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## Housing and Overcrowding in Remote Indigenous Communities: Impacts and Solutions from a Holistic Perspective

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### Abstract

Over three years, a \$12 million Commonwealth funded consortium project implemented energy efficiency initiatives in six remote Indigenous communities. An ecological community-based participatory action research design that utilized qualitative and quantitative research approaches in a multiple methods design was employed to clarify how Yolŋu use power, to identify the barriers and enablers of Yolŋu using power wisely, and to evaluate the project. 16 Indigenous co-researchers conducted 125 in-depth qualitative interviews with community members across the six communities in the local languages. The principal non-Indigenous researcher also conducted 24 in-depth qualitative interviews with relevant non-Indigenous community members. All interviews were transcribed and systematically analysed using a combination of content, thematic and narrative analysis strategies. This culturally responsive research design provided the opportunity for Indigenous and non-Indigenous community members to disclose their perspectives authentically. The analysis of the quantitative and qualitative data revealed that house designs used in remote communities are inappropriate for the tropical climate and for the Australian Indigenous culture and society. Additionally, the housing situation has culminated in overcrowding. The holistic and critical perspective employed identified that climatically and culturally inappropriate housing, and insufficient housing and overcrowding are key contributors to power being used inefficiently and to a myriad of intertwined challenges faced by Indigenous people in remote communities, such as chronic disease, depression, conflict, employment and school attendance. Together, these issues are undermining and

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challenging the strength and resilience of Indigenous people, harming the very culture that might hold the key to our survival.

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*Keywords:* Housing; Overcrowding; Indigenous Communities; Holistic Perspective

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## 1. Introduction

For well over 40,000 years before European colonisation, Australian Indigenous people experienced high levels of health and wellbeing as a result of their nomadic lifestyle, eating nutritious native foods and engaging in sophisticated ancestral spiritual and cultural practices [1, 2, 3]. In contrast, as is widely recognized, today Australian Indigenous people are experiencing significant physical and psychological health, and social issues, resulting in much lower life expectancies as compared to the Australian non-Indigenous population (10 years less for females, 12 years less for males)[1, 2, 3, 4]. Housing design and quality, and chronic overcrowding are widespread problems especially in remote Indigenous communities where over 48% of adults live in overcrowded conditions [3, 5].

To address these issues, a \$12 million Commonwealth funded consortium project trialled energy efficiency initiatives in six remote Indigenous communities in Northern Australia. The objectives of this project consisted of measuring household power usage, identifying and clarifying barriers to Indigenous households using energy efficiently, designing and trialing energy efficiency education and technologies, and developing a best practice engagement model for working together with Indigenous communities. Following an outline of the research design, we will discuss the interactions between energy household consumption in remote Indigenous communities, tropical climate, Indigenous culture, house design and overcrowding. Next, we will explore the impacts of house design and overcrowding holistically, considering energy usage, health and social impacts. We will conclude with suggesting pathways facilitating designing houses suitable for the tropical climate and Indigenous people.

## 2. Research design

To clarify how Yolŋu use power, to identify the barriers and enablers of Yolŋu using power wisely, and to evaluate the project, a research component was included in the project. An ecological community-based participatory action research design that utilized qualitative and quantitative research approaches in a multiple methods design was employed [6, 7, 8, 9]. Taggle data loggers were installed in over 660 households across all communities to measure household energy consumption in 30-minute intervals. To investigate thermal comfort variables specific to tropical climates a thermal comfort tracking study was conducted with six households in one community over six months. Indoor temperature, relative humidity, air velocity and radiant temperature were measured using Taggle data loggers and Kestrel Mobile or Hobo Stationary Weather Stations. These data were used to calculate the heat index inside the house (apparent temperature). During the household visits conducted in all six communities, maximum number of occupants living in a household was recorded as part of the household surveys. An appliances survey, which used pictorial representations of common household appliances to record the number of these appliances in the household, was also conducted with the majority of households.

Qualitative data was collected using an Indigenous co-researcher approach. A lead Yolŋu co-researcher, a Yolŋu interpreter and 16 local Yolŋu co-researchers across the communities were employed and educated. Over three months, the lead Indigenous and non-indigenous researchers conducted participant observation in the communities. The 16 local Yolŋu co-researchers interviewed their fellow community members in their local languages towards the beginning of the project using narrative interviews ( $n = 40$ ) and towards the end of the project employing semi-structured and narrative interviews ( $n = 85$ ). In total, the Yolŋu co-researchers conducted 125 interviews with community members across the six communities. The recorded interviews were interpreted by a trained Indigenous interpreter and fully transcribed. The non-Indigenous principal researcher also conducted 24 in-depth qualitative interviews with relevant non-Indigenous community members, such as electricians, plumbers, doctors, nurses, and

shire council employees. The pre-project interviews were analysed using a combination of thematic and narrative analysis [10, 11] to extract the salient themes from the interview data and to order the themes sequentially. The evaluation interviews were analysed using a combination of content, thematic and narrative analysis to ensure that both the evaluation topics that were of interest to the project team and consortium as well as the evaluation topics that were of interest to the Yolŋu would be captured [10].

### 3. Findings

Together, the analysis of the quantitative and qualitative data illuminate the wider issues associated with housing design and chronic overcrowding in Indigenous communities. The culturally responsive qualitative research design gave Indigenous community members the opportunity to disclose their perspectives authentically.

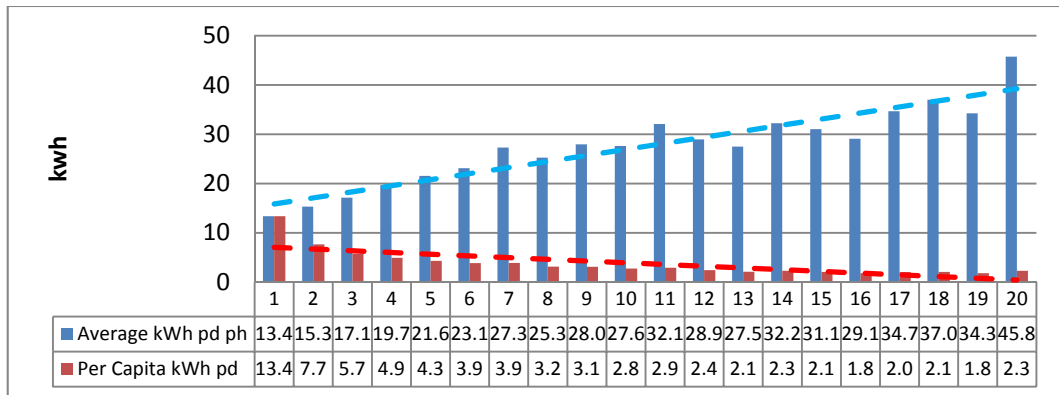
#### *3.1. Energy consumption in remote Indigenous Communities: Tropical climate, Indigenous culture, house design and overcrowding*

The climate in Northern Australia is tropical monsoonal and consists of a dry and a wet season. The dry season (May to October) is experienced as cooler due to the combination of temperatures over 30 degrees and lower humidity of around 60-65%, whereas the wet season (November to April) is experienced as very hot because of the combination of temperatures over 30 degrees and higher humidity of up to 80% [12]. The literature [13] and the participants' accounts indicate that before European colonialization Yolŋu were skillful in designing and building a variety of different types of temporary houses adapted to and suited for the monsoonal climate and for Indigenous cultural and social ways of living. For instance, during late March to April, Yolŋu built round iglu-like houses for protection against mosquitos. The house included a small vent in the roof that permitted lighting a smoky fire inside using wood that repels mosquitos. During the height of the wet season, tree houses with roofs kept Indigenous people sheltered from water and crocodiles. The missionaries settling Australian Indigenous people in communities and introducing Western-style houses ended Indigenous people building their own traditional houses.

The quantitative data provides an understanding of household consumption and thermal comfort in the Western-style houses built in remote Indigenous communities today. All houses are provided with lights, fans and hot water systems. The appliance data survey results show that only 65% of houses have a wall unit air conditioner. Power consumption was higher during the hotter and more humid conditions of the wet season than during the cooler dry season, indicating that residents needed to use more air-conditioning during the wet season to ensure thermal comfort in the houses. The thermal comfort tracking study suggests that people living in new and refurbished houses experience heat stress. The heat index was above the typical thermal comfort zone from 10 am to 9 pm in new houses and from 10 am to 11 pm in refurbished houses. During these hours, householders would need to use mechanical cooling appliances to experience thermal comfort, increasing household energy consumption. More air-conditioning needs to be used in refurbished houses than new houses. However, only 65% of houses having air conditioning means that 35% of houses do not have the option of using air conditioning to cool their houses, suggesting that they experience substantial thermal discomfort in their houses between 10 am and 11 pm.

The analysis of the survey data revealed that, on average across the six communities, nine people live in a house (range 6.8 - 10.7). However, this number is likely to be conservative. The analysis of the qualitative data indicates that actual tenancy is commonly higher than the reported numbers. The acute shortage of housing forces a high number of Yolŋu to live in a house. Yet, tenancy contracts permitting only a certain number of tenants per house leave Yolŋu no choice but to under-report tenancy numbers. The participants' accounts and participant observation suggests that often well over 10 people from several families and generations are sharing one house. This number rises considerably for prolonged periods spanning several weeks during ceremonies, especially funeral ceremonies, when local residents are hosting their kin. The analysis correlating energy consumption and number of people living in a house shows that the more people live in a house the higher the household energy consumption, but the lower the energy consumption per person (see Table 1).

Table 1: Correlation of average daily power consumption per household and capita by number of occupants



These findings combined indicate that one of the largest levers for increasing household energy efficiency in remote communities would be designing and building houses that are suitable for the specific tropical conditions and for the specific local Indigenous culture and society. These houses could be designed, built, and maintained synergizing traditional and local Yolŋu knowledges and skills as well as Western knowledges, technologies and skills. Increasingly, Western science discovers that Indigenous house designs outperform Western house designs in terms of energy efficiency, and in terms of applying sustainable or green architecture that utilizes local traditional materials, designs and technologies [14, 15, 16]. Well designed houses could drastically reduce power consumption while ensuring thermal comfort and address the issues discussed below. At the very best, well designed houses could be zero energy houses that do not require residents to use cooling appliances at all. Well designed houses could also contribute to reducing overcrowding. One suitable design could be, for example, several one bedroom houses being connected to communal spaces (e.g., living space, kitchen/fire place, several bathrooms designated to males and females) in a circular arrangement. Power could be charged separately for each one bedroom house and the common space, reducing responsibility diffusion, conflicts and dependency issues highlighted below. This design might provide independence, space and privacy while also providing connection between family members. Importantly, by addressing the housing and overcrowding issues a wide variety of the health and social issues would be dealt with besides reducing energy consumption, as will become apparent in the next section.

### 3.2. Impacts of house design and overcrowding: A holistic perspective

At first glance, the finding that the more people are living in a house the lower the energy consumption per person could be interpreted as overcrowding being a pathway to conserve power consumption. However, the analysis of interview accounts and participant observation suggests that this interpretation is only valid from a narrow short-term focus that masks the complex ways in which house design and overcrowding increase power usage, and contribute to amplifying health and social issues.

The quantitative and qualitative data shows that if the houses and surroundings were designed in ways that are appropriate to the tropical climate Yolŋu would need to use less electrical cooling to ensure thermal comfort. For example, current house designs mean that houses typically heat up above the typical optimum thermal comfort zone, requiring Yolŋu to use electrical cooling to reduce temperatures to accomplish thermal comfort. Additionally, current housing designs mean that it takes a long time for houses to cool down using air conditioners. Thus, as several participants shared, some Yolŋu leave their air conditioners on when nobody is in the house and when they are away for a long time not only to ensure thermal comfort but also to prevent mould growing as result of heat and humidity. The qualitative analysis also revealed that many Yolŋu prefer cooking outside, sitting outside in the shade and sleeping outside (during the cooler season around the fire) as this way of living is more akin to their traditional customs. However, current house designs hinder Yolŋu living the traditional ways that would conserve energy. Several participants said that, if all houses would have outdoor living spaces that are sheltered from rain, Yolŋu could spend more time outside even while raining or cool, reducing the use of air conditioners. Participants

also said that, if houses had outdoor living spaces that are secure and allow using fire, Yolŋu could sleep more securely outside even during the cool nights rather than using heating and could cook outside even while raining rather than using the oven. Yolŋu living more outside using traditional ways of living would increase their health and wellbeing. The finding is consistent with the literature, which says that Indigenous people in Australia and worldwide enjoyed great health and wellbeing when they lived their original ways in nature [1,2,3].

The analysis of the interview and participant observation data revealed that overcrowding could increase the power usage in houses. For instance, overcrowding further contributes to Yolŋu leaving air conditioners switched on when nobody is in the house as so many people living in the house makes it difficult to keep track of movements of people and when people came back to the house. Moreover, many people living in a house defuses responsibility for switching off mechanical cooling and makes it difficult to ascertain when people are in the house or come back to the house. unemployed and younger house tenants commonly rely on the principal tenant and household members who work to pay for power. Principal tenants and employed householders have to accept this practice not only because their culture places a high importance on helping family (reciprocity), but also because they cannot tell those householders who do not pay to leave as there are not enough houses available in the communities. Because they do not pay for power, there is no financial incentive for these householders to use power efficiently. Further, the analysis suggests that many people having to share a house diffuses the responsibility to use energy efficiently. For example, many people sharing a house where power is charged for the whole house makes it challenging to establish individual usage of power and contribution to paying for power. The analysis of the interview accounts shows that overcrowding is often leading to conflicts among householders when they are negotiating how to use power and agreeing on who is paying for power. Likewise, tenants observing other household members using a lot of power or using power inefficiently, and these household members not changing the way they use power, increases the likelihood of them to also use power unwisely. The likelihood of householders using power wisely is also reduced by neighbours who run out of credit on their power cards using their power via power cords, using their washing machines, or both. A combination of these factors increases power usage, which, in turn, increases the burden on the principal tenants and money-earning household members to pay for power cards. From the perspective of participants, the higher number of people living in a house increases the use of household appliances, especially washing machines. Interviews with non-Indigenous people who influence the decision of what is sold in the community stores<sup>†</sup> brought to light that they sell low power efficiency washing machines because they believe Yolŋu are unable to afford more expensive power efficient brands. Thus, Yolŋu have no choice but must buy appliances that use more power, further increasing power usage.

The analysis of interviews with both Indigenous and non-Indigenous community members indicates that issues related to power and overcrowding have critical and far reaching impacts on Yolŋu health and wellbeing, employment, and school attendance. For instance, Many Yolŋu shared that the interactions between the factors discussed could impede constant connection to power, which provokes distress and sickness. Several Yolŋu said that, although most Yolŋu prefer the power card system to the previous billing system and generally manage to maintain the power because of the kinship system and the practice of reciprocity, the power card system is difficult for Yolŋu to manage. The issue is frequently on their mind and they are anxious about being left without power as power disconnections can impair their immediate security and safety, health and comfort. Several participants shared that they are particularly concerned about the disabled and sick as they typically are not able to move outside if the fans and air conditioners are not working. Moreover, participants working in the medical professions emphasized that medication storage, food storage and thus diet, sleep quality, hygiene, and washing of clothes are all under threat when power is disconnected. These immediate impacts have wider reaching and long lasting impacts on mental and physical health, school attendance, and employment.

The responsibility to ensure that the power meters are in credit resting only on the shoulders of a few increases the likelihood of households being disconnected from power. Many participants who are principal tenants said that

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<sup>†</sup> Typically, one store in the community supplies the predominately Indigenous population in remote communities with groceries, appliances, clothes and other necessities. Commonly, only a small majority of non-Indigenous people lives in these remote Indigenous communities.

having to ensure continuous power flow creates significant distress because due to overcrowding a lot of their kin would be impacted by being without power. Further, principal tenants or tenants who work perceive it as unfair that they are paying for power yet are typically not at home during the day due to working and, thus, are not using as much power as those who are home all day. Some participants who work shared that this situation is frustrating and stressful, reducing their motivation to work. Moreover, some participants shared that, when clothes cannot be washed due to being disconnected from power, or not managing to get their turn using the washing machine (many participants reported that the washing machines are on around the clock due to so many people living in a house and Yolŋu not owning a lot of clothes), children are less likely to attend school and adults are less likely to go to work. The interview analysis shows that the house designs commonly not being culturally and climatically suitable in combination with many households not being able to afford to sufficiently cool the house down not only increases thermal discomfort, but also the prevalence of chronic illness and the spread of diseases, reduces energy levels, reduces sleep quality and amount, and impacts negatively on mood. According to participants, the impact is especially pronounced for the sick and disabled who cannot easily move outside to cool off. Having to stay in a too hot and humid house can amplify their sickness.

The interview accounts and observations revealed that children not attending school, adults not working and children or adults being sick means more residents are staying at home during the day, increasing household power consumption. Furthermore, children not attending school means they do not receive a Western education at all or to a lesser degree, reducing their chances of employment, and increasing their dependency on the welfare system and other householders. Moreover, when adults do not participate in work or training activities they are not developing skills that would increase their employability. Without employment they depend more on welfare and other householders paying for power. Overcrowding contributing to increasing the prevalence of chronic illnesses and spread of diseases further reduces the likelihood of Yolŋu working and paying for power cards. The prevalence of disease also results in sick Yolŋu using more power for devices they need to manage their diseases. Several interviewees shared that overcrowding means that many Yolŋu from different generations have to sleep in one room. Overcrowded and hot rooms are impairing sleep quality and duration, which contributes to physical and mental health issues, to lower energy levels and to children and adults being too tired to attend school or work. To be able to sleep, many Yolŋu sleep outside the house on mattresses on verandas or in tents. However, several participants said that sleeping outside increases the risk of being bitten by dogs or snakes, and of women being harmed. As already pointed out, during the times of ceremonies, especially funerals which are a community affair, the number of people living in or around already overcrowded houses can swell substantially for several weeks, exaggerating all the issues discussed.

The above factors, and their interaction, contribute to many Yolŋu experiencing their life as hard and stressful. The data indicates that, to cope with the distress caused by the living conditions in the communities especially the overcrowding, some Yolŋu resort to drinking alcohol and consuming drugs, reducing their ability to learn, to work and to contribute to the power card payments. Alcohol and drugs also contribute to physical and mental health issues, and to engaging in violent behaviour that harms themselves and others. As a result of all of the connected issues introduced by non-Indigenous Western systems, Yolŋu, especially Indigenous elders, are increasingly concerned and worried. However, colonisation undermining the authority of elders through various practices weakened their ability to lead their people in ways that would facilitate better adaptation [1, 2]. The analysis of the interview accounts indicates that the current state of affairs in remote Indigenous communities is leading to children increasingly losing respect for their adults and elders. One consequence of the disrespect is, according to many participants, that they typically disregard what they are told and continue to use power inefficiently. Many participants shared that, as a result of insufficient housing stock in the communities, children and young people have to continue to live in their parents and other kin's houses as well as to depend on their parents to pay for power and food. To care for themselves, parents pay for power, but the overcrowding means that there is no way of excluding children and non-earning householders from using the power as long as they are living in the same house. Being able to depend on their kin reduces the necessity of young adults having to work. Living in houses that are not designed in a way that is suitable to living in the tropics without air conditioning greatly amplifies all of these issues.

#### 4. Discussion

Together, these findings demonstrate the complex interactions, and interdependencies, between house design, overcrowding, power usage, and health and social issues in remote Indigenous communities. Thus, designing and building houses that are suitable for living in tropical climate and addressing overcrowding would not only increase power efficiency but may contribute to addressing key issues in the communities: mental and physical disease, unemployment, and school attendance. The linkages that emerged from the data indicate the value of government agencies shifting their thinking to a more holistic perspective. By adopting a holistic perspective, the complexities, linkages and processes interacting to create the above issues could be identified and addressed more effectively. Capturing these complexities and linkages could lead to the identification of effective levers for not only enhancing energy efficiency but also addressing the connected issues highlighted above. Addressing these levers opens the possibility of governments as whole, rather than different departments, accomplishing effective outcomes cost-effectively. For example, based on the above outlined linkages, the Departments of Housing (DoH) could, by outlaying the necessary funding to build houses that are culturally and climatically suitable, address several critical issues that other government departments were unable able to address to date because the root cause is overcrowding, an issue that cannot be addressed in isolation and by using short-term projects. Although the up-front costs for creating culturally and climatically suitable housing is high for the DoH, this investment is likely to save considerable money for departments managing health, education, welfare, business and environment as well as for power providers, resulting in overall cost-effectiveness. Interviews with non-Indigenous participants suggests that the major barriers to designing climatically and culturally suitable house are the high costs for building and maintaining new houses in remote communities. Additionally, in the past, Yolŋu communities seem to have rejected energy efficient house designs. However, the qualitative data collected in this project indicates that Yolŋu rejected energy efficient houses in the past due to a combination of not addressing perceptions and judgments accrued by both non-Indigenous and Indigenous people that hinder working together, of ineffectively communicating across paradigms and exchanging knowledge, and of failing to build on existing Yolŋu knowledge systems and to consider cultural and social appropriateness.

#### 5. Conclusion

In conclusion, quantitative and qualitative findings from this project revealed that house designs used in remote communities are inappropriate for the tropical climate and Indigenous culture, and that these designs contribute to increasing energy consumption. More importantly, insufficient housing being available in remote communities has resulted in overcrowding with often well over 10 people sharing one house. For Yolŋu, overcrowding remains the key problem in their communities. The holistic and critical perspective employed by this research identified that inappropriate and insufficient housing is a key contributor to a myriad of intertwined and serious health and social issues Indigenous people face in remote communities. Together, these issues are undermining the strength and resilience of Indigenous people, harming the very culture that might hold the key to our survival.

Because of the central position of housing in the web of disadvantage that Indigenous people experience, governments worldwide have started to focus on improving housing for Indigenous people. For instance, addressing housing is a key pillar in an innovative Canadian Aboriginal Horizontal Framework developed to address disadvantages of Canadian First Nation people [3]. In Australia, healthy and safe housing has been suggested as one of the seven platforms on which to build health and wellbeing of Indigenous people [17]. Adapting a long-term development approach to strengthen housing and essential services in Indigenous communities has also been advised [18]. Ensuring Australian Indigenous people returning to experiencing the human right of physical and mental health and wellbeing would require major shifts not only in government policies but also, and maybe more importantly, in implementing these policies [3]. Research and various reviews (e.g., 17, 18, 19, 20) suggest that real changes in restoring health and wellbeing require rebuilding self-determination of Indigenous people and communities by:

- adapting a long-term holistic development approach that is flexible
- acknowledging the difficult social and cultural environment Indigenous people live in



- working together across government agencies and levels adapting a holistic, coordinated approach
- supporting Indigenous people and communities to lead and to participate in designing and implementing policies and program
- enhancing communication across different cosmologies, ontological and epistemological worldviews, and languages

Interestingly, these pathways forward have been consistently suggested for over 20 years [3]. Given that they have not been implemented or implemented ineffectively, we are wondering what factors are still hidden from our views that are at the source of blocking the implementation of these pathways and whether a paradigm shift is needed to afford change [21]. The physical and human costs of not effectively addressing the issues Indigenous people are facing are increasing fast and are also experienced by non-Indigenous people (e.g., disease, climate change and disasters, destruction of nature) [1, 2, 3, 4, 21]. Thus, if we do not act fast we might run out of time.

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