Designing the Next Generation of Built Environments
The built environment is estimated to use around 30% of all energy and 40% of all materials produced globally. Yet research on impacts of the built environment and scope for action on sustainability remain fragmented and the relevance overlooked. Never before has it been more important for research on the built environment to challenge business-as-usual, remove traditional research silos, and plot a course for the future.

The Designing the Next Generation of Built Environments (DNGBE) project, led by Chief Investigator Professor John Macarthur, sought to achieve this by fostering collaboration at school, faculty, and institutional levels, and by actively engaging with industry and government to identify priority research areas, and assess roadblocks to implementation.

Researchers came from a range of specialisations, including architecture, electrical engineering, civil engineering, and water engineering (ACWEB).

Highlights from DNGBE include a new Visualisation Laboratory that has already been utilised by UQ and industry partners to enhance research, teaching, and engagement; a full feasibility study into energy security for a rural town in the Atherton Tablelands; a collaboration with a building company to test prototypes for modular housing; a dossier on design governance published in Australia’s leading architectural magazine; government engagement to ensure research aligns with, and influences, future policy; the preparation of grants to further the research of a number of the sub-projects; and an upcoming major exhibition at State Library of Queensland, which will showcase six of the research projects from DNGBE.
DESIGNING THE NEXT GENERATION OF BUILT ENVIRONMENTS

NEW LABORATORY

The Visualisation Laboratory provides a 360° immersive environment allowing data visualisations to come to life. This will enhance research, teaching and engagement with other Schools and Faculties and with industry.

PUBLICATIONS 51
LECTURES, WORKSHOPS OR PRESENTATIONS 29
COURSES INFORMED BY RESEARCH 14
GRANT SUBMISSIONS 9
EXHIBITIONS 5
BOOKS OR BOOK CHAPTERS 4
PROJECT OVERVIEWS

The 18 research sub-projects within the DNGBE project explored a range of topics, from design governance and designing with communities, to digital twins and timber processing innovations. In examining ways to drive and support the future of the built environment, sub-projects investigated challenges and tools including sustainability, climate change, digitisation, material innovations, city planning amendments, new approaches to housing typologies, and community involvement in design and planning conversations.

Cities and Suburbs

Designing and Developing Next Generation Urban Villages – a Cairns Case Study
Project Contact: Mr Peter Hyland

In October 2022, the University of Queensland, in partnership with James Cook University, held a workshop that discussed the complex urban development problems facing Cairns, and explored opportunities for new approaches in the future. The workshop brought together 24 professionals from the areas of architecture, planning, urban design, development, agriculture, sociology, civil engineering, Indigenous groups, local council and state government. Six pillars were identified as core principles to guide recommended future research:

1. Adaptive – A resilient, sustainable, and decentralised built environment and infrastructure adaptive to climate change and able to live with water in a regional, tropical location.
2. Connected – Enhanced transport and mobility options to connect geographically dispersed communities.
3. Community – Facilitation of connection within the urban village community through intentional design interventions.
4. First Nations Partnerships – Collaborations with Indigenous communities to inform sustainable patterns of urban growth, restoring natural and cultural systems, and integrating layers of cultural heritage to inform a distinctive urban form.
5. Productive – New architecture for the next generation of the Cairns economy, including new approaches to agriculture and home-based small businesses.
6. Inclusive – Ensure the growth of Cairns prioritises diversity, inclusion, and opportunity.

These pillars require innovation in the property sector to demonstrate that housing, transport, resilience, and social wellbeing can be successfully integrated in Northern Australian regions. Key to the changes needed is a shift from low-density to medium-density housing, planned as urban villages where appropriate.

A white paper presented to Minister Craig Crawford sought Government funding for future research, and collaboration opportunities have been explored as part of UQ’s The Queensland Commitment.

Inner Brisbane

Project Contact: Mr Peter Hyland

As central business districts lose their vitality and sense of purpose in the modern era, UQ School of Architecture researchers have explored the value of redeveloping these areas into central connectivity districts (CCDs). Using Brisbane as a case study, researchers Mr Peter Hyland and Dr Ayodeji Adeniyi assessed the unique benefits Brisbane offers – excellent climate, a strong connection to the river, and burgeoning knowledge economies – and where opportunities exist to improve liveability, vibrancy and business growth in the inner-city. Ultimately, they examined how best to harness the power of organic growth in Brisbane’s inner-city.

Benchmarking Brisbane against ten river cities around the world, five key areas were identified as having the position to produce significant impacts: equity, enterprise, connectivity, creativity, and sustainability. Inner-Brisbane has a competitive advantage in health, education and liveability, and potentially in sports-medical research and music. But these advantages must be strategically leveraged to see Brisbane through the next two decades of growth.

The research proposed a shift from city planning that is based primarily on function, to planning that prioritises connectivity. This includes:

- Interventions in the urban planning of strategic intersections in Brisbane’s inner-city where the potential exists to celebrate the river’s edge and forgotten cultural legacy, and unite disparate commercial and residential urban forms.
- Improved residential opportunities around business precincts to ensure vibrancy in the inner-city every day of the week.
- The creation of ‘third places’, located between home and work, providing much needed opportunity for the collision of ideas across industries and disciplines, while taking advantage of Brisbane’s unique landscape and climate to foster more vibrant inner-city communities.
- Strategic activation of spaces around existing knowledge precincts to facilitate public communication of projects and break down existing barriers to the private sector, allowing for greater competitive opportunities to be discovered.
- Support of the next stage of growth in the knowledge economy in Brisbane, which requires a shift in government support towards identifying market-derived growth, rather than adhering to prescriptive and rigid growth standards.

Through the optimisation of existing capital and resources, and strategic shifts in planning and policy, Inner-Brisbane has the potential to be a highly competitive, liveable and vibrant city well into the 21st century.

These findings were strategically presented to the Brisbane City Council (BCC) together with a delegation from the Barcelonan Olympics as part of the BCC’s ‘City Centre Masterplan and Inner City Framework’ initiative, and presented to the Committee for Brisbane as part of their ‘Designing the Inner City of Brisbane’ initiative.

Image credit: Tope Adeniyi
Middle-ring suburbs in Brisbane face a unique set of challenges, including aging housing stock and water infrastructure, changing demographics, and planning codes that prevent densification while not mandating sustainability requirements. The consequences of these challenges, if left unaddressed, are increased severity of climate events such as flooding, vulnerability to droughts and more severe heat islands, insufficient housing supply for future population needs, and housing that does not perform at the levels required to meet sustainability targets.

Two projects – Collaborative Water Sensitive Design and Urban Performance Analysis, and a Pathway to Future-Proof Housing Standards – responded to these issues with a view to adapting regulations, economics, and behaviours towards the development of resilient and productive communities.

Culminating in a book titled House Precinct Territory: Design Strategies for the Productive City (2023), the project addressed planning, governance and policy issues with a view to adapting regulations, economics, and behaviours towards the development of resilient and productive communities.

The research has generated two reports as part of their Resilient Homes and Suburbs webinar. Presented to Queensland Urban Utilities and to the Planning Institute of Australia as part of their Future Strategies Seminar.

Floating Cities
Project Contact: Dr Brydon Wang
Buoyant urbanism is a concept supported by the United Nations in response to rising sea levels and the need to house climate refugees, yet it requires legal changes and new ways of thinking about the city to support the transition to design and planning to facilitate the realisation of this concept.

The project amalgamated work by a number of researchers on this uncharted area of built environment, culminating in Floating Cities: Buoyant Urbanism, Legal Change & Amphibious Architecture (2023). Here, a raft of new floating architectural proposals sought to engage with the future of our cities to make them more amphibious, human-centred and flood-resistant.
Regional and Remote Infrastructure

**Small Town Power Resilience**
Project Contact: Dr Mashhuda Glencross

Energy security is a concern for many Australians, particularly those in remote communities who are regularly affected by severe weather events causing lengthy power outages. This is the case for the small town of Milaa Milaa in the Atherton Tablelands, where its population of around 1000 people can go for up to two weeks without power after a cyclone.

This project, run in partnership with the Centre for Energy Data Innovation, examined how a microgrid might be established in Milaa Milaa utilising existing alternate energy sources (such as diesel generators and solar panels) to support community needs in the event of extended loss of power. Brining together the energy provider, consumer advocacy groups, local council, and homeowners, researchers developed more accurate assessment tools for the existing power grid and worked closely with all stakeholders - through town hall meetings and social media engagement - to ensure the design solutions responded to a range of needs.

The result was a Full Feasibility Study for the Milaa Milaa Microgrid. The Feasibility Study forms the basis for ongoing research and an opportunity to explore this approach to energy security in small towns across Australia.

**National Parks**
Project Contact: Dr Timothy O’Rourke

This project investigates the role and significance of infrastructure design in Australian national parks. The design of infrastructure and capital works mediates the experience of different groups of national park users, including tourists, researchers and traditional owners. The two primary uses of national parks – recreation and environmental conservation – are often regarded as contradictory. The project explores how design might balance the requirements of the different users of national parks and the need to minimise damage to the natural and cultural environments in protected areas.

Tourists are one of the threats to conservation, the primary research question is to ask ‘how might design improve the tourist experience while minimising threats to biodiversity?’

The project began with research into the history of national parks in Australia to elicit themes which reflect changing uses, policies, and advocacy campaigns that have direct and indirect influences on infrastructure design – walking tracks, accommodation, and visitor centres. The project also investigates changing design conditions in national parks based on novel and escalating threats such as high visitor numbers, climate change, bushfires, and pathogens. In addition to historical analysis, and given new challenges, the project aims to critically evaluate selected types of infrastructure/capital works, with an emphasis on exemplar projects across different Australian states.

This research will inform a larger study of infrastructure design in Queensland and Australian national parks, with potential to expand to a multidisciplinary project that extends methods for data collection and analysis. A grant submission is planned for 2024.

Sustainability and Governance

**Climate Literacy and Action in Architecture Education**
Project Contact: Dr Liz Brogden

The release of the 2021 National Standard of Competency for Architects (NSCA) prompted a national review at every level of the architectural profession, from degree accreditation to professional registration requirements. Most notably, new Professional Competencies have been introduced, requiring that architects and educators engage with climate change and sustainability issues, as well as First Nations care for country principles.

This project is concerned with how schools of architecture are foregrounding climate change issues in parallel with architectural practice. This same National Standard aligns architecture degrees with professional competency for registration and informs continuing professional development (CPD) for practising architects.

Initial research surveyed students, PhD researchers, sessional academics, and faculty staff in all architecture schools in Australia and New Zealand to gather perceptions about education in climate change and sustainability. The second phase of the project involved a national survey of industry perspectives on climate literacy and action in architectural practice. A combination of quantitative and qualitative data was sought to compare and contrast current activities in architectural practice with findings from the architecture schools survey.

The results of the research will be presented in a new report published mid 2023.

**Design Governance and the Architecture Profession**
Project Contact: Dr Susan Holden

Design-led governance is emerging as an effective way to include consideration of design quality in strategic planning and complex multi-stakeholder projects and ultimately to improve the quality of built environment. Yet it is under-researched and under-valued as an aspect of architectural knowledge and part of professional practice. This project sought to remedy this by exploring the place of architecture in design governance.

Particular governance processes and policy types were examined including the role of state government architects and other design leaders in state and local government, design review panels that involve professional experts, and policies that shape the built environment including procurement, heritage and cultural policy. The research also looked more generally at the role of institutions in managing built environment values.

Concepts from governance theory, policy studies and the sociology of the professions guided the interrogation of how design governance might recast notions of professional expertise and citizenship.

The research found that some of the most effective forms of design governance operating in Australia are informal (non-statutory) and rely on capacity- and culture-building in organisations and political commitment. This expertise is tacit and comes from direct experience, thus requiring specific methods to understand it. However, the profession does not currently collect data on architects in built environment governance, making it difficult to evaluate and expand this expertise.

This project resulted in a recommendation to review international benchmarks in order for Australia to advance design governance expertise, and prompted a dossier on the subject in Australia’s leading architectural journal, Architecture Australia. Several grants have also been approved or are pending for further research.

Above: Storm at Milaa Milaa in Queensland.
Digitisation of Architecture

Digital Twin of the UQ St Lucia Campus
Project Contact: Dr Frederico Fiahlo Teixeira

Rapid progress in digitalisation and artificial intelligence is providing numerous opportunities for human interaction research. Connecting the real world to the digital world using digital twins is one such opportunity that is more feasible than ever before thanks to increased availability of sensor information, allowing new applications in many different areas to be explored.

For this research project, existing data from various locations at UQ’s St Lucia Campus was utilised, and new data generated, to model, simulate and forecast changes around campus. These models include flood simulations, mobility around campus and how it’s affected by construction, building occupancy assessment with spatial data, and mapping of building age in relation to campus infrastructure.

This facilitated the discovery of key opportunities for efficiency in campus management, such as the use of 3D point-clouds for Properties and Facilities, and also developed reproducible workflows to enable adaptation at scale. Additionally, it highlighted the benefits of cross-departmental collaboration in the University as staff from Architecture, Civil Engineering, ITEE and Properties & Facilities collaborated to generate optimal outcomes.

This project demonstrates what the future of built environment management can look like. It showcases the possibilities of digital twin technology in the strategic management of the Campus and its facilities, and presents a pilot study for broader-scale application of spatially enabled digital twins at the urban scale. A Mega-CRC grant will be submitted in 2023 for ongoing research.

Remote Robotic Additive Manufacturing
Project Contact: Dr Frederico Fiahlo Teixeira

This project investigated remote robotic 3D printing of clay-based bio-materials to produce blocks with improved structural and environmental performance. Using a UR10 collaborative robot, varying percentages of algae were combined with clay to explore the relationship between the percentage of algae in the mixture and the resulting structural integrity of the printed blocks.

This material exploration was paired with an examination of diverse geometries inspired by biomimicry patterns, testing the proposition that the versatility of robotic 3D printing enhances material and geometric properties and optimises the use of bio-composites in construction.

A computational script was also developed. This provided a user-friendly augmented reality interface for designing blocks as well as controlling the robotic 3D printer that can be utilised by people with no or limited experience in the field.

The research aimed to improve clay-based construction in remote communities and move towards a carbon-negative future by introducing a new digital and material culture in these communities. It contributes to the structural improvement of localised resources and supports a more sustainable and resilient mode of construction.

The research was shared as part of the SHERobots workshops and exhibition at the University of Sydney, and will inform an ARC LIEF grant being submitted in 2023.

Augmented Reality for Design and Manufacture
Project Contact: Dr Frederico Fiahlo Teixeira

This project sought to develop a framework for Augmented Reality studies in the optimisation of the Architecture, Engineering and Construction (AEC) industry. Specifically, it addressed both the ad hoc adoption and distribution of BIM component parts, assemblies and fixtures in the manufacturing industry, and the linking of design, manufacturing, production planning and assembly operations within organisations. With the ability to aggregate and expand data, the potential for new insight into advanced manufacturing and operations was explored through the total process simulation of an actual production process. Going beyond the digital twin with the Augmented Reality experience, the key outcome was a connected digital design and fabrication process in real-time, through an executable digital model of a physical system which brings in learning and experiences taken from the real-world processes to update a digital twin process.

This project forms part of the Digital Twin Mega-CRC grant application being submitted in 2023.

Digital Heritage Standards
Project Contact: Dr Susan Holden

As the built environment industry moves towards digitisation, a question arises regarding the integration of digitised heritage buildings and the need for a standardised approach in the digitisation process. This project seeks to clarify this question in order to influence future policy at a national level, and ensure heritage buildings are adequately incorporated into the digital cities of the future.

The researchers created a 3D digital scan and model of UQ’s Zelman Cowen building, which was then incorporated into the Digital Twin on Campus project. This demonstrated the ability for integration of digitised heritage buildings into BIM models and digital twins.

The team also sourced and archived sets of drawings of the Zelman Cowen building from various architects who have worked on the building over decades.

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This informed a report for the Mornington Shire Council, which aimed to better inform the Council about how to improve current procurement practices and implement design for housing on the Island in a way that considers the community cultures and the environment. It includes a guideline called Gununawan Design Principles, and a Briefing and Procurement Model.

The aim is to produce dwellings that are economically sustainable for residents and government cost models, as well as climatically and culturally appropriate. Recommendations include dating dwellings with passive design principles in mind to maximise breezes, reduce sun exposure, and provide ample shaded outdoor spaces; offering greater diversity of housing options to allow for a range of family types and sizes; facilitating privacy, and supporting community interaction.

Future research will integrate energy experts to go beyond housing design, and look at broader infrastructure issues connected with disparities on the Island embedded in the built environment.

### The Future of Housing and Urban Design on Gununa

**Project Contact: Dr Carol Go-Sam**

Gununa (Mornington Island) is facing a range of problems familiar to many in remote indigenous communities: housing that is not fit for purpose, both culturally and environmentally, with too little housing for the community and energy security disparities.

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The aim is to produce dwellings that are economically sustainable for residents and government cost models, as well as climatically and culturally appropriate. Recommendations include dating dwellings with passive design principles in mind to maximise breezes, reduce sun exposure, and provide ample shaded outdoor spaces; offering greater diversity of housing options to allow for a range of family types and sizes; facilitating privacy, and supporting community interaction.

Future research will integrate energy experts to go beyond housing design, and look at broader infrastructure issues connected with disparities on the Island embedded in the built environment.
Designing the Next Generation of Built Environments research has directly impacted the School’s teaching and research methods, its engagement with industry and government in research planning and execution, and its reputation as a leader in the field of built environment research across academia and Queensland communities.

**VISUALISATION LAB LAUNCH**

The Visualisation Lab was funded through DNGBE and provides a 360° immersive environment for display of a broad range of computer-based visuals while also integrating with Virtual Reality (VR) and Augmented Reality (AR) headsets. Championed by Dr Frederico Fiahlo Teixeira, the Lab is designed to allow visualisations to come to life, which enhances research, teaching, and engagement with other schools, faculties, and industry.

The launch of the Visualisation Lab showcased the opportunity the space provides for different disciplines to come together, with academics and industry guests from architecture, planning, IT, electrical engineering, and Property and Facilities in attendance.

This is reflected in the Lab’s usage over the past six months, which has included:

- **Research workshops** reporting significantly better integration of online and in-person attendees, and improved outcomes as a result.
- **The Planning and Infrastructure at Springfield City Group** using the Lab twice after seeing the School’s work on digital twins in the virtual lab, with potential for adoption for Springfield.
- **Sullivan Nicolaides Pathology** using the Lab for development of a functional pathology tool training module in VR, as well as a fully interactive laboratory experience in XR.
- **UQ Serious Games Society** using the Lab for an education and training program to incorporate a competency-based assessment framework to Mechanical and Mining Engineering focused around training and assessment.
- **UG Property and Facilities using the Lab** to visualise the campus digital twin (developed by Dr Teixeira) in 360 degrees and compare drawings to as-built projects through the use of point-clouds.
- **Teaching and Learning Enhancement Team** using the Lab for multiple EAIT inductions focused on completion of additional field training requiring spatial understanding.
- **UQ XR Community** using the Lab for enhancing the use of XR technologies by EAIT students.
- **Architecture Master Thesis Development** promoting quantitative and qualitative immersive experiences of the Digital Twin.
- **DAQA Workshop** in the Lab focusing on the development and use of the Digital Archive of Queensland Architecture (DAQA) through amplified visualisation of the data.

DEMONSTRATING THE POTENTIAL OF IMMERSIVE DIGITAL ENVIRONMENTS, THE VISUALISATION LAB HAS FACILITATED MORE INTEGRATED DUAL MODE WORKSHOPS, ALLOWED PROPERTY AND FACILITIES TO DEEPLY ENGAGE WITH THE CAMPUS DIGITAL TWIN, AND PROVIDED A PLATFORM FOR VIRTUAL INDUCTIONS WITH STUDENTS.
In August 2023, the School of Architecture will open an exhibition at the State Library of Queensland showcasing eight research projects from Designing the Next Generation of Built Environments.

Titled Purpose Built: Architecture for a Better Tomorrow, the exhibition will juxtapose the SLQ Collection content as historical precedent and current state context with the School’s research into resilient design and innovation in the built environment.

The design and content of the exhibition aims to appeal to a broad audience while provoking a reconsideration of built environment policy and cultural norms in advocating for the change required to meet sustainability targets and improve living standards for changing populations.

The exhibition will extend from slq Gallery across Level 2 into the Asia Pacific Design Library. The projects included are:

- Mapping Forest to Fibre, Fibre to Building
- The Future of Housing and Urban Design on Galuna
- Digital Twin of the UQ St Lucia Campus
- Collaborative Water Sensitive Design and Urban Performance Analysis
- A Pathway to Future-Proof Housing Standards
- Augmented Reality for Design and Manufacture
- Remote Additive Robotic Manufacturing

The research content will be further amplified by public programming over the course of the exhibition period, allowing strategic engagement with policy makers, stakeholders, students, industry groups, and the broader public.

Government Engagement

A number of projects actively engaged with local councils or state government to ensure research aligns with, and influences, future policy directions.

The Inner-Brisbane Project

Researchers Peter Hyland and Dr Tope Adeniyi presented their report to Brisbane City Council (BCC) councillors and the BCC Better Suburbs Initiative Board to present their findings on home-based businesses, and discuss the need to better clarify the range of business types and scales taking place in Brisbane’s suburbs. Councillors agreed that the research was critical to resolving an existing gap in information regarding small businesses based in residential settings, which is needed for Council to develop strategies to support this active yet underrepresented part of Brisbane’s economy in the future.

Productive Cities

The Productive Cities project team met with a number of Brisbane City Council (BCC) councillors and the BCC Better Suburbs Initiative Board to present their findings on home-based businesses, and discuss the need to better identify the range of business types and scales taking place in Brisbane’s suburbs. Councillors agreed that the research was critical to resolving an existing gap in information regarding small businesses based in residential settings, which is needed for Council to develop strategies to support this active yet underrepresented part of Brisbane’s economy in the future.

Designing and Developing Next Generation Urban Villages - a Cairns Case Study

A two-day workshop held in Cairns in October 2022 brought researchers and industry together with local council and state government. The workshop identified priorities for all stakeholders, and where these priorities aligned versus where roadblocks existed. This allowed for a broad needs assessment and identified a way to progress the proposition that a significant change is needed to urban design, planning, transport, and housing typologies in order to address the needs of a growing population in Cairns.
The School of Architecture further strengthened its network across the full scope of the built environment during the DNGBE grant period. This included strong inter- and cross-institutional collaborations, industry involvement, and government consultation.
Books


Book Chapters

Conference Papers


Hall, N; Simpson, P; Frank, P; Memmott, P; Redmond, A; Go-Sam, C; Nash, D. ‘How housing maintenance and crowding can support or undermine health: A case study from the Barkly Region NT’. 18th National Aboriginal and Torres Strait Islander Environmental Health Conference (NATSEIH). Darwin, Australia. 5-8 September, 2022.


Exhibitions


Lansbury, N; Lofthus, S. (CI); Memmott, P. (CI). MHSV Ideas Grant 2023: Living in Country: Aboriginal & Torres Strait Islander Peoples Navigating Their Health in a Global Warming-Affected Future (LOCATING).

Carapetis, J. (Lead CI); Bowen, A (CI); Memmott, P. (CI); Pearlson, G. (CI); Bloom, D. (CI); Ralph, A. (CI); Davies, M. (CI); Haji, N. (CI); Wyber, R. (CI); Barnett, T. (CI). MHSV Synergy Grants 2023: Stopping Acute Rheumatic Fever Infections to Strengthen Health (STARSHF).


Grant Submissions


Industry Reports
Brogden, L; Greenop, K; Oldfield, K; Peck, J; Ashton, S. (2022). Policy for EAIT ECRs.


Publications


Haji, N; Memmott, O; Barnes, S; Redmond, A; Go-Sam, C; Nash, D; Frank, T; Simpson, P. (2022). Phyi Papulu Pumuki-jagi (Good housing to prevent sickness): A study of housing, crowding and hygiene-related infectious diseases in the Barkly region, Northern Territory.


Lansbury, N; Memmott, P; Redmond, A. (2023). Improving housing to support health and reduce infections and disease: Tennant Creek Community Living Area Trials: a summary of discussion questions for CLA leaders and local communities.


Haji, N; Memmott, O; Barnes, S; Redmond, A; Go-Sam, C; Nash, D; Frank, T; Simpson, P. (2022). Phyi Papulu Pumuki-jagi (Good housing to prevent sickness): A study of housing, crowding and hygiene-related infectious diseases in the Barkly region, Northern Territory.


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Haji, N; Memmott, O; Barnes, S; Redmond, A; Go-Sam, C; Nash, D; Frank, T; Simpson, P. (2022). Phyi Papulu Pumuki-jagi (Good housing to prevent sickness): A study of housing, crowding and hygiene-related infectious diseases in the Barkly region, Northern Territory.


Lansbury, N; Memmott, P; Redmond, A. (2023). Improving housing to support health and reduce infections and disease: Tennant Creek Community Living Area Trials: a summary of discussion questions for CLA leaders and local communities.