Using Systems Thinking to Better Understand Risks and Protective Factors for Urban Indigenous Peoples during COVID-19

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About the Project: This innovative, *systems thinking* study was conducted at the University of Queensland and was funded through the National Health and Medical Research Council Centre of Research Excellence (NHMRC CRE), the Australian Partnership for Preparedness Research on Infectious Disease Emergencies (APPRISE, AppID 1116530) through a donation from the Paul Ramsay Foundation.

Study Rationale: Systems thinking provides an "intuitive language" that enables specialists from different fields and professions to speak on common terms to better understand complex problems that require a multi-faceted approach. By exploring the relationship between system structure and behaviour, practitioners and policy makers can better understand how complex systems work, assess the efficacy of existing practices, and identify what levers can be pulled to result in better behaviour patterns.

Study Methodology: Participatory System Dynamics (PSD) is an evidence-based methodology and a tool that uses systems maps or causal loop diagrams (influence diagrams). By adopting this approach, this study has provided insights into the current determinants of COVID-19 transmission in urban Indigenous settings, their interrelationships, and implications for intervention. The research involved three workshops, which were held on the 25th of June, the 7th of September, and 7th of October 2021.

Engagement: The systems map was constructed using input from a large group of Indigenous and non-Indigenous experts, comprising of 14 health system stakeholders and 6 research team members. There was Indigenous representation from Federal, State, Local, and community jurisdictions as well as from Aboriginal and Torres Strait Islander Community Controlled Health Organisations (ACCHOs).

Impact: Through the lens of systems theory, this study encouraged stakeholders to see and think differently about COVID-19, providing a tool through which to visually map the interlocking parts within the urban Indigenous health system which enable or mitigate transmissions of disease. This study identified that Indigenous health workers and Community Controlled Health Organisations are best positioned to provide culturally informed and integrative responses that are tailored towards local needs. Building Indigenous and non-Indigenous capacity and recognising the educational value of "service" touch points and the voice of Elders and leaders can provide the trust needed for effective health responses including prevention, intervention, and mitigation.
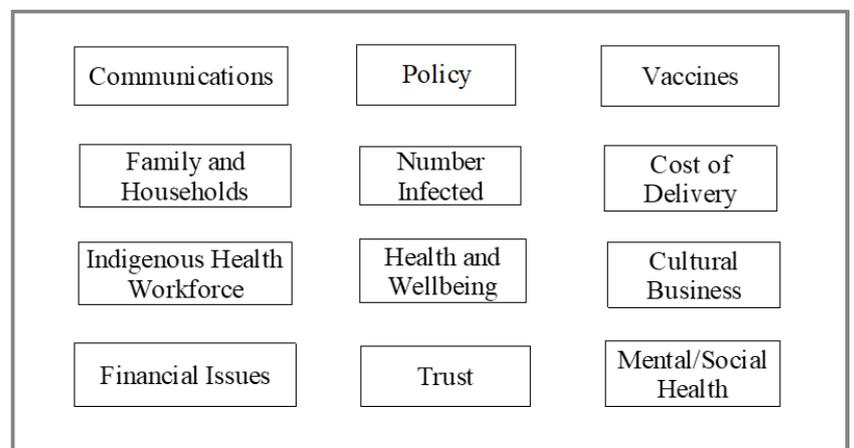
Summary of Workshop Outcomes

Each workshop comprised a series of scripted activities that guided the group to the following outcomes:

Workshop 1 Outcomes	✓ Agreement on the outcome(s) of interest (number infected with COVID-19) ✓ Identification of key system stakeholders ✓ Identification of the key system elements impacting the outcome of interest ✓ Prioritisation of the key system elements impacting the outcome of interest ✓ Development of a diagraph to causally connect the main elements
Workshop 2 Outcomes	✓ Discussion and consensus on terminology and system variables ✓ Deeper understanding of systems thinking concepts ✓ Development of causal linkages and systems maps for different system parts ✓ Discussion and presentation of causal loop diagrams
Workshop 3 Outcomes	✓ Deeper understanding of system feedback loops and the behaviour they are producing ✓ Development and discussion of intervention points and avoiding policy resistance ✓ Identification of levers across the system to address COVID transmission risk attributed to mob mobility, the behaviours of the young, and workplace fatigue

Key Elements

The participants worked collaboratively to prioritise 12 variables (or determinants) that conceptually represented the urban health system, and classified the relationships between those variables, using arrows. In the systems map that follows, the variables have been clustered into six themes (dynamics), each composed of interlocking feedback loops.

Communications · Policy · Vaccines · Family and Households · Number Infected · Cost of Delivery · Indigenous Health Workforce · Health and Wellbeing · Cultural Business · Financial Issues · Trust · Mental/Social Health

Thematic Clusters within Urban COVID-19 Systems Map

The Urban COVID-19 Systems Map presented in Figure 1 contains six key sub-systems or dynamics:

The **infection-susceptibility dynamic** could be described as the engine room and consists of two reinforcing loops (R1, R2) which drive infection risk higher, and two balancing loops (B1, B2) which counter or act to put a break on this risk. When COVID-19 is present (e.g., through hot spot arrivals), or risk of transmission is increased (e.g., due to the reinforcing nature of high rates of mobility), the virus has the potential to spread exponentially. The more transmission events, the increased chance of environmental exposure and the greater risk of infection. The Susceptible Population variable accounts for the fact that having COVID-19 creates immunity. Recent evidence suggests that COVID can be caught more than once so in future work, consideration may need to be given to those infected remaining in the susceptible population if supported by the evidence.

The **family-community dynamic** contains a number of feedback loops, some of which act to protect and mitigate the risk of COVID (B3, B4, R8) and others which contribute to its transmission (R4, R5, R6, R7, R9). Overcrowded housing for many Indigenous people in the greater Brisbane area, the inability to isolate, the loss of employment and burnout due to the pressure on community member's recognised "sources of trust", create transmission potential. Balancing this risk, is the protective power of Indigenous culture. Recognised community leaders, many with roles in the health workforce, play a significant role in keeping their communities safe and protected from COVID. The added pressures on these "sources of trust" can lead to burnout, which both threatens the scaffolding keeping their community safe, and positions them to be "at risk" to environmental transmission themselves.

The **young people dynamic** contains three reinforcing loops (R10, R11, R12) which increase the risk of COVID spreading through urban communities. Firstly, the actions of any asymptomatic youths, who are less likely to get tested, more likely to test positive and more likely to have more social contacts, can fuel transmission. In addition, often the very strategy deemed to be protective, namely lockdown, can trigger a loss of social connection. This can potentially cause disenfranchisement and scepticism in youths which might elevate their risk-taking behaviour, believe misinformation, and misuse QR codes. Finally, the evidence suggests that detention centres have contributed to COVID spread, added to by the tendency for youths to "go off the grid" on release.

The **Indigenous workforce dynamic** contains two reinforcing feedback loops (R13 and R14) which address the pressure on the Indigenous health workforce serving both mainstream and community-controlled health services. The consequences of burnout and retention were raised as significant risks that can reinforce the spread of COVID-19. Indigenous health workers and Community Controlled Health Organisations are best positioned to provide culturally informed, integrative, and holistic responses that are tailored towards local needs. Culturally safe care can reduce transmission and improve health outcomes for Indigenous peoples (who already bear a <u>disproportionate burden of disease</u>), whilst improving Indigenous peoples' trust in health policy.

The **media misinformation vaccine hesitancy dynamic** contains two reinforcing loops (R15, R16) which address the role of misinformation and mistrust in the spread of COVID. Delivering services and building policy with the input of community members, Elders, leaders, and Indigenous workforces are essential to building trust within Indigenous communities. Disproportionate reporting and a lack of Indigenous voices in mainstream media has fuelled both misinformation and a lack of trust that has manifested itself in vaccine hesitancy and poor vaccination rates. These reinforcing loops are in need of disruption.

The **vaccine uptake dynamic** contains three reinforcing loops (R17, R18 and R19) and two balancing loops (B5, B6) driving the uptake of vaccines. Where there is marginalisation from health services (R19), the uptake is less. When there is no COVID present in the community (R17), the urgency to vaccinate is less. B5 is a balancing loop which suggests that poor experiences, racism and/or insensitivity at vaccination sites and hubs can feed back to community members and create hesitancy. R18 suggests that improving culturally safe experiences and <u>education</u> can reduce hesitancy and improve uptake, as can the engagement of Community Controlled Health Services.

Urban COVID-19 Systems Map

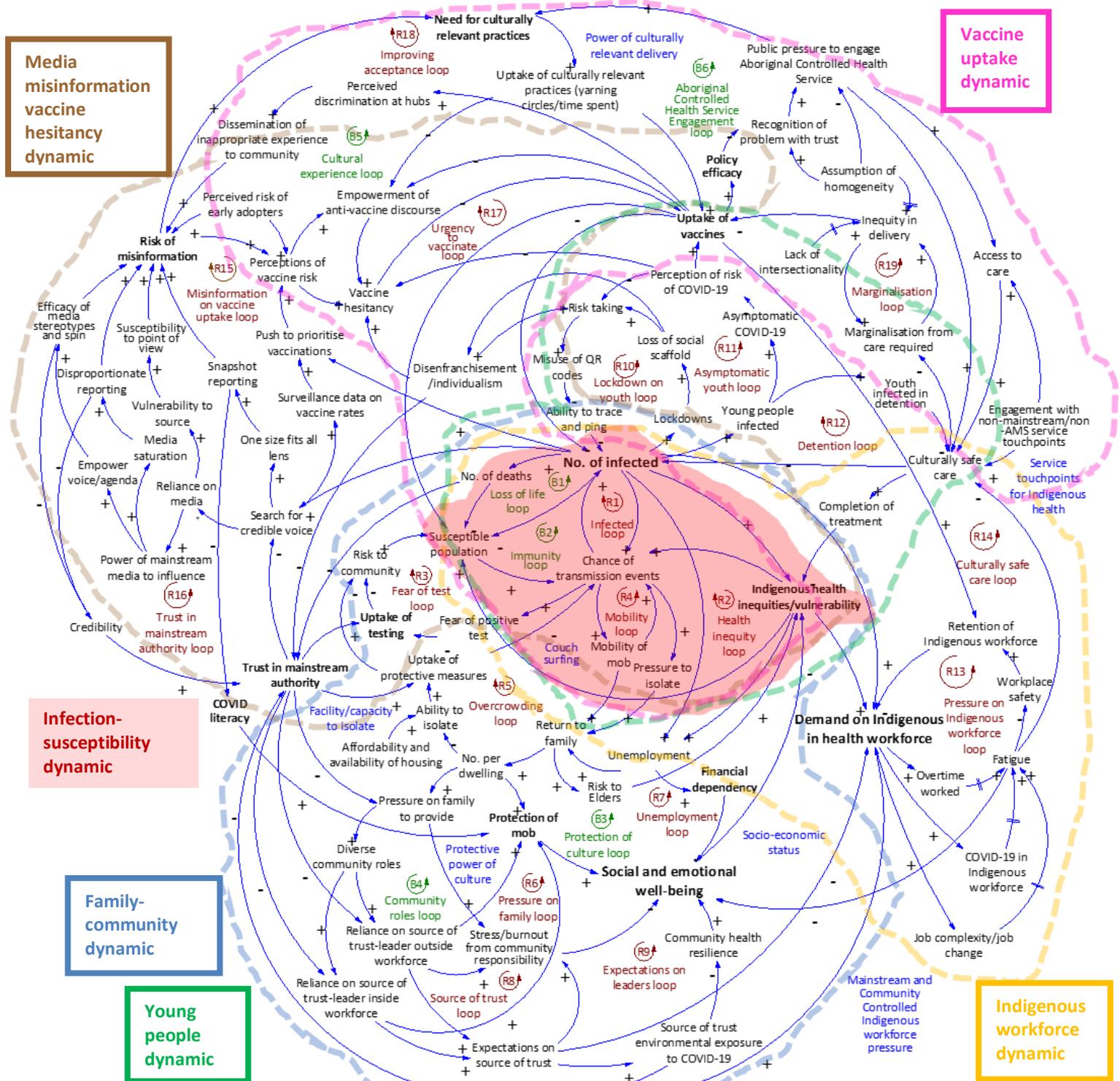*Note: Each feedback loop is explained in detail in the attached Appendix.*

Media misinformation vaccine hesitancy dynamic

Vaccine uptake dynamic

Infection-susceptibility dynamic

Family-community dynamic

Young people dynamic

Indigenous workforce dynamic

Need for culturally relevant practices — R18 Improving acceptance loop — Power of culturally relevant delivery — Uptake of culturally relevant practices (yarning circles/time spent) — Public pressure to engage Aboriginal Controlled Health Service — B6 Aboriginal Controlled Health Service Engagement loop — Recognition of problem with trust — Assumption of homogeneity — Policy efficacy — Perceived discrimination at hubs — B5 Cultural experience loop — Dissemination of inappropriate experience to community — Empowerment of anti-vaccine discourse — R17 — Uptake of vaccines — Inequity in delivery — Access to care — Lack of intersectionality — R19 Marginalisation loop — Perceived risk of early adopters — Perception of risk of COVID-19 — Risk of misinformation — R15 Misinformation on vaccine uptake loop — Perceptions of vaccine risk — R17 Urgency to vaccinate loop — Vaccine hesitancy — Risk taking — Loss of social scaffold — Asymptomatic COVID-19 — R11 Asymptomatic youth loop — Marginalisation from care required — Efficacy of media stereotypes and spin — Susceptibility to point of view — Push to prioritise vaccinations — Snapshot reporting — Disenfranchisement/individualism — Misuse of QR codes — R10 Lockdown on youth loop — Young people infected — Youth infected in detention — Engagement with non-mainstream/non-AMS service touchpoints — Disproportionate reporting — Vulnerability to source — Surveillance data on vaccine rates — Ability to trace and ping — Lockdowns — R12 Detention loop — Culturally safe care — Service touchpoints for Indigenous health — Media saturation — One size fits all lens — No. of infected — B1 Loss of life loop — R1 Infected loop — Completion of treatment — R14 Culturally safe care loop — Empower voice/agenda — Reliance on media — Search for credible voice — No. of deaths — B2 Immunity loop — Susceptible population — Chance of transmission events — Indigenous health inequities/vulnerability — R2 Health inequity loop — Power of mainstream media to influence — R16 Trust in mainstream authority loop — Credibility — Risk to community — R3 Fear of test loop — Uptake of testing — Fear of positive test — R4 Mobility loop — Mobility of mob — Pressure to isolate — Retention of Indigenous workforce — R13 Pressure on Indigenous workforce loop — Workplace safety — Trust in mainstream authority — COVID literacy — Uptake of protective measures — Couch surfing — R5 Overcrowding loop — Return to family — Demand on Indigenous in health workforce — Overtime worked — Fatigue — Facility/capacity to isolate — Ability to isolate — No. per dwelling — Unemployment — Financial dependency — Affordability and availability of housing — Risk to Elders — R7 Unemployment loop — Socio-economic status — COVID-19 in Indigenous workforce — Pressure on family to provide — Protection of mob — B3 Protection of culture loop — Social and emotional well-being — Job complexity/job change — Diverse community roles — Protective power of culture — B4 Community roles loop — R6 Pressure on family loop — Reliance on source of trust-leader outside workforce — Stress/burnout from community responsibility — Community health resilience — R9 Expectations on leaders loop — Reliance on source of trust-leader inside workforce — R8 Source of trust loop — Expectations on source of trust — Source of trust environmental exposure to COVID-19 — Loss of trusted voice in mainstream health — Mainstream and Community Controlled Indigenous workforce pressure

Figure 1 – Urban COVID-19 Systems Map

Legend
Plus (+) polarity: two variables move in the same direction
Minus (-): polarity: two variables move in the opposite direction
Delay (||): response time, waiting time
R: reinforcing loop or positive feedback loop
B: balancing loop or negative feedback loop

Intervention Points and Policy Resistance

An objective of this study was to use the systems map (Figure 1), which identifies key variables and causal linkages, to investigate interventions that might prevent the spread of COVID over time, in urban Indigenous communities. Exploring the interventions, through the lens of feedback loops, can provide insights into possible points of policy resistance and unintended consequences. Policy resistance can arise because the full range of feedbacks are not understood[1]. Table 1 below summarises the interventions identified by participants:

Table 1 – Intervention Points

Target Variable	Intervention Point
Minimise the mobility of mob	• Designated family members appointed to do 'run arounds' • Sell the idea on social media (i.e., Facebook or TikTok)
Put safety cushion around risk-taking behaviour of young	• Financial incentive through MyGov • Time limited (i.e., up to January 2022) • $350 for fully vaccinated individuals of up to 25-years of age
Recognise more service touchpoint	• Recognise that the services and organisations people access daily may also serve as touchpoints to further engage and education • Co-ordinated responses amongst bodies such as Centrelink, community clubs and organisations, schools, and universities can all influence Indigenous health trajectories by providing more effective messaging and directing community members to a greater number of trusted sources of information
Define fatigue through cultural lens	• Renumerate for working back and overtime • Flexible work arrangement to support cultural needs of Indigenous workers
Prepare a COVID-19 outbreak checklist	• Create a step-by-step, easy to understand action plan, similar to emergency services plan for flood
Increase testing	• *'Carrot not the stick'* approach including the use of sewerage testings as 'stick' • Incentivize using a home test kit and work out how to report to government • Simplify understanding of how the vaccine and transmission works and explain the goal and role of testing
Limit overcrowding	• Use crisis housing, dongers, and tiny houses for youth at risk
Include culturally relevant messaging	• Honour cultural protocol to acknowledge traditional owners by empowering the Elders' voice • Connect the Elder Advisory Council and empower the Council to bring in right young talent and sources of trust
Increase vaccine uptake through messaging	• Community Co-designed Communication Campaign (CCCC) • Improve messaging through QH, ACCHOs, QAIHC, TSRA, PHNs

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[1] Sterman J 2000 Business Dynamics

Not all policies or interventions have the desired effect. The participants explored areas of policy resistance in the current system. These are listed in Table 2 below and informed the Intervention Points activity:

Table 2 – Unintended Consequences and Policy Resistance

Target Variable	Unintended Consequences	Causes of Policy Resistance
Young people	• More risky behaviours • More mobility • More mistrust	• Lockdown policy breaks protectiveness of social scaffold • Split families and lack of scaffold leading to mistrust
Policy	• Ignoring social distancing and lockdown rules	• COVID not on the radar • Not using a holistic definition of health • Low policy efficacy due to lack of trust and lack of co-design • Snapshot reporting • An absence of a systematic disease management approach • What's in it for me? mindset • Poor visibility for action
Vaccine uptake	• Not getting vaccinated	• Not using a holistic definition of health • Did not go back to basics to address misinformation and improve understanding of the pandemic • No COVID literacy • Missed opportunity to learn from NSW outbreak
Trust in System	• Disenfranchisement	• Siloed ways of working • Bureaucracy blocks at high levels • Ingrained territorial behaviours • Assumption of homogeneity • Individualistic behaviour

Conclusion

We acknowledge that this project only included a small number of stakeholders in proportion to the Indigenous peoples in greater Brisbane and thus is not representative. Nevertheless, the scores of stakeholders who were involved over the course of the three workshops generously shared their time, experience, and expertise of working within the urban Indigenous health sector during COVID-19 and assisted in providing a deeper and more comprehensive understanding of some of the concerns, issues, and needs of Indigenous peoples within the region. Collectively, participants networked, shared ideas, collaborated, and built on each other's knowledge through their participatory and collaborative work. While stakeholders were already acutely aware of the numerous interlocking variables and factors influencing health outcomes in urban Indigenous Australia, including responses to health crises such as COVID-19, articulating and communicating the need for holistic, targeted, and culturally appropriate approaches to healthcare can remain a challenge. Through systems thinking, the research team has attempted to unpack and present such complexities so that points of intervention can be visually identified while culturally appropriate and effective health policies and practices may be applied.

Appendices

Appendix 1 – Unpacking the CLD Dynamics

The tables below describe each of the loops in the Urban COVID-19 systems map by cluster:

INFECTION – SUSCEPTIBILITY DYNAMIC: These loops describe the commonly discussed feedbacks in epidemiology, relating to susceptibility and transmission of disease.

Loop Type	Loop Name	Loop Description	
R1: REINFORCING	Infected loop	This loop recognises that the more COVID infections there are the more the chance of further transmission and more infections.	
B1: BALANCING	Loss of life loop	This loop acts to reduce the susceptible population through deaths, thereby reducing the chance of transmission.	
B2: BALANCING	Immunity loop	This loop shows that as the number of infections increases, the susceptible population decreases, which then decreases the chance of transmission.	
R2: REINFORCING	Health inequity loop	This loop recognises that First Nation people's systemic health inequities increase susceptibility to COVID[2].	

FAMILY – COMMUNITY DYNAMIC: The family and household dynamics were recognised as being highly influential and connected. Rich stakeholder feedback informed the articulation of a number of sub-systems within this wider dynamic.

Loop Type	Loop Name	Loop Description	
R3: REINFORCING	Fear of test loop	This loop represents the reluctance to get tested due to a fear of employment and income loss. Fear of testing leads to a lower uptake of testing, which then increases the risk to and susceptibility of the community as if COVID remains undetected.	
R4: REINFORCING	Mobility loop	This loop recognises that mobility of mob can seed the opportunity for transmission events, which spread COVID amongst the community. Mobility increases as spread increases as mob seeks the protection of family.	
R5: REINFORCING	Overcrowding loop	This loop recognises that return to family increases the numbers per dwelling, reducing the ability to isolate and adopt protective measures, which in turn can lead to more COVID-19 infections, when the virus is active. Affordability and availability of housing are factors in overcrowding. The return to family also increases the risks to one's family (Elders) and community members becoming infected with COVID, and it further increases the health inequities and vulnerability, leading to higher chance of transmissions.	
B3: BALANCING	Protection of culture loop	Countering the negative impacts of overcrowding (as shown in R4 and R5), this B2 loop captures the significant potential of family and community to protect. As family members return to their family units, the protective powers of a strong cultural identity are enabled, improving the social and emotional well-being of the mob, making them less vulnerable to transmission events.	
R6: REINFORCING	Pressure on family loop	This loop recognizes that return to family, that COVID-19 stimulates, puts pressure on family/community to provide housing, food, emotional support, and general advice to a growing number of family members. Anecdotally, this has resulted in stress induced burnout on family members, reducing social and emotional well-being.	
R7: REINFORCING	Unemployment loop	This loop shows that as infections increase, unemployment increases, leading to the return to family dynamics and infection risks as explained in loop R5.	
B4: BALANCING	Community roles loop	This is an important protective loop for the family/community because it recognises that community leaders, both inside and outside of the paid workforce, play significant yet largely unrecognised community roles, which protect the community through the provision of knowledge and care, support, and culturally relevant communications.	

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[2] The CLD does not explore the systemic health inequity in detail, but its inclusion recognises its importance.

Loop Type	Loop Name	Loop Description	
		These important community leaders, who assume culturally specific roles and responsibilities, and may or may not hold an official role in the health workforce, are regarded as "sources of trust" for the community and fulfill diverse roles, thereby taking pressure off the mainstream system.	
R8: REINFORCING	Source of trust loop	This loop refers to the responsibilities described in B4, and it acknowledges that the extra pressure can create burnout, reconnecting with R6, to deliver more vulnerability to community members, and to COVID-19. Altogether, the R6, R8 and B3, B4 loops recognise that whilst the roles families and community leaders play can protect the community during pandemics, they can also create added pressures.	
R9: REINFORCING	Expectation on leaders loop	This loop, as distinct from the R8 loop, focuses on the ripple effect through the community if the sources of trust themselves are exposed to and infected with COVID-19. With expectation comes environmental exposure. Their removal leads to a decreased community health resilience, and a deficit in the mainstream and community-controlled Indigenous workforce, which acts to lower community social and emotional well-being.	

YOUNG PEOPLE DYNAMIC: Whilst a subset of the *Family-Community dynamic*, the particular risks being introduced by young people (in the 25 to 35 age demographic) was singled out as uniquely contributing to the risk of COVID spread.

Loop Type	Loop Name	Loop Description	
R10: REINFORCING	Lockdown on youth loop	This loop represents a COVID-19 related demographic dynamic and shows the unintended negative consequences of lockdowns on youth. Whilst lockdown is primarily viewed as a protective factor to community, it can put young people at risk by impacting their social scaffold. This is reportedly leading to increased risk taking (e.g., misuse of QR check-in) with the consequential challenges created for contact tracers. The participants noted several dynamics influencing the risk-taking behaviour in the young. In particular, the disenfranchisement/individualism dynamic impacts the trust in government and mainstream authorities, which can be linked back to the decreased uptake of testing and protective measures.	
R11: REINFORCING	Asymptomatic youth loop	This loop recognises that the absence of symptoms in the young impacts the perception of risk (i.e., young people regularly referring to COVID-19 as nothing more than the flu), which translates to unknowingly or knowingly taking risks, seed transmission events.	
R12: REINFORCING	Detention loop	This loop extends on R13 in recognition of the high youth incarceration rates and the evidence that the young are less culturally safe in detention, leading to vulnerabilities that translate to a higher risk of COVID-19. Also noted was the tendency youth exhibit to go "off the grid" on release, complicating contact tracing processes.	

INDIGENOUS WORKFORCE DYNAMIC: There was a recognition of both an official and unofficial Indigenous health workforce, each with complex dynamics that generated both risks and protective factors for Indigenous peoples.

Loop Type	Loop Name	Loop Description	
R13: REINFORCING	Pressure on Indigenous workforce loop	This loop recognises the factors in the official workforce that affect capacity through adding to the strain on and retention of Indigenous health workers, including overtime pressure, COVID in the workforce, the changeability of job expectations and additional training as health organisations respond to changing system demands. As part of the skills optimization, workforce is also deployed into different roles. The impact on fatigue was recognised as influencing retention and social and emotional wellbeing. The capacity of the Indigenous workforce is influenced both by burnout of their official role and burnout in their unofficial community roles.	
R14: REINFORCING	Culturally safe care loop	This loop builds on R13 recognizing that fatigue also impacts culturally safe care, which may increase the risk of getting COVID and worsen existing health inequities.	

MEDIA – MISINFORMATION – VACCINE HESITANCY DYNAMIC: The role of the media received a lot of attention, not much of it very positive. There was an acknowledgement that much of the comms was not culturally appropriate and as a consequence, was a risk rather than a protective factor insofar as the misinformation spread it generated led to both mistrust in messaging and vaccine hesitancy.

Loop Type	Loop Name	Loop Description	
R15: REINFORCING	Misinformation on vaccine uptake loop	This loop articulates that rising COVID-19 infection prompts a search for a credible voice, which increases reliance on media sources and susceptibility to misinformation. Hesitancy, poor vaccine uptake, and more infections are consequences. The perception of risk has empowered the anti-vaccine discourse. The empowerment of media that comes with the reliance on media enables voices and agendas to dictate narratives, giving rise to stereotypes that both perpetuate the spread of misinformation, as well as cause guilt in the community. Media saturation and disproportionate reporting also leads to risk of misinformation. The 'one size fits all' lens at place leads to snapshot reporting, rather than telling the whole story, fuelling the risk of misinformation. This snapshot reporting is also responsible for limiting COVID literacy, which impacts on the protectiveness of the mob.	
R16: REINFORCING	Trust in mainstream authority loop	This loop reflects misinformation and disproportionate reporting undermining credibility and therefore trust in the mainstream authority and hence policy. Where trust is displaced in the authority, the risk of infection rises, because there is poor uptake of protective measures. The search for a credible voice increases the pressure on family to provide and the reliance (and pressure) on sources of trust in the community.	

VACCINE UPTAKE DYNAMIC: The current gaps across Australian in Indigenous vaccine uptake versus state averages positioned vaccine hesitancy and vaccine uptake as key elements. Poor uptake was connected to cultural experiences, misinformation, disenfranchisement, and inequities in service delivery amongst others.

Loop Type	Loop Name	Loop Description	
R17: REINFORCING	Urgency to vaccinate loop	If there is no COVID-19 in the community, it becomes harder to convince the population of the urgency to get vaccinated (currently an issue in QLD). Conversely, if there is COVID-19 in the community, recent experience in Australia suggests this creates urgency.	
B5: BALANCING	Cultural experience loop	This loop visualises the impact of a poor vaccine experience (e.g., discrimination at hubs) on uptake. One inappropriate experience can instil community hesitancy, adversely impacting the uptake of vaccines.	
R18: REINFORCING	Improving acceptance loop	This loop introduces culturally relevant practices to counter B5's impact to improve vaccine uptake. The dissemination of information suited to the Indigenous culture and expectations, such as yarning circles, could positively impact the uptake of vaccines and minimise the anti-vaccine discourse.	
B6: BALANCING	Aboriginal Controlled Health Service Engagement loop	Engagement with Aboriginal Controlled Health Services can improve the uptake of vaccines as they offer culturally relevant experiences. Poor vaccine uptake signals problems signals problems with policy efficacy and trust, leading to engagement with Aboriginal Controlled Health Services. The group offered the assumption of homogeneity and the lack of intersectionality as impacting trust and driving inequity in health services delivery (with delay), which then negatively impacts vaccine uptake.	
R19: REINFORCING	Marginalisation loop	This loop focuses on inequity in delivery of health services (including vaccine delivery), and it recognises the relationship between marginalisation from healthcare and inequity in delivery, which goes both ways. Inequity includes but is not limited to experiences at the health touchpoints and processes used to administer vaccines to Indigenous peoples.	