrams are tools that visually represent mental models around hypotheses about the causes of a specific problem or issue (Sterman, 2000). In the case of this research, the central issue that was presented to stakeholders was: what are the protective and risk factors that contribute to COVID-19 infections for Indigenous peoples in urban Brisbane? Stakeholders identified and prioritised 12 key dynamics impacting COVID-19 infection rates and outcomes:

Systems thinking encourages a holistic understanding of the causal links and interconnections between system elements, so that leverage points can be identified for interventions that can move the system into better behaviours. This involves thinking through the intended and unintended consequences of actions. Stakeholders were asked to not only consider the actions and decisions believed to shape one dynamic, but to also work towards representing the content within their mental models as a web of feedback loops. For example, messaging and communications can impact outcomes in vaccination uptake, but also impact trust and mental and social health amongst other things. Thinking in feedback loops introduces a dynamic perspective (Sterman, 2000; Richmond and Peterson, 2001; Richmond, 2010).

Reinforcing and balancing loops

The CLD is a visual mental model that maps feedbacks, of which there are two types. Reinforcing loops reinforce change (Monat and Gannon, 2015). The rapid increase in COVID-19 in a community is a simple but powerful example of a reinforcing loop, as there is a direct link between the rate of infection and the number of COVID-19 cases. The more people in a population with COVID, the higher the risk of more people becoming infected (Richmond, 2010).

However, when an action counteracts change to produce a different result, it is known as a balancing loop or counteracting loop (Brailsford, 2008). One example of a balancing loop identified by the stakeholders was how tailoring COVID-19 responses around trusted and culturally appropriate messaging and service delivery could reduce negative experiences believed to obstruct protective behaviours, such as vaccination, and, in doing so, improve vaccine uptake amongst Indigenous peoples. Counteracting loops maintain stability (Richmond, 2010).

The purpose of visually documenting loops lies in their ability to reveal the leverage points where interventions can be made to: a) change the trajectories that drive undesirable health outcomes; and b) surface the pandemic behaviours and responses that produce positive results (Calder et al. 2018). For example, overcrowded housing clearly stood out as a touchpoint in need of intervention in this study. Inadequate infrastructure was deemed to lead to overcrowding, which in turn led to an inability to self-isolate, all of which exacerbated the risk of COVID-19 infection. How systems thinking has been applied to other health studies, and how this informed the current research, which sought greater understandings of pandemic responses in urban settings, is now discussed.

Systems thinking in health

Systems thinking has been widely applied to complex health issues in an attempt to build an understanding of the problems that are faced, and to inform policies that are responsive to diverse health challenges. For example, a study conducted by the Mitchell Institute for Education and Health Policy at Victoria University investigated how rates of physical inactivity correspond to health outcomes in Australia (Craike et al. 2020). It recognised the potential of systems thinking, stating that 'a whole-of-system approach to physical activity, which includes many separate sectors, organisations, and agencies, may be a good way to move forward in tackling population physical inactivity' (Craike et al. 2020:8). A study conducted by Trani and colleagues (Trani et al. 2016) also applied community-based system dynamics to outline the barriers hindering access to healthcare for people with mental illness in Afghanistan.

A cross-sectional review of literature of comprehensive community initiatives and the methodologies used when engaging with Indigenous communities found that studies that incorporated systems thinking often 'viewed contextual issues as impediments to generalisability and focused on control over, as opposed to understanding of such issues' (Gillespie et al. 2020:180). In agreement with its authors' critique, it is argued that contextual issues, such as the impact of colonisation, cannot be written out of studies that seek to gain a holistic understanding of health in settler-colonial settings. Challenges relating to colonisation, and exacerbated by COVID-19, were consistently raised by stakeholders during this research, demonstrating the importance of incorporating context into systemic research.

Although a discipline that seeks holistic understandings of a given problem, Reynolds argues that systems thinking research must not be tasked with providing a picture of a 'total, unified system' as this would be arrogant and 'quite problematic' (in McIntyre-Mills and Corcoran-Nantes, 2021:691). The benefits of systems thinking lies in its ability to challenge stakeholders and audiences, including policymakers, to think differently about issues that are often treated as if they exist in isolation to one another. It provides a 'conceptual lens that can help us understand complexity' (Riley et al. 2021:556).

However, defining a system can be difficult (Morgan, 2022), and the current research faced challenges as to what constituted the 'urban Indigenous health system' and which stakeholders to include or could be included in relation to their availability while they were managing responses to the pandemic. In systems thinking methodology, this is referred to as defining the boundary conditions of a system.

The CLD that was produced is by no means total or complete, but it does represent the interconnections between some of the actions and policies that are driving health outcomes, often in unexpected and unintended ways. Whilst not 'solving' the complexities attached to pandemic responses, CLDs can contribute to 'the capacity of governments in Australia to work using systems thinking; that is, to be responsive, flexible, and adaptable to meet community needs' (Morgan, 2022:9). The benefits of systems thinking lie in its ability to provoke critical discussion about policies from a grass-roots community level (Bogdewic and Ramaswamy, 2021); this was from an urban Indigenous perspective in this study.

The capacity of systems thinking to effectively shape government health policy was further identified by Bradley and colleagues (Bradley et al. 2020:1), who observed how systems thinking 'can help policymakers understand and influence the spread of infection and its multifaceted consequences across the community since society is itself a complex adaptive system.' The data represented in this study reflect points in time within local contexts, countering policies driven by top-down approaches that are often homogenous and static. Bogdewic and Ramaswamy (2021:6) highlighted 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'. Interventions must be informed by the voices and needs of Indigenous peoples but also demand 'understanding of relationships between micro and macro determinants of health from which population and health inequalities are produced' (Sharma et al. 2021:2).

Pandemics require that governments respond to local social and cultural needs whilst not appearing inconsistent, discriminatory or contradictory. In their construction of a CLD during the early stages of the COVID-19 pandemic, Sahin and colleagues (Sahin et al., 2020:20) observed how:

> *Government policies need to consider deeper leverage points that can be realistically maintained over the long-term, as infection rates trend up and down. Public confidence and trust in governance may be negatively impacted with regular 'shallow', knee-jerk daily or weekly rule changes.*

The inconsistencies of COVID-19 messaging by governments and its failure to reach Indigenous audiences in Australia were identified by stakeholders in this study, who described them as both compromising trust amongst a population already mistrustful of mainstream services and impacting protective responses such as vaccination rates (see for example Fredericks et al. 2022a).

Although an emerging methodology within Indigenous settings, numerous studies have applied systems thinking to research seeking to address and build understanding of social challenges faced by Indigenous peoples in local, national and global settings. Systems thinking has been used to document the impact of past pandemics such as an outbreak of influenza that disproportionately affected Indigenous peoples in 2009 (Crooks et al. 2018). Crooks et al. (2018) caution against one-size-fits-all responses to

healthcare and call for greater integration of Indigenous voices and perspectives, especially during pandemic responses. The authors argue that collaborative and participatory responses are needed to form meaningful partnerships with Indigenous communities, but emphasise that Indigenous peoples must be at the centre of decision-making processes.

Browne and colleagues (Browne et al. 2021) documented the potential of systems thinking and GMB to bridge Western approaches to healthcare with Indigenous ways of knowing, doing and being in Australia. Evaluating the responses of 18 Aboriginal peoples who participated in GMB projects in New South Wales and Victoria, they noted how the disciplines' inclination to disseminate data visually and via storytelling techniques appealed to their Indigenous participants and translated to methodologies that Aboriginal people were familiar and comfortable with (see also Sharma et al. 2021). The participatory and collaborative nature of systems thinking was also seen to create community ownership, incorporating Indigenous voices and input in real time. As an Indigenous-led project, this research sought to create a safe environment that encouraged stakeholders to define the problems faced in relation to COVID-19 in urban settings. This approach aligns with Indigenist and decolonising methodologies (Rigney, 2006; Smith, 2012), which emphasise that research with Indigenous peoples must always be performed for the benefit of Indigenous peoples and seek to build capacity and long-term prosperity with and for Indigenous communities. Moreover, the research needs to be grounded in the reality of Indigenous lives (Rigney, 2006).

Some of the Indigenous stakeholders in this study commented on how the technical jargon and terminology – embedded within the Western paradigms that LaValle, Troupe and Turner (2016) forewarn – was difficult to follow and understand. The content was at times dense, with workshops providing insufficient time to recap key concepts and terms. Whilst efforts were made to bridge Indigenous knowledges with the Western paradigm in which systems thinking is based (for example, through applying storytelling methods [Gorman and Toombs, 2009; Walker et al. 2014]), more is needed to be done to 'develop a culturally adapted GMB methodology' (Browne et al. 2021:6). In their use of GMB, Browne and colleagues (2021:5) have stated 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'.

Accordingly, having an Indigenous workshop facilitator familiar with both systems thinking and Indigenous cultural protocols in the current workshops would have helped break down some of the barriers associated with its frameworks and methodologies. This would have also made it easier for the Indigenous researchers who were present, and the senior Indigenous people within the workshops. While this study was Indigenous-led and aimed to build knowledge of systems thinking amongst its Indigenous CIs and stakeholders, the Indigenous staff had varying degrees of understanding of the discipline, placing the responsibility of leading the systems work on the non-Indigenous expert and outsourced a non-Indigenous workshop facilitator who was familiar with systems thinking models.

It is acknowledged that capacity building amongst Indigenous peoples in the field of systems thinking will take time and that there does need to be greater discussion about the advantages and disadvantages of this type of work with Indigenous communities. In addition, those people working within systems thinking in the field need to make a commitment to transferring knowledge and skills, along with

co-sharing power. Regardless, capacity in systems thinking did build amongst participants who gained a foundational knowledge of the method and took new insights with them to consider and potentially apply in their fields of expertise.

Indigenous researchers are best equipped to advance systems thinking methodologies for the benefit of both their communities and a range of fields and disciplines. In their review of systems thinking literature, Riley and colleagues (2021) noted how systems thinking is inherently interdisciplinary and requires a range of methodologies to identify boundaries, different perspectives and interrelationships. The authors question: 'where do we find systems scientists able to move across and between methods and inquiry processes?' (Riley et al. 2021:559). Indigenous scholars who work in disciplines and institutions, which in some cases are fundamentally different to their own cultures and worldviews, are best placed to conduct interdisciplinary research and lead discussions that collate different perspectives and drivers of outcomes. This view was evidenced by the stakeholders of this study, many of whom were Aboriginal, whose input into the interrelationships between Indigenous and non-Indigenous dynamics of health systems provided insight into pandemic preparedness and responses.

Research findings: factors contributing to the spread and mitigation of COVID-19

Stakeholders identified 12 themes that play a key role in shaping COVID-19 response outcomes. Six subthemes also emerged. Each theme was unpacked individually by stakeholders who were asked to identify feedback loops between the system variables. The subthemes identified were infection rates; family and socioeconomic considerations; age-specific responses; trust and burnout amongst Indigenous health workers; media and communications; and vaccinations. Some of the key findings from each subtheme are discussed below. The position of a feedback loop within the wider system (Figure) are numbered (such as, in R1 and B2 the 'R' refers to a reinforcing loop, producing a reinforced outcome, whilst 'B' indicates that the action is counterbalanced).

Infection rates

Central to pandemic responses is the need to control, mitigate and ideally eliminate rates of infection (Moodie et al. 2021; Bollyky et al. 2022; Stanley et al. 2021). The number of COVID-19 cases serves as the epicentre of the CLD with all loops in the diagram being traced to/from the 'Infected loop' (R1). The paths leading to/from R1 outlines the chains of behaviour that either increase the number of cases or mitigate them. As infections increase, so does the risk of further spread. Whilst the risk of the virus spreading is balanced by the albeit short-term immunity gained by contracting COVID-19 (B2), which may delay the rate of spread, this was not seen as a viable prevention strategy or as proportionate with the risk of severe symptoms, long COVID or death (Slot et al. 2020). Consistent in all the discussions with stakeholders was that pre-existing health inequalities and vulnerabilities due to the immunocompromised health status of many Aboriginal and Torres Strait Islander peoples (Thurber et al. 2021; Power et al. 2020) ultimately placed the Indigenous populations at greater risk of infection. The persistence of health inequities and vulnerabilities was documented as a reinforcing loop (R2) that increased risk of infection, whilst measures that balanced inequities and improved the overall health and immunity of Indigenous peoples was integral to mitigating this risk.

Socioeconomic considerations

Whilst the pandemic provoked feelings of isolation amongst many people during the lockdowns (Dudgeon et al. 2022b), by its very nature, it exposed the extent to which people and their health and wellbeing are

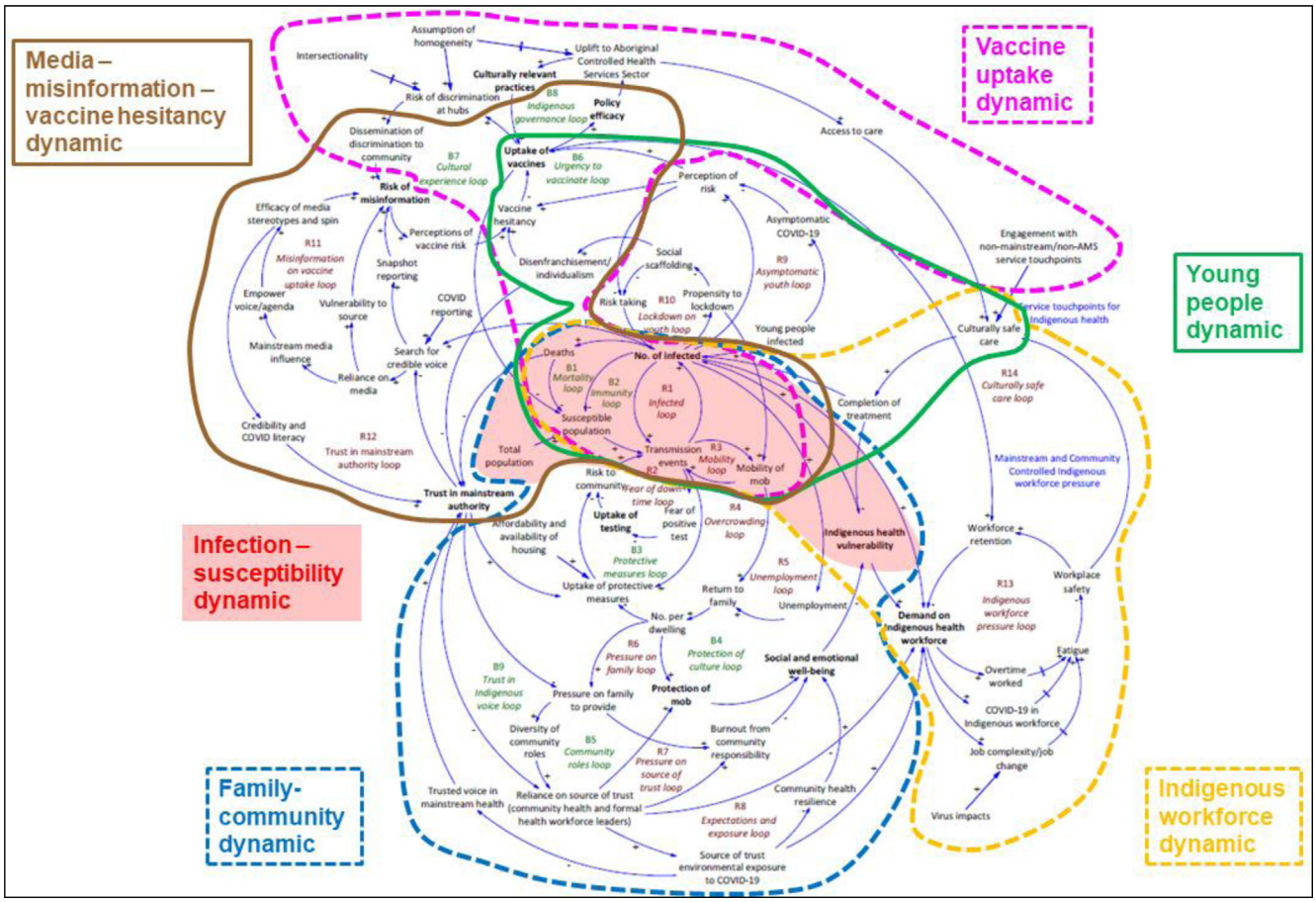

Figure: A causal loop diagram of health responses to Indigenous health in urban Brisbane.

interconnected. During outbreaks, policy responses to the virus necessitated community-wide responses. For Indigenous peoples who maintain strong connections amongst kin, communities and places across the continent, the role of family and 'mob' were seen by stakeholders as imperative to pandemic responses and outcomes. Indigenous peoples' mobility was identified as having the potential to increase transmissions and infections (R4); therefore, family had the potential to increase the risk of the virus spreading, but also played a role in the messaging and enforcement of preventative behaviours (McCalman et al., 2021).

Monitoring infections through consistent testing of symptoms was the primary preventative strategy adopted during the early stages of the pandemic (National COVID-19 Health and Research Advisory Committee, 2020). During the first workshop, held in March 2021, access to a COVID-19 vaccine was not readily available in Australia. Stakeholders spoke of many Indigenous workers' reluctance to get tested out of fear that they would lose their employment and the income used to support their families (Williams and Haire, 2020). Socioeconomic conditions were identified as key drivers that reinforced this reluctance. Stakeholders spoke of Indigenous peoples' struggles

to afford the very basics such as rent, food and electricity, which exacerbated their hesitation to get tested (Fredericks and Bradfield, 2021; Green et al., 2022; Lee et al. 2021; Yashadhana et al. 2020; Power et al. 2020; Watego and Whop, 2020). Less testing meant that infections could potentially go undetected or be ignored, increasing community spread (R3). Loss of income increased financial dependency on family and affected social and emotional wellbeing.

Overcrowding in homes has long been a problem that has disproportionately affected Indigenous peoples (Buckle et al. 2020; Moodie 2021; Lansbury et al. 2020). Numerous studies have demonstrated how the number of people per room per dwelling, alongside the quality and upkeep of infrastructure, correlates with health outcomes (Ali et al. 2018). Stakeholders were aware of this reality, speaking of the immense risk airborne viruses such as COVID-19 posed in settings where people lived in close proximation to each other (R5) (Memmott et al. 2022). This raised serious concerns for Elders. Overcrowding was also discussed in relation to mobility where greater transience, paired with increased bodies per dwelling, posed greater risk of transmission flows between community networks and the household, and vice versa.

Family was also seen as a source of support and empowerment that improved social, emotional, mental and physical health and wellbeing. Cultural support via family, helping with financial and social burdens, such as accessing food or ensuring that those infected were safe in isolation, were seen to balance some of the risks posed by COVID-19 (B3). As communities locked down, some stakeholders spoke of Indigenous peoples' decisions to return home (Markham and Smith, 2020); this increased the number of people per dwelling contributing to overcrowding and placing additional strain on families to house, feed and pay for utilities for the additional people (see R6) (Fredericks and Best, 2020; Fredericks and Bradfield, 2021; Lee et al., 2021). This also expanded support networks that protected people across the lifespan, counterbalancing some of the health inequities experienced by a diverse range of Indigenous peoples.

The role of community members, especially those trained in health or service-related roles, to support the wider community was seen by some stakeholders to create additional workload that supplemented the neglect of mainstream health services. This work was often in addition to their employment, unpaid, and contributed to personal financial and emotional stress. In some cases, it contributed to burnout (Watego and Whop, 2022; Dudgeon et al., 2022a). However, stakeholders unanimously agreed that key community leaders provided trusted sources of information that are crucial to delivering messaging in ways that avoided mainstream services, which were not always trusted (B4). Words such as 'stress', 'burnout' and 'overworked' were often used by stakeholders in relation to both the workplace and responsibilities to care and provide for family. As trust in mainstream authorities declined, community members increasingly picked up the workload, adding to the pressures placed on families, the potential for burnout and the decrease in social and emotional well-being (R8).

The need for age-specific responses

Stakeholders consistently spoke of the need for age-specific and appropriate policies. As Indigenous households are more likely to be multigenerational (Memmott et al. 2012), the connection between the youth and the elderly was identified as a potential driver of spreading the virus. Whilst lockdowns affected people in different ways, stakeholders

specifically spoke of its impact on the mental health of youth. Family and social networks provide young people with what was described by participants as 'social scaffolding', which help youth navigate stressful situations (Usher et al. 2020). As lockdowns increased, this social scaffolding broke down in some cases (R10). For some, this was described by stakeholders as resulting in a sense of alienation, an increase of risk-taking behaviour and rejection of health directives such as check-in protocols. This had both social and legal implications, such as affecting youths' interactions and encounters with law enforcement (Boon-Kuo et al., 2021), but also weakening the ability to contact trace the spread of virus.

Law enforcement was also identified in terms of detention: some stakeholders spoke of the increased risk of infection within juvenile detention centres, and the lack of support post-release (R12). Concerns of the virus spreading were further exacerbated by fears that infected youth were more inclined to be asymptomatic and mobile (Viner et al. 2021). This, paired with an active and social lifestyle, could have potentially reduced youths' perceptions of risk of contracting COVID-19, which could have increased vaccine hesitancy. Conversely, as perceptions and awareness of risk increased, so could inclinations to uptake vaccines (R11).

Trust and burnout amongst Indigenous health workers

A key topic raised in the discussions surrounding pandemic responses was 'trust'. Stakeholders spoke of the mistrust many Indigenous peoples have towards mainstream health services and messaging (Priest et al. 2020; Nolan-Isles et al. 2021; Graham et al. 2022). Whilst Indigenous health workers and Aboriginal Community Controlled Health Organisations (ACCHOs) were widely recognised as the most appropriate sources to deliver trusted information to Indigenous peoples (Finlay and Wenitong, 2020; McCalman et al., 2021), the demand placed on the Indigenous workforce had significant consequences that impacted Indigenous peoples' personal and professional lives, while also hindering efforts to curb the spread of virus.

Further demands were placed on Indigenous workers who were expected to respond to and provide information about the virus in ways that surpassed their usual job description (R13). Working additional hours increased fatigue and reduced workplace safety for both practitioners and community members. This had the potential to reduce the available Indigenous workforce, placing additional demand on those who remained (R12). As the Indigenous workforce was seen as the heart of delivering culturally safe care, boosting and retaining staff, and recognising the demands placed on ACCHOs were identified as key touchpoints.

Media, messaging and COVID-19 literacy

As the virus spread, people naturally sought information from sources they deemed credible. This initially came from health experts and politicians, but commentary about the virus quickly became saturated in all forms of media. One-size-fits-all responses to the virus, alongside snapshot and sensationalised reporting, were seen by stakeholders to increase the risk of people seeking or encountering misinformation that would adversely impact protective measures (R15) (Best, 2018; Power et al. 2020). This was particularly the case for unverified information that was freely accessible online via social media (Fredericks et al. 2022a; Pickles et al. 2020). Perceived and lived experiences of discrimination and racism in hospitals (Priest et al. 2020), clinics and vaccine hubs were spoken of as boosting Indigenous peoples' inclination to seek information from 'alternate sources', which in extreme cases

propagated the spread of misinformation, uncertainty and doubt, along with damaging conspiracy theories (Fredericks et al. 2022a; Carlson et al. 2021).

Stakeholders spoke of media bias and disproportionate reporting that portrayed certain ethnic and cultural groups as 'problematic' and reinforced negative stereotypes. The reporting on 'panic buying' was one example raised as stigmatising Indigenous peoples. Like hesitancies associated with accessing mainstream health services, mainstream media was seen as equally problematic, particularly due to media's lack of ethnic diversity and representation in its reporting (Groutsis et al. 2022). However, not all alternate media was characterised as negative. The role of community and Indigenous-run media, such as Triple A radio in Brisbane or Deadly Choices, has been integral to spreading creditable information about protective behaviours via trusted Indigenous sources (Carson, 2020). Stakeholders believed that boosting COVID-19 literacy was also the responsibility of mainstream media, who needed to do more to incorporate credible Indigenous voices and encourage protective measures such as the uptake of testing and vaccinations (R16).

Vaccinations

One of the somewhat ironic challenges identified by stakeholders was that vaccination rates were driven by the rate of virus spread in the community and the sense of urgency to protect oneself (R17). This was particularly the case in Brisbane, which experienced a delayed outbreak compared with the rest of the nation. It is also applicable today, at a time when the pandemic is widely perceived as over, even though community transmission continues with variants and subvariants emerging (Barraclough, 2022; Wood, 2022).

Hesitancy, nonetheless, is a factor that stakeholders identified as influencing vaccination uptake. Negative and racist experiences encountered by Indigenous peoples at the hands of health service providers and vaccination hubs were readily shared amongst kin and friend networks. Stories of negative experiences and culturally unsafe settings increased perceptions of risks associated with getting vaccinated, which was also seen by stakeholders to boost inclinations towards misinformation and further empower anti-vaccine discourses (B5).

The spread of negative perceptions was countered by the amplification of positive Indigenous voices and the incorporation of culturally safe practices within health service delivery and messaging. Allocating and spending adequate time with Indigenous communities so that Indigenous peoples gained better COVID-19 literacy was seen by stakeholders as essential to counter anti-vaccine discourses (R18). This was particularly the case online, where rumours and conspiracies spread quickly (Richards et al. 2021; Fredericks et al. 2022a). Aboriginal Community Controlled Health Organisations were unanimously seen by stakeholders as pivotal to providing targeted responses to COVID-19, especially in encouraging and facilitating protective measures such as vaccinations (B6).

Stakeholders highlighted that ACCHOs balanced community members' mistrust in government policies, a key driver of vaccination hesitancy, by providing information delivered by trusted members of Aboriginal communities. Stakeholders, who included representation from Institute for Urban Indigenous Health, or IUIH (an ACCHO servicing the north of Brisbane), spoke of how Aboriginal community control countered homogenous responses that often failed to recognise intersectionality and in doing so provided inequitable healthcare. Health inequities failed to respond to Indigenous peoples' needs and cultures, which increased a sense of marginalisation and further drove inequity in health service delivery (R19).

Using the causal loop diagram to identify meaningful leverage points

Within this research, group model building was used to produce the causal loop diagram shown in the Figure. This was performed with the aim of identifying the areas where targeted interventions could be made. By no means complete, the seven leverage points that follow represent some of the areas within the CLD that stakeholders identified as touchpoints that may initiate positive outcomes in pandemic responses, particularly in urban Indigenous settings. Changing the behaviours in the following dynamics has the potential to have flow-on consequences, which may improve outcomes within the entire system.

Leverage point 1: Minimise mobility

Stakeholders believed that interventions targeting mobility in the general population – but particularly for Aboriginal peoples – need to be addressed to curb rapid COVID-19 transmission. One way this could happen is through having a designated family member within a household or several households to run errands and/or liaise with service providers; this initiative could be promoted through trusted social media sources and messaging, as well as partnerships with ACCHOs and existing organisations.

Leverage point 2: Incentivising protective behaviours

Vaccinations are the most viable protective measure against COVID-19. Incentivising behaviours to boost vaccination rates was seen as essential. Whilst some stakeholders raised the idea of cash incentives or lotteries for vaccinations, community-driven responses and awareness campaigns led by Indigenous-run organisations, such as Deadly Choices, were identified as having the greatest potential to encourage protective behaviours. Greater resourcing of community-controlled organisations, including building the Indigenous workforce, is also needed for both health service delivery and messaging.

Leverage point 3: Generate coordinated responses amongst service providers

A coordinated response amongst service providers – such as community clubs, universities and Centrelink – was raised by stakeholders as having the potential to build awareness about health risks and improve COVID-19 literacy. Stakeholders believe that mainstream approaches to healthcare are too often siloed and informed by one-size-fits-all mentalities. Disseminating information across different organisations and services has the potential to reach targeted populations, such as Indigenous youth, whilst also increasing exposure to consistent messaging.

Leverage point 4: Define fatigue through a cultural lens

Stakeholders spoke of how the demands associated with embodying numerous profession and cultural roles impacted health workers' mental health and wellbeing. Policies need to recognise the demands and pressures associated with working in healthcare, and the contributions made by the Indigenous workforce. Whilst this may be done via addressing the root causes that drive increased demand and workplace pressure – including social determinants of health, socioeconomic inequity and the need to increase the Indigenous workforce – immediate action through renumeration of overtime and implementation of flexible work arrangements, which support the cultural needs of its Indigenous workers, must be built into policies of health and service industries.

Leverage point 5: Prepare a coordinated and streamlined checklist

Many ACCHOs and Indigenous service providers were prepared in their quick and targeted response to the challenges associated with COVID-19. This was partly due to having suffered during past outbreaks such as

the 2009 influenza epidemic. However, the success of responses to COVID-19 varied between communities due to a range of reasons including geography and access to resources. Stakeholders suggested that a streamlined step-by-step action plan (like emergency services plans for natural disasters) could help identify the key areas/demographics that need to be targeted during responses. Such a checklist could be based on the CLD developed in studies such as this one.

Leverage point 6: Limit overcrowding

As an airborne virus, overcrowding has the potential of exacerbating the spread of COVID-19 amongst numerous households. In recognition of the mobility of many Indigenous peoples, increased communications on the importance of self-isolation and establishing support networks to help those who were isolating is needed. Leverage points included addressing the lack of availability of affordable and social housing; however, this was seen as a long-term response to what is a pervasive and systemic issue. Immediate responses to overcrowding, especially for those who contracted COVID-19, included the establishment of appropriate temporary housing with the reassurance of financial and social support should a person become infected.

Leverage point 7: Culturally relevant messaging and service delivery

One of the most effective responses to COVID-19 is ensuring that Indigenous peoples and voices are visibly represented across all sectors. A lack of trust in mainstream services amongst Indigenous peoples continues to be a major barrier to accessing creditable services and information. This is due to centuries of neglect and mistreatment. Leverage points in this dynamic include building trust with Indigenous peoples through partnerships with Indigenous-led organisations. However, trust of mainstream services may take generations to rebuild. In acknowledgement that Indigenous peoples are best positioned to respond to the issues impacting their communities, governments must be willing to finance, resource and support Indigenous-led and controlled initiatives.

Conclusion

Conducted during the midst of COVID-19, researchers from the University of Queensland, led by Indigenous scholars Professor Bronwyn Fredericks and Professor James Ward, set the bold task of systematically unpacking the dynamics that contribute to health and social outcomes of Indigenous peoples and health workers during pandemics in urban settings. Whilst the produced causal loop diagram is by no means complete or all-inclusive, it is in agreement with systems thinkers, such as Reynolds (in McIntyre-Mills and Corcoran-Nantes, 2021:691), who emphasise that the benefit of the methodology lies not in its capacity to 'fix the problem' but in its ability to provoke new ways of thinking and approaching complex problems, with the aim of finding common solutions.

This study successfully highlighted some of the challenges associated with pandemic responses and preparedness, many of which are systemically ingrained in the social fabric of settler-colonial spaces; meaning that the pandemic merely exacerbated pre-existing health and social issues rather than being their cause. Whilst the leverage points identified by stakeholders provide clear markers of some of the areas where policy reform is needed (for example, housing), the task of putting the insights of the CLD into lived practice remains a challenge.

It is also acknowledged that this research was limited to urban southeast Queensland, and that a systems thinking approach is likely to produce different insights and leverage points when applied to other urban, rural or remote settings. Therefore, the practical application

of systems thinking in Indigenous health warrants further investigation, as does building the capacity of Indigenous systems thinkers who may assist in transforming the discipline in a manner better suited to local Indigenous contexts.

Author contributions

BF led the project. BF supervised the project. BF, JW and SM conceptualised the project. BF, JW and SM were involved in the methodology. BF, AB, JW, SS, SM, TC and AT-P conducted the analysis. BF, AB, JW, SS, TC and AT-P were involved in implementation. BF and AB reviewed the project. BF and AB edited the paper. BF, AB, SM and AT-P performed the literature review. BF and AB reported the project. SM wrote the original draft. SM and AT-P were paid from the project for work undertaken.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors. The funding for this project came from the National Health and Medical Research Council (NHMRC, CRE), Australian Partnerships for Preparedness Research on Infectious Disease Emergencies (APPRISE – ID 1116530) through a donation from the Paul Ramsay Foundation, and the Office of Indigenous Engagement, The University of Queensland.

Author biography

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Dr Abraham Bradfield is a non-Indigenous research officer with the University of Sydney. Grounded in Anthropology, Social Sciences and critical Indigenous Studies, Abraham applies a cross- and transdisciplinary approach to his research to explore themes relating to colonisation, identity and the intercultural. He remains committed to developing and implementing morally responsible research that challenges colonial power structures and encourages new habits of thought and praxis. He formerly worked as a research officer in the Office of the Deputy Vice-Chancellor (Indigenous Engagement) at the University of Queensland.

Professor James Ward is a Pitjantjatjara and Nukunu man, an infectious diseases epidemiologist and a national leader in Aboriginal and Torres Strait Islander research. He is currently the Director of the Poche Centre for Indigenous Health at the University of Queensland. James has over 25 years of experience in Aboriginal public health policy for both government and non-government organisations, in urban, regional and remote communities. He has built a national program of research in epidemiology and prevention of infectious diseases in Aboriginal and Torres Strait Islander communities.

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