(See, Treat, Prevent) Skin Sores and Scabies

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ABORIGINAL CORPORATION

Skin Health Situational Analysis

to inform skin disease control programs for the Kimberley

Acknowledgements

This Situational Analysis is a product of collaboration between researchers, communities, and health providers. We would like to acknowledge and thank all who contributed data to this compilation and recognise it reflects the ongoing and steadfast commitment of families, communities, non-government organisations and government to improve skin health in the Kimberley region of Western Australia.

Telethon Kids Institute acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land and waters of Australia, and the lands on which this report was produced. We also acknowledge the Nyoongar Wadjuk, Yawuru, Kariyarra and Kaurna Elders, their peoples, and their land upon which the Institute is located and seek their wisdom in our work to improve the health and development of all children.

This Situational Analysis was conducted in 2017. The authors acknowledge there are likely changes to since that time and limitations in the most up to date information, but it accurately reflects the information available in 2017 regarding skin infections in the Kimberley.

Suggested citation.
McLoughlin F, Mullane M, Pavlos R, Enkel S, Bowen A. C, on behalf of The SToP Trial. Skin Health Situational Analysis to inform skin disease control programs for the Kimberley. Perth: The Skin Health Team, Telethon Kids Institute, 2021.

Frieda Mc Loughlin designed and conducted this situational analysis report. Frieda Mc Loughlin, Marianne Mullane, Rebecca Pavlos, Stephanie Enkel, and Asha Bowen reviewed and edited the report on behalf of the SToP Trial Investigators and partners.

The authors are grateful to those who gave their time to be interviewed or complete surveys for this report. The work of Dr. Rusanthi Pereira and Dr. Pippa May (formerly Chizney) on the Kimberley APSGN and ARF outbreak is also acknowledged.

The cover artwork was designed and painted by Luke Ritches from Ardyaloon. In his words; "*This art piece titled 'Gathering Circles' represents the 9 Indigenous communities that work with the Skin Team of the Telethon Kids Institute. The circles vary in colour and composition, just as the communities hold their own unique identities. The backdrop of pindan orange and coastal blues convey the land and sea setting that makes the Kimberley so beautiful. The dot painted trails show a connection between the communities, of both foot trails and song lines that unite the people.*"

STOP
(See, Treat, Prevent) Skin Sores and Scabies

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Discover. Prevent. Cure.

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GOVERNMENT OF WESTERN AUSTRALIA SUPPORTER

NIRRUMBUK
Environmental Health & Services

Letter of Introduction

Dear Reader,

We as leaders of Kimberley Health Service providers and steering partners in the SToP Trial to See, Treat and Prevent skin sores and scabies in the Kimberley commend this Situational Analysis to you.

It describes the long history of commitment by Kimberley people and service providers to improve health outcomes for Aboriginal Australians. It is a snapshot of what was happening in 2017, the year when the research was conducted through interviews, phone calls, emails, and surveys of a variety of Kimberley stakeholders prior to the implementation of the SToP Trial (2018 – 2023). As presented in this report, much of this information, previously inaccessible to communities and health services busy on the ground, reveals the challenge we now set ourselves to address and reduce the heavy burden of skin infections and related disease complications in partnership across the Kimberley.

We have a significant foundation from which we can build. Many of the positive achievements described in this report were initiated through the Kimberley Aboriginal Health Planning Forum (KAHPF). This Forum holds the key to continuing success in improving skin health in the region, based on the *Kimberley Skin Health Regional Partnership* signed by every KAHPF member in 2015, and affirms the importance of strengths-based approaches, the power of community control and evidence.

Time always moves things on. Some of this will now be out of date, but much will reflect the wonderful way that people in the Kimberley have developed to work together, to solve problems, improve skin health and to envision a brighter future for Aboriginal children and families resident in the Kimberley.

Sincerely,

The SToP Trial Partnership Steering Committee

Vicki O'Donnell, Ray Christophers, Bec Smith, Jonathan Carapetis and Asha Bowen

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Glossary

AATSIHS	Australian Aboriginal and Torres Strait Islander Health Survey	**KM²**	Square kilometres
ABS	Australian Bureau of Statistics	**KMHDS**	Kimberley Medical Health and Drug Service
ACCHO	Aboriginal Community Controlled Health Organisation	**KPHU**	Kimberley Population Health Unit
ACCHS	Aboriginal Community Controlled Health Services	**KRSP**	Kimberley Regional Service Providers
AHW	Aboriginal Health Worker	**MRSA**	Methicillin-Resistant *Staph. aureus*
AKI	Acute Kidney Injury	**NCHS**	Nindilingarri Cultural Health Service
APSGN	Acute Post Streptococcal Glomerulonephritis	**NT**	Northern Territory
ARF	Acute Rheumatic Fever	**OVAHS**	Ord Valley Aboriginal Health Service
ARIA	Accessibility/Remoteness Index of Australia	**PHC**	Primary Health Care
BRAMS	Broome Regional Aboriginal Medical Services	**PSG**	Partnership Steering Group
CARPA	Central Australian Rural Practitioners Association	**RAN**	Remote Area Nurse
CDCD	Communicable Disease Control Directorate	**RCT**	Randomised Control Trial
CDEP	Community Development Employment Program	**RFDS**	Royal Flying Doctor Service
CHL	Community Housing Limited	**RHD**	Rheumatic Heart Disease
COAG	Council of Australian Governments	**STEP**	Support and Tenant Education Program
DAHS	Derby Aboriginal Health Service	**Strep A**	Group A Streptococcus (GAS) / *Streptococcus pyogenes*
DCPFS	Department for Child Protection and Family Support	**SToP Trial**	See, Treat, Prevent Skin Sores and Scabies Trial
EH	Environmental Health	**UPK**	Uwankara Palyanyku Kanyintjaku
EHS	Environmental Health Service	**WA**	Western Australia
GP	General Practitioner	**WAACHS**	Western Australian Aboriginal Child Health Survey
HCAT	Healthy Community Assessment Tool	**WACHS-K**	WA Country Health Service-Kimberley
HP	Health Promotion	**WHO**	World Health Organization
KAMS	Kimberley Aboriginal Medical Services	**YYMS**	Yura Yungi Medical Service
KAHPF	Kimberley Aboriginal Health Planning Forum		

1 Executive Summary

In Australia, Aboriginal and Torres Strait Islander people have not equitably received the health benefits of economic, political, social, and cultural inclusion that their non-Indigenous counterparts have profited from. The legacy of colonisation and sustained public policy that hampers Aboriginal and Torres Strait Islander wellbeing means that approximately one third of the gap in observed health outcomes can be linked to social determinants of health – all entirely amenable. Until Australia achieves parity in opportunities for Aboriginal and Torres Strait Islander people, strategies must be targeted towards addressing these underlying drivers of ill health. Skin health is one such example.

This report and accompanying infographics are intended to act as a resource for communities in the Kimberley who would like to develop strategies to prevent skin infections. In addition, research and service organisations may use this report as a resource to inform future planning and priorities, in conjunction with community consultation and evidenced-based approaches.

The situational analysis was conducted in 2017 with and for stakeholders in the Kimberley region as a precursor to the SToP Trial to highlight all that was already known prior to commencement in 2019. There are limitations to this methodology, but it accurately reflects the information available in 2017 regarding skin infections in the Kimberley.

Firstly, a desktop review of information about skin health management and service delivery was conducted. Then, 42 Kimberley stakeholders were interviewed to gain a deeper understanding of the broader context in which a comprehensive skin program would sit, informing most of the situational analysis. Additionally, 87 questionnaire responses (48 questions) were analysed and have informed this report in conjunction with transcripts from two focus group meetings (environmental health and health promotion) and community consultations (for the SToP Trial[1] in nine remote Kimberley communities during 2017). The combined results from this comprehensive analysis are presented in this review.

Matrixes were incorporated into this written report, providing an overview of the details of services identified, including service provision activities, funding and linkages/partnerships and capacity. Information obtained regarding service types and location were also converted into graphics to provide a visual display of services over the geographic region of the Kimberley, and visually display gaps in service provision.

Key findings

1. Skin infections are common in the Kimberley, however there is evident good will in services working together to reduce this burden.
2. The environment, including homes and resourcing within communities contributes to poor skin health. Despite this, interventions in these areas can improve skin health and overall wellbeing of individuals, families, and communities.
3. Addressing the Social Determinants of Health is critical to preventing skin infections. As their incidence is determined by a complex array of factors, a holistic approach is required to address skin infections.
4. The Kimberley has led the way in Australia environmental health by developing the Environmental Health referral form to better integrate health care assessment with prevention activities.
5. Achieving the Healthy Living Practices will require attention to housing maintenance systems, environmental health and health services working together.

2 What is a Situational Analysis?

A 'situational analysis' describes the collection and study of information to identify trends, driving forces and conditions related to the problem trying to be solved.

2.1 Aims of Skin Health Situational Analysis

The aims of this analysis are to deliver a useful resource for key stakeholders in the Kimberley region of Western Australia (WA) and to provide baseline data for the SToP Trial,[1] designed to 'See, Treat and Prevent' skin sores and scabies in partnership with service providers in the Kimberley[2]. Utilising a situational analysis methodology, we assessed the current 'state of play' of skin health in the region in 2017. We aimed to map and describe skin health services currently available in the Kimberley to manage skin infections.

2.1.1 Primary Objectives

1. Map the existing skin health services and activities, including specific skin treatment, environmental health (EH), and skin health promotion (HP) services, available to manage skin infections within the Kimberley. Where possible, existing services and activities will be compared against the standards of practice identified from the literature review.
2. Identify where gaps exist in the above skin health services, activities and resources.

2.1.2 Secondary Objectives

1. Within the health services identified, describe their current activity and capacity including service provision, structure, management, funding, infrastructure, personnel, training, target population/area, partnerships and linkages, specific skin treatment, and data management.
2. Within the EH services identified, describe their current activity and capacity including service provision, structure, management, funding, personnel, target population and partnerships and linkages.
3. Within the skin related HP services identified, describe their current activity and capacity including service provision, structure, personnel, target population and partnerships and linkages.

3 Methods of the Situational Analysis

A model of collaborative leadership was used for this situational analysis project. The Partnership Steering Group (PSG) of the SToP Trial provided principal oversight for the situational analysis project. The PSG was chaired by Jonathan Carapetis (Telethon Kids Institute) with membership including Bec Smith (Kimberley WA Country Health Service), Vicki O'Donnell (Kimberley Aboriginal Medical Services), Ray Christophers (Nirrumbuk Environmental Health and Services) and Asha Bowen (Telethon Kids Institute). The PSG provided strategic and scientific direction to the situational analysis, including review and endorsement of the study protocol and report. The PSG met at least quarterly during the situational analysis project via teleconference.

This situational analysis was a cross-sectional/descriptive study using both quantitative (desk review and questionnaires) and qualitative (interviews/focus group) data collection methods. The situational analysis was conducted following a six step process adapted from the Health Communication Capacity Collaborative (Health COMpass) situational analysis guide.[3] An overview of this process is shown in Figure 1.

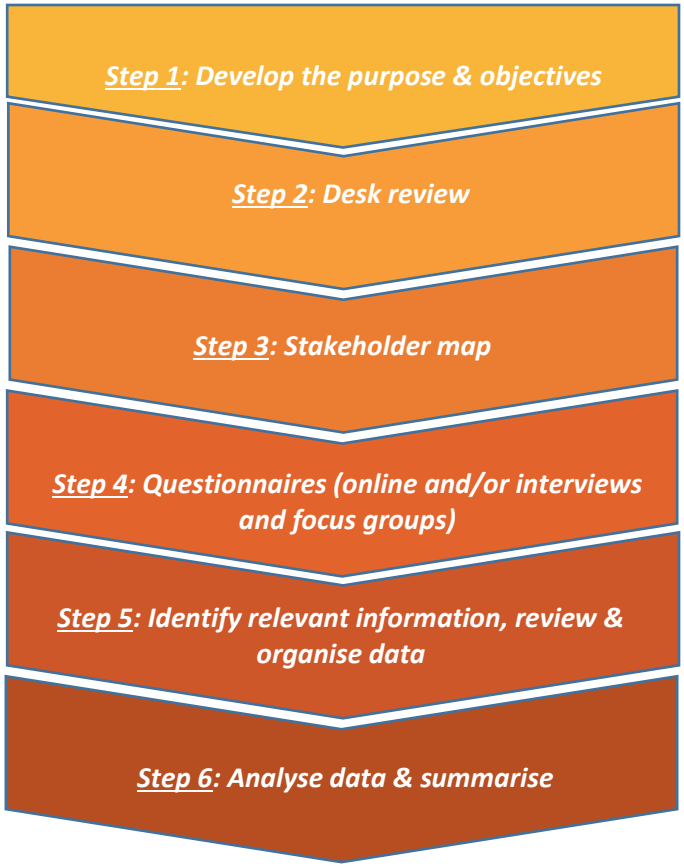


Figure 1: Six step process for conducting a situational analysis.

3.1 Desktop review

An internet search was conducted to identify relevant websites and organisations, utilising publicly available information. Google Scholar™ and the Google Web Search™ engine were searched using a defined search strategy. This strategy also includes searching specific Kimberley organisation websites and Australian Aboriginal health related website such as HealthInfoNet. Inclusion criteria for websites and publications were as follows.

- Relevant to skin disease services, treatment, prevention, or EH services or skin related HP; and
- Kimberley based, referring to Kimberley activities or state-wide/national strategies accessible and of relevance to the Kimberley population.

3.2 Stakeholder map

Based on the results of the desk review and in consultation with regional partners and the PSG, the project team mapped out the key stakeholders involved in skin practices who could provide further information. This stakeholder map was circulated to the PSG for feedback and approval, ensuring that regional service partners could provide input into the stakeholder identification process. In turn, potential key informants who could be approached and

asked to participate in the questionnaires were identified during this process. Informants were not approached until approved by the PSG.
Using a snowball method of sampling, the key informants were also asked to help link to other informants or organisations who could potentially participate, by asking them:

- Which organisations or individuals they are aware of who provide or employ skin health prevention, treatment, HP, or EH strategies, and;
- Which organisations or individuals they recommend the team contacts for further information.

The sampling strategy was designed to be exhaustive, to include and involve as many organisations and individuals involved in skin health as possible. The PSG approved the following stakeholders to be consulted in the situational analysis (Box 1).

Box 1: Approved Stakeholder list for the Situational Analysis.

- Association of Independent Schools WA
- Boab Health Services
- Broome Regional Aboriginal Medical Services (BRAMS)
- Catholic Education of Western Australia
- Department for Child Protection and Family Support (DCPFS)
- Department of Education
- Derby Aboriginal Health Service (DAHS)
- Kimberley Aboriginal Medical Service (KAMS)
- Nindilingarri Cultural Health Service (NCHS)
- Nirrumbuk Aboriginal Corporation
- PATHWEST, Broome Ord Valley Aboriginal Health Service (OVAHS)
- Royal Flying Doctor Service (RFDS)
- Save the Children
- Shires of Broome, Derby/West Kimberley, Halls Creek and Wyndham/ East Kimberley,
- The Housing Authority
- WA Aboriginal Environmental Health
- WA Country Health Services – Kimberley (WACHS-K)
- Yura Yungi Medical Service (YYMS)

3.3 Questionnaires (online and/or interviews)

Following the identification of potential key informants, relevant organisations/services were invited to participate in a questionnaire. The questionnaire was administered predominantly online (via SurveyMonkey®) and emailed to the CEO/Director (or their delegate) to be distributed within their organisation. Where interviews occurred, most were via telephone; however, some occurred face to face for non-government/Aboriginal Community Controlled Organisations (ACCHOs), if preferred, and where resources permitted. Interviews were undertaken by a Broome based Project Manager. Online questionnaires and interviews were conducted until data saturation was reached. A summary of the survey respondent roles and organisations is provided in Appendix 1. Discussions with key community stakeholders for consultation about the concept and design of the SToP Trial also took place in parallel with the situational analysis, and help informed the result (Figure 2).

The full list of questioning was informed by the results of the desktop review, an iterative approach ensuring that the questionnaire built upon the information already collected. This targeted gaps in information and, ultimately, asked the 'right' questions – those are relevant to the Kimberley service provision context without making assumptions about this context.

3.4 Identification of relevant information, revision and organisation of data

Information obtained from the desktop review was tabulated and classified into categories including service type and location/intended population or communities. Information obtained from the questionnaires/interviews were added to the existing tabulated information, to fill in gaps of information and describe more detailed information about the service operations and capacity. Data was reviewed and cleaned, duplicates removed, and tabulated into final matrixes, organised by shire region areas/communities.

Figure 2: Images from discussions with stakeholders that helped inform the situational analysis results. Top panel: Brian Darkie (Aboriginal Health Worker KAMS remote clinic Billiluna and Billiluna council member), Frieda Mc Loughlin (Telethon Kids Institute), Shirley Brown (Aboriginal Health Worker KAMS Remote Clinic Mulan and Mulan council member) and John Jacky (Telethon Kids Institute). Bottom left: John Jacky and Kristen White, (Kalunga), Telethon Kids Institute at community consultation. Bottom Right: Dr Kim Isaacs and niece, BRAMS/KAMS.

3.5 Analysis and summary

The following data was collected from the approved stakeholder list and analysed accordingly.

1. Eighty-seven stakeholders completed a 48-question online SurveyMonkey survey which was first emailed in May 2017. Most responses came during the months of June and August 2017 after reminders were sent to stakeholders. Given the survey was sent to eligible staff on behalf of SToP Trial team members, the response rate is unclear.
2. Forty-two people took part in face to face or phone interviews (average 1-hour duration) throughout 2017 which were completed by the end of December 2017. All approached for an interview agreed to take part.
3. Two focus group meetings were held and the learnings from nine SToP Trial community consultations were combined in analysing the results.

Matrixes were incorporated into this written report, providing an overview of the details of services identified, including service provision activities, funding and linkages/partnerships and capacity. Information obtained regarding service types and location were also be converted into graphics to provide a visual display of services over the geographic region of the Kimberley, and visually display gaps in service provision.

3.6 Cultural and Data Sovereignty

Data sovereignty, as it relates to Aboriginal and Torres Strait Islander peoples, is the *'right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as their right to maintain, control, protect and develop their intellectual property over these.'*[4] This report was compiled by the SToP trial research team at Telethon Kids Institute under the leadership of Kimberley Aboriginal and non-Aboriginal Health Service Providers with the intention of using collated data to guide further research in the region to the benefit of skin health. Community consultation as aided by Telethon Kids Kimberley Aboriginal staff guided much of the methods employed in writing this report and influenced the analysis of results and key findings.

3.7 Ethics approval

Ethics approval was granted from the WA Country Health Service Human Research Ethics Committee (Project Reference #2016/28), The Western Australian Aboriginal Health Ethics Committee (Project Reference #752) and the University of Western Australia (RA/4/1/8874).

4 Background: Skin infections

Within Aboriginal culture, skin plays an integral part in personal identity, kinship and connection to Country.[5] However as a result of a myriad of social, environmental and demographic determinants[6] Aboriginal people living in remote Australia are at a disproportionally higher risk of skin infections, including impetigo, scabies and crusted scabies;[7] the more common infections discussed in this review. Characteristics of these conditions are described in Figure 3. Left untreated, skin infections can progress to more complicated disease.[8]

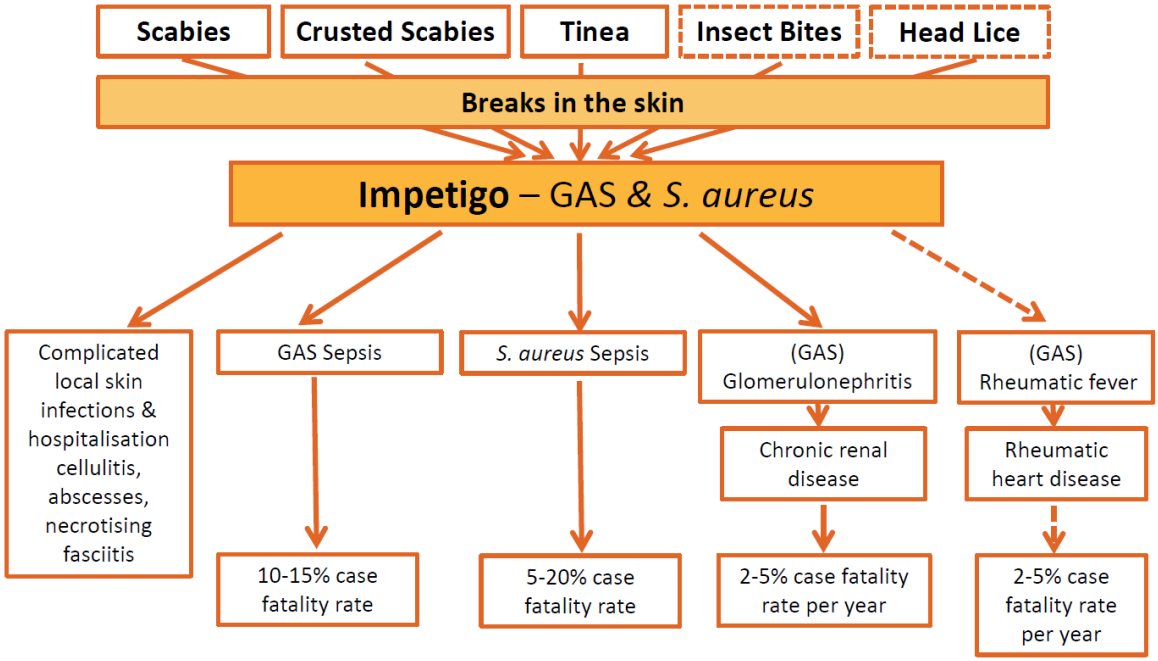


Figure 3: The complications of Strep A and S. aures infection. Adapted from Engelman et al. 2013.

4.1 Impetigo

Impetigo is also known as skin sores, school sores or pyoderma. Highly contagious, impetigo follows minor trauma such as cuts, insect bites, head lice or scabies infestation that cause breaks in the skin.[9] Impetigo generally begins as a small, pink blister that will then fill with pus and become purulent (Figure 4).[9] As the sore heals it will develop a thick crust, then peeling to leave a flat, dry sore that will fade with time.[9] The recommended treatment of impetigo is oral trimethoprim- sulfamethoxazole (cotrimoxazole) twice daily for 3 days, or a single dose of benzathine penicillin G.[9]

Figure 4: Purulent impetigo.

Staphylococcus aureus and *Streptococcus pyogenes* are the causative bacteria which drive impetigo.[10] Strep A remains the key driver of impetigo in tropical contexts and co-infection with *S. aureus* is common.[11] Figure 5 details some complications of skin infections, further expanded on below.

4.1.1 Acute post streptococcal glomerulonephritis

Acute post streptococcal glomerulonephritis (APSGN) is a childhood inflammatory disease characterised by the sudden appearance of oedema, haematuria, proteinuria and hypertension.[12] It proceeds a recent case of impetigo or pharyngitis and is caused by 'nephritogenic' strains of Strep A (occasionally groups C or G streptococcus). The symptom of proteinuria compromises renal function, in turn increasing the risk of chronic kidney disease in adulthood.[13] Short term but life-threatening kidney failure will occur in 1% of patients with APSGN, and at least 15% of patients with APSGN will have permanent evidence of kidney dysfunction requiring dialysis, high blood pressure or both.[14] APSGN is rare in developed countries, yet remains common in Australian Aboriginal children living in remote communities.[15]

4.1.2 Acute rheumatic fever and rheumatic heart disease

ARF is an inflammatory condition primarily of childhood that affects the joints, brain and heart.[16] Although an acute illness with subsequent recovery, repeated episodes of ARF can lead to rheumatic heart disease (RHD).[17,16] Following an initial diagnosis of ARF, patients require long term treatment with monthly penicillin injections (secondary prophylaxis) to prevent further infections that may damage the vessel of heart.[18] While unconfirmed, it is plausible to link Strep A skin infections with ARF. This hypothesis is underpinned by the presence of very high rates of ARF and RHD in Australian Aboriginal populations, where rates of Strep A pharyngitis are low and impetigo rates high.[19]

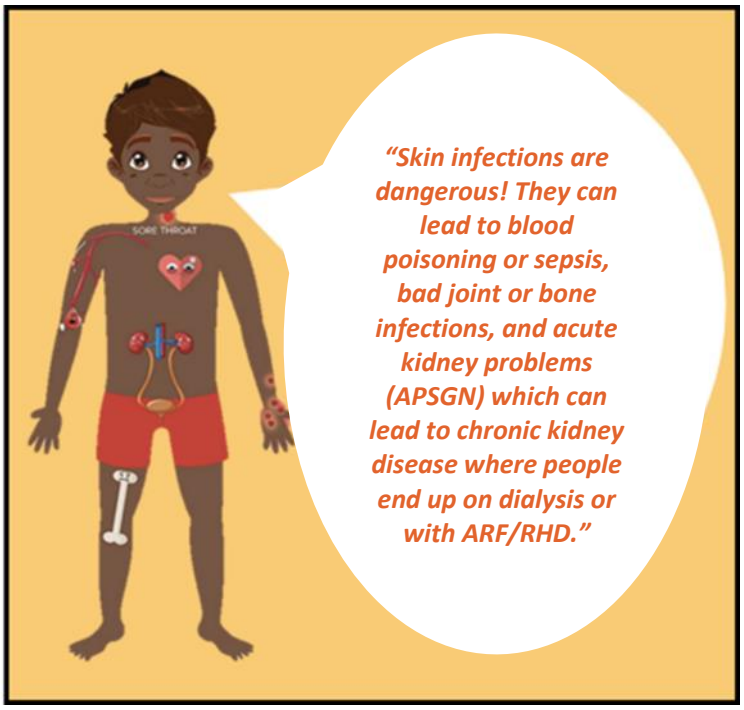


Figure 5: Skin Infections can lead to serious health problems.

Sepsis

While Strep A is the key driver of impetigo in tropical settings, it is often found in combination with *Staphylococcus aureus* (S. *aureus*), a gram-positive bacterium commonly associated with invasive disease, bacteremia and sepsis.[20] S. *aureus* sepsis and bloodstream infection carries a high mortality rate without treatment and may leave patients disabled. Antimicrobial resistance is further contributing to treatment challenges and increased mortality in Australia and globally.[21] Sepsis may also be associated with skeletal infections that often result in long hospitalisations.

4.2 Scabies

Scabies is a skin disease transmitted through close personal contact and is caused by the mite *Sarcoptes scabiei var hominis* which burrows under the skin of humans causing raised papules and itch (Figure 6).[9] Scabies and its complications are regarded as diseases of poverty, and particularly affect young children.[22] Scabies was added to the World Health Organization's (WHO) list of neglected tropical diseases in 2017 and is estimated to affect more than 130 million people globally at any time.[23,24] Although widely believed to be just a 'nuisance' disease that causes 'a bit of itch and sleepless nights,' the reality is that scabies is responsible for considerable morbidity and mortality, mostly via secondary bacterial infection. Untreated scabies can lead to Streptococcal and Staphylococcal sepsis, bone infection and complications of Strep A infection, including chronic kidney disease and possibly RHD.[25] Substantial evidence indicates that scabies is a risk factor for impetigo, and high prevalence of scabies overlaps with high incidence of APSGN.[26-30] In addition, the stigma of scabies can socially ostracise affected individuals.[22]

Figure 6: Scabies papules in the armpit.

Scabies remains widespread and common in remote Aboriginal communities, symptomatic of poor infrastructure such as inadequate housing, overcrowding, poor health knowledge and literacy, and lack of access to water or the necessary facilities for washing. The continued existence of scabies due to these factors is an indicator of social disadvantage.[31] Treatment however is relatively achievable. The topical agent permethrin is the first line treatment for scabies, with orally administered ivermectin reserved for recurrent or crusted scabies.

Figure 7: Depigmentation of the skin with thick crusted areas consistent with crusted scabies.

4.3 Crusted scabies

Crusted scabies is a highly infectious, debilitating and disfiguring condition that occurs when the immune system fails to control the initial scabies infestation.[32] It is caused by the same mite, *Sarcoptes scabiei var hominis* but rather than 10-15 mites present on a person as with classical scabies, individuals with crusted scabies will have up to a million mites in their hyperkeratotic skin crusts.[33] These individuals are highly contagious as their flaking skin contains multitudes of mites that will slough off and expose those around them a scabies infection (Figure 7).[9] Often the crusts form on hidden areas of the body, for example under the breast or in the groin and buttocks.[34] The medical management of crusted scabies is challenging and intensive, involving a three-pronged approach with a clinical, public, and EH aspect.[35] Unmanaged crusted scabies is a known risk factor for outbreaks of classical scabies and contributes to the hyper-endemic rates seem in many remote communities.[34] Individuals with crusted scabies are 'core-transmitters'.[32]

Crusted scabies is generally seen in immunocompromised patients,[36] although this view has recently been challenged,[34] and historically had a 5- year mortality rate of up to 50%.[34] The annual mortality rate has reduced to 1.6% in the NT since the introduction in 1996 of a multi-dose regimen of ivermectin, benzyl benzoate and keratolytic agents.[34]

5 The Kimberley

The Kimberley region in the north of Western Australia (WA) covers 423,517 square kilometres (km^2), three times the size of England. The Kimberley has a diverse economy, with mining, tourism, agriculture and pearling all major contributors to the economic output of the area (Figure 8).[37] Geographically, this region features arid desert areas, spectacular gorges and river valleys, beautiful beaches, pockets of rainforest and extensive cave systems. The Kimberley is famous for pindan cliffs meeting aqua oceans and white beaches, dusty red ochre roads and many cultural treasures of great significance to Aboriginal culture. The Australian Bureau of Statistics (ABS) estimated the total population in 2016 to be 34,369, including an Aboriginal population of 14,299 (42%).[38] However, this figure may be a significant underestimation as obtaining realistic population figures in the Kimberley is challenging due to its vastness, remoteness of many communities and transitory nature of residents.[39]

While Aboriginal people are socioeconomically disadvantaged across the whole of Australia, remote Aboriginal people, including most residents of the Kimberley, are in the lowest socioeconomic quartile of Aboriginal people.[39] In addition to the economic disadvantage, the health status of Kimberley Aboriginal people continues to lag behind the non-Indigenous population, reflective of national trends in health and economics.[40,41]

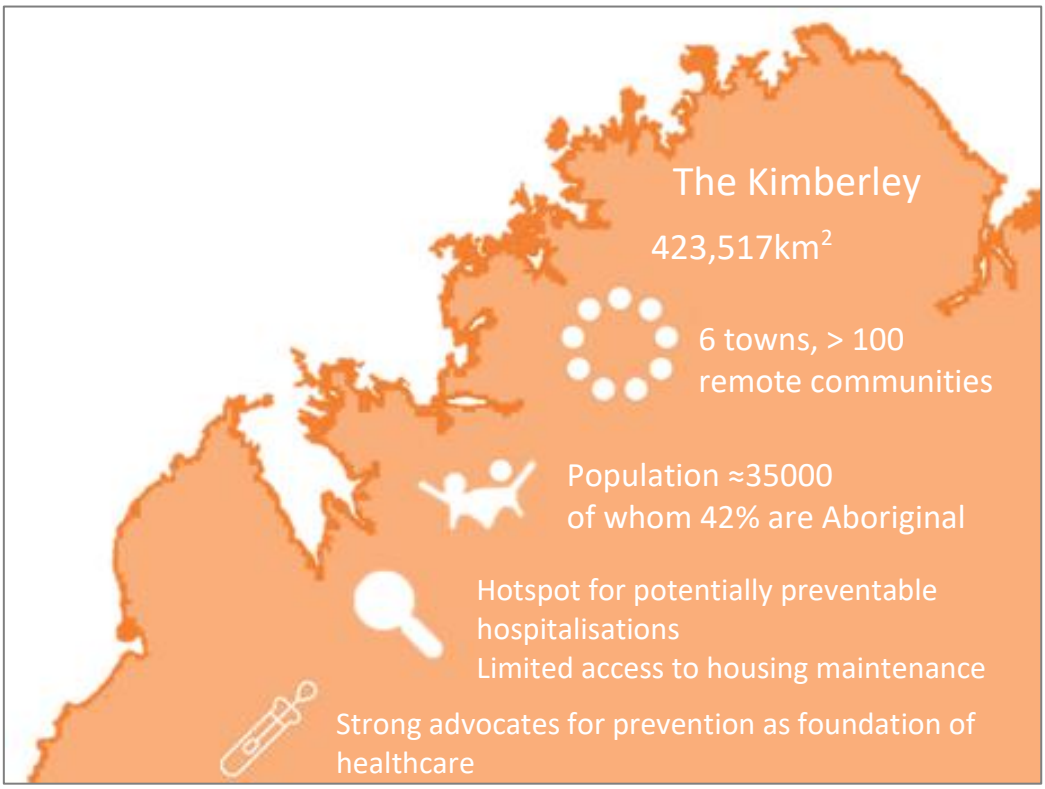


Figure 8: The Kimberley.

5.1 Towns and local government

The major population centres in the Kimberley region are the towns of Broome, Kununurra, Derby, Halls Creek, Wyndham and Fitzroy Crossing.[42] There are four local governments in the region (Table 1); the Shire of Broome, Shire of Derby-West Kimberley; Shire of Halls Creek and Shire of Wyndham-East Kimberley.

Table 1: Demographic information for the Shires of the Kimberley region.

Shire	Major centres	Resident population (2016 census)	Distance from Perth
Broome	Broome	16,222	2,230 km
Wyndham-East Kimberley	Kununurra & Wyndham	7,148	3,206 km and 3,216 km
Derby-West Kimberley	Derby & Fitzroy Crossing	7,730	2,383 km and 2,558 km
Halls Creek	Halls Creek	3,269	2,846 km

5.2 Estimating the Aboriginal population in the region

Outside of the major population centres of the Kimberley, there are over 100 Aboriginal communities of various population sizes, scattered throughout the region and nearly 100 properties servicing the pastoral industry (Figure 9). The region has a large Aboriginal population, with nearly a third of the population of Aboriginal or Torres Strait Islander ethnicity.[43]

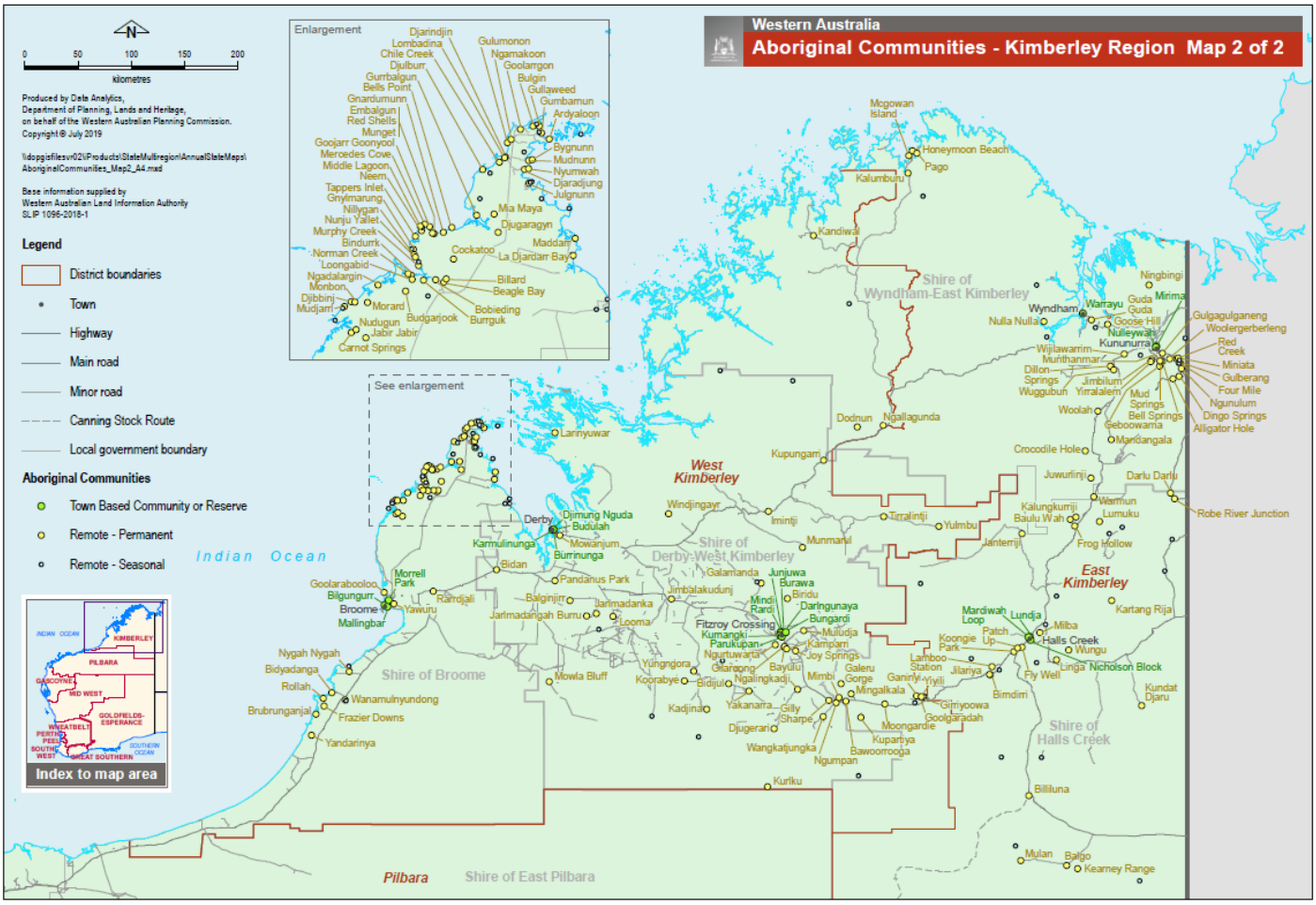


Figure 9: Map of the Kimberley showing remote Aboriginal communities. Source: Department of Planning, Lands and Heritage, Government of Western Australia.

To plan health services, it is essential to begin with an accurate estimation of the size of the population to be serviced. One of the major difficulties in planning services for the Kimberley region is obtaining realistic and consistent population figures, a previously mentioned challenge. Since the 1976 census, the ABS has used an evolving set of procedures to accurately count the population of Aboriginal people.[44] However, the most recent census (2016) is not any more reliable than previous counts, with an estimated undercount of Aboriginal people as high as 24% in parts of the region.[40] Kimberley Aboriginal Health Planning Forum (KAHPF) members have actively briefed ABS staff on the issues associated with census collection methodology in the region, particularly the implications of the undercount. This may become a more acute issue if population-based funding formulas are adopted by governments and hence the problem of the undercount of Aboriginal people must be resolved if prior to the use of such approaches. We remain hopeful that the 2021 census counts for the Kimberley and throughout Australia will improve accuracy.

5.3 Snapshot of Kimberley health profile

The Kimberley health profile reveals that the burden of illness in the region is high comparable both to other Aboriginal populations in WA and the overall State population.[43] As an example, between 2008 and 2009 the most common major disease categories causing Kimberley Aboriginal people to present to emergency departments were skin and subcutaneous tissue infections, followed by injury, poisoning and toxic drug effects.[43] As noted previously, skin infections are largely preventable and primarily associated to socioeconomic and environmental circumstances

and their management should be within the primary health care (PHC) sector as opposed to emergency departments.[43]

The report *Lessons of Location: Potentially Preventable Hospitalisation Hotspots in Western Australia* identified areas in WA where health inequalities are prevalent and, without intervention, likely to continue.[45] The term '*hotspot*' was used in the report to define an area with a hospitalisation rate at least 1.5 times above the state average, as calculated by a standardised age adjusted rate ratio. The report determined that each area in the Kimberley was a hotspot for multiple conditions, including 'Potentially Preventable Hospitalisations', considered collectively and for each major category of acute, chronic and vaccine-preventable conditions.[45] The Kimberley region also had a rate almost 6 times the state average for cellulitis (the skin infection used for this analysis).[45] Derby – West Kimberley and Halls Creek were the hotspots with the highest burden above the state average and the greatest inequity of outcome.

The drivers of the hotspot predictions for the Kimberley were socioeconomic disadvantage and being comprised of large proportions of Aboriginal people who tended to be less advantage than their non-Indigenous counterparts. All Shires within the Kimberley region had a high proportion of Aboriginal people, with the highest at Halls Creek (82%) and Derby – West Kimberley (55%%), compared to a State average of 3%. All areas, except Broome, which had the lowest composition of Aboriginal people at 28%, were in the top 10% of the most socioeconomically disadvantaged areas in the State, and Broome was in the top 30%.[45]

Developing a comprehensive picture of the broader context in which a healthy skin program will operate requires looking at the underlying forces driving the current situation i.e., the Social Determinants of Health. An exhaustive enquiry into these factors is beyond the scope of this review, however Section 5.4 below presents an overview of the current situation in the Kimberley.

5.4 The Social Determinants of Health in the Kimberley

The WHO defines the social determinants of health as follows.

> *'The conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels. The social determinants of health are mostly responsible for health inequities- the unfair and avoidable differences in health status seen within and between countries.'*[46]

Most people living in Australia do not need to consider how to access safe drinking water and stable, functioning electrical power, or how wastewater and rubbish are removed from their homes and managed. If their house, or any water or power connections are damaged, or fittings or outlets are not working, it is a straightforward process to get the problem fixed by calling a tradesperson. This is not the case for many families living in remote Aboriginal communities. The distance from regional towns, service providers and tradespersons can be vast, making access to repairs and maintenance expensive and slow. This can and does affect the quality of the living environment and, in turn, affects the health of community residents.[47]

Inhabitants of the Kimberley region of WA previously lived a forager lifestyle, with the skin of children kept clean and free from sores by using the resin in the leaves of certain eucalypts and other bush medicines.[48] However, Aboriginal people in the Kimberley were forced into a 'settled' lifestyle circa 1910 and from this time onward health and skin hygiene began to deteriorate.[49] This was compounded by housing that was structurally and culturally inadequate.[47] Tiny single- roomed concrete and tin-roofed "*dog boxes*" remain visible on the edge of the missions of Kalumburu and Balgo. This crisis in housing continues to this day with overcrowding in the Kimberley towns and communities being some of the worst in the nation.[49-53]

These historical determinants, among others, make skin infection management a priority for the Kimberley.[54] Research into the health impacts of the environmental determinants (housing, overcrowding, water etc.) and links to health and disease has been strongly promoted by local health service providers.[55-57]

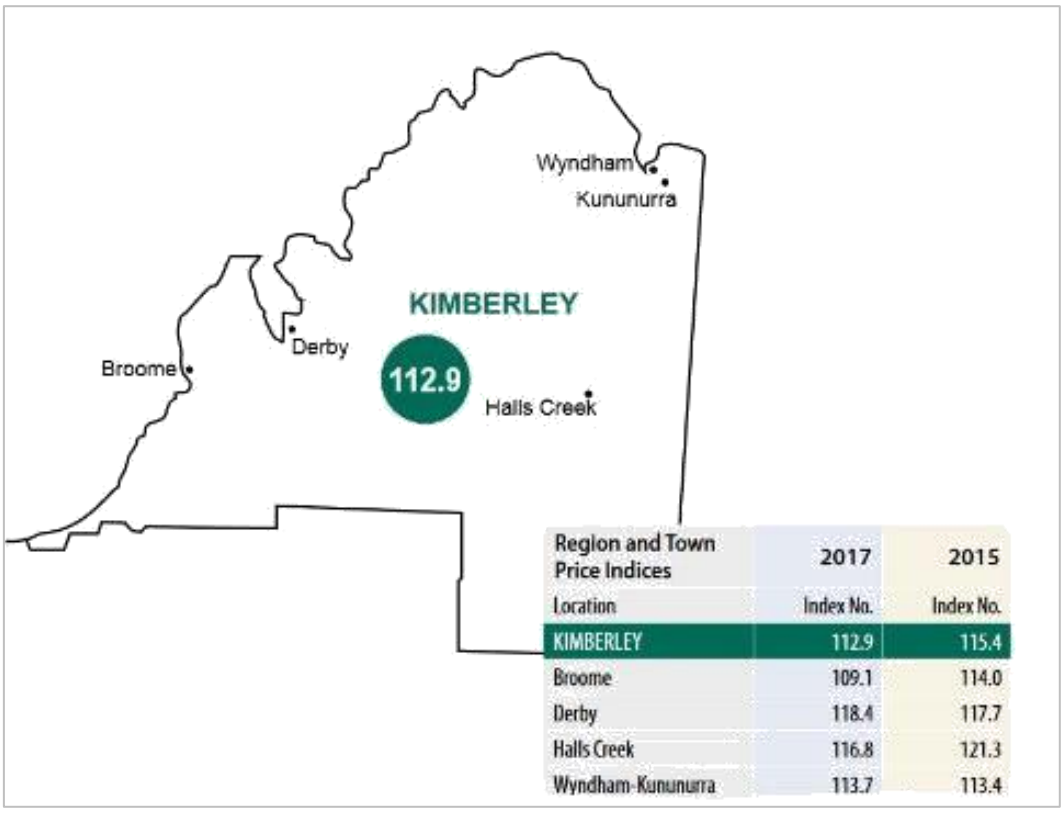
5.5 Access to community: logistic challenges and cultural issues

The Accessibility/Remoteness Index of Australia (ARIA) classification system contains five categories, which range from Major cities to Very Remote. The majority (97%) of the Kimberley is classified as Very Remote and 3% is classified as Remote, which include the areas around Broome and Kununurra. The Very Remote and Remote classification has many implications, from high staff turnover, higher costs of goods and services, reliance on employer provision of housing. In addition, if patients need care at tertiary hospitals, these are all located in Perth, over 2000km away and dependent on an adequate Patient Assisted Travel Scheme budget.[39,41,58]

A lack of infrastructure and unfavourable weather conditions, particularly in the wet season, mean that many remote Aboriginal communities are cut off or inaccessible for long periods of time. Higher death rates and the larger families of Kimberley Aboriginal people inevitably leads to frequent funerals or 'Sorry Business' in communities. During these periods and other cultural obligations and/or ceremonies, or during moments of family conflict and feuding, communities may be inaccessible to outsiders. There are acceptable and inacceptable times to visit communities, and this information must always be sought out and respected prior to contemplating travelling to a community.

5.6 Cost of service delivery

It is more expensive to deliver services in the Kimberley than in metropolitan Australia. Some evidence of this is provided by the Regional Prices Index, a WA project undertaken to compare the pricing of a basket of 250 goods and services purchased in Perth with the same goods purchased at 21 regional locations. The 2017 Regional Prices Index found that, across a broad range of goods and services, Kimberley towns were 14-21% more expensive than Perth (Figure 10).[59]



Region and Town Price Indices	2017	2015
Location	Index No.	Index No.
KIMBERLEY	112.9	115.4
Broome	109.1	114.0
Derby	118.4	117.7
Halls Creek	116.8	121.3
Wyndham-Kununurra	113.7	113.4

Figure 10: Price of goods in Kimberley towns relative to Perth prices (Perth being the base of 100).

6 The burden of skin infections in Kimberley Aboriginal Children

Reducing skin infections and achieving skin integrity has been identified as a priority for communities and health care professionals in the Kimberley.[54,55,60] Poor skin health is a substantial issue in the region, with many children and adults seen at the PHC clinics or admitted to hospital for treatment of skin infections and their complications.[17,61]

Active, community-based surveillance data for skin infection in the Kimberley is not available. Health and education providers report a high burden of skin infections, with anecdotal reports reflecting published estimates of between 45-70% for impetigo and 5-20% for scabies.[10] The SToP Trial aims to collect baseline skin infection data in school-aged children as part of a skin health intervention, commencing for three years in 2019.[2] As a partnership with local service providers, the SToP Trial will provide up to date data on skin infection prevalence in the Kimberley to tackle this priority area.[60]

6.1 Published studies on skin infection prevalence in the Kimberley

Prevalence data for skin infections is difficult to ascertain in the Kimberley due to the complexity of multiple health service providers and incompatible electronic data systems within each of these. This coupled with a highly mobile population and a high turnover of staff means there is currently no recent comprehensive skin prevalence data for the Kimberley region. Several historical studies indicate the prevalence of skin infections is both high and under-reported in the Kimberley. A 1988 survey of remote Aboriginal children in the northwest Kimberley reported 35% of those aged 0-12 years had skin infections.[62] A more recent WA linked dataset from 1996-2012 demonstrated that Kimberley Aboriginal children have the highest burden of skin infection hospitalisations in the state,[63] with 15% of Kimberley Aboriginal infants hospitalised each year with skin infections, compared to <1% in their non-Aboriginal peers.[63] This burden continues throughout childhood.[63]

A study carried out in the Fitzroy Valley in 2013[64] found that skin infections were generally poorly reported. As ascertained by PHC data, skin infections were under-reported in the Communicare database compared to in clinical notes.[65] Despite this, skin infections in children under 4 years of age were the second most recorded condition, with 20% of children in this age group having had at least one episode of skin infection.[65] In the 5-9 and 10-14 age groups, skin infections were the most common reason for clinic presentation, affecting 17% and 14% of children respectively[64] (Figure 11).

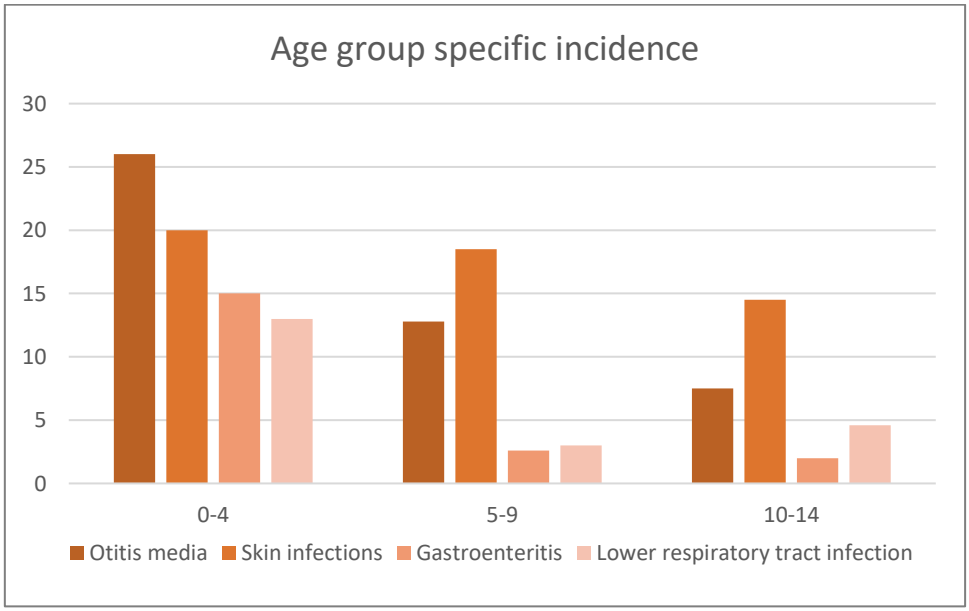


Figure 11: Relative burden of skin infections compared to other common childhood illnesses modified from Davis et al (2015).[51,64]

More recently as part of the regional disease control outbreak response triggered by an unprecedented number of APSGN cases in Aboriginal Children in the Kimberley during 2014, two community screenings were undertaken in Kalumburu, East Kimberley. Kimberley Population Health Unit (KPHU) data between 2012 and 2014 showed that

skin infections were the top reason among children aged between 0 and 17 years to present to the local clinic. Clinic attendances for skin infections were five times higher than presentations for any other reason.[54,66] A summary of the known burden of skin infections in the Kimberley is presented in Box 2.

Box 2: Summary data on the burden of skin infections for Aboriginal children in the Kimberley.

While data confirming the true burden of skin infections is incomplete, the following is known.

- Among north-west Kimberley children assessed in 1988, 35% of those less than 12 years of age had a documented skin infection.[62]
- Data collated prior to the introduction of a community swimming pool (2003) indicated that between 14% and 20% of remote-dwelling Kimberley children attend the clinic each year with a skin infection.[65]
- Skin infections were identified in more recent research as the top reason for clinic attendance in children aged between 5 and 15 years old.[61,62]
- 13% of Kimberley Aboriginal infants are hospitalized before their first birthday because of a skin infection or associated complication.[61]
- 53% of children hospitalised for any reason had a skin infection concurrently or as the cause for admission.[61]

Skin infections rarely cause death directly;[67] however have a high morbidity accounting for 3% of overall childhood hospitalisations in WA and 15% of Aboriginal child admissions.[68,69] Despite this high burden of hospitalisation, the '*normalisation*' of skin infections by health professionals[61] who often view them as 'harmless' and self-limiting contribute to the significant underreporting. Treating clinicians unaware of potentially serious complications and sequela of skin infections may not document incidences of scabies, impetigo, tinea or head lice in the medical record.[61] Furthermore, skin infections may not be prioritised as a significant issue by clinicians or other health staff, especially when patients present with other primary complaints or have multiple presentations that may require more urgent attention.[61] Therefore any hospital morbidity or mortality data and even compilation of primary care data can considerably underestimate the extent of the problem, particularly in the PHC context with limited capacity for ongoing surveillance.[55,64]

Similarly due to the high burden and infection frequency, families frequently do not see skin infections as a sufficient reason to visit the clinic or hospital, further contributing to an under-appreciation of the significance of the problem in health data.[55] Despite under-reporting it is accepted that skin infections have a significant health impact, with the 2010 Global Burden of Disease study finding that skin infections were the fourth leading cause of nonfatal health burden expressed as years lost to disability.[70]

6.1.1 Royal Flying Doctor Service data

Data from the RFDS provides further evidence for the high burden of skin infections in remote Indigenous communities including WA. Between July 2013 and December 2015, 5.1% of Aboriginal aeromedical retrievals were due to diseases of the skin and subcutaneous tissue.[71] Of these, 23.1% were from WA (though the Kimberley/per region is not specified). Aboriginal females were 1.2 more likely than Aboriginal males to undergo an aeromedical retrieval for skin infection (54.1% and 45.9% respectively).[71] Retrieved patients ranged in age from <1 to 96 years.

6.1.2 The Western Australian Aboriginal Child Health Survey (WAACHS)

To date, the WAACHS is the largest and most comprehensive survey undertaken to investigate the health, wellbeing and development of WA Aboriginal and Torres Strait Islander children.[72] As part of the survey carers were asked if their children had '*recurring skin infections, such as school sores or scabies,*', and were prompted to exclude eczema as a non-infection. Carers reported that 8.5% of all Aboriginal children aged 0–17 years had recurring skin infections.[72] Children aged 4–11 years had the highest rate of recurring skin infections (10.3%) followed by 12–17-year old's at (6.1%). The prevalence doubled in extremely isolated areas – which encompasses most of the Kimberley region.[72]

6.2 Scabies and Crusted scabies prevalence in the Kimberley

Scabies is endemic in many remote Aboriginal communities in the Northern Territory (NT), which shares a common jurisdictional border with WA, and community members travel throughout the Top End. In the NT, up to 50% of children and 25% of adults in some communities have scabies.[32] Crusted scabies rates, while rare in urban settings,

are reported at some of the highest in the world in the NT.[34,73] The Kimberley lacks robust data both for scabies and crusted scabies. It has been estimated that approximately 10% of children in remote Aboriginal communities in the Kimberley may have scabies.[61] The rate of crusted scabies is unknown. Crusted scabies was made notifiable in the NT from 1 January 2016; prior to 2016, only limited information had been available regarding the number of people with crusted scabies in the NT and the geographical and demographical distribution of these cases. In the year since becoming notifiable in January 2016, 27 people were confirmed as having crusted scabies in NT. Of these, 17 (63%) were from remote / rural areas and 10 from urban areas, with a mean age of 45 years.[35] 26 of those patients identified as Aboriginal.[35] Crusted scabies is not notifiable in WA.

6.3 Other skin infections in the Kimberley

While this situational analysis is focused on impetigo and scabies, other skin infections are also common in the Kimberley warranting mention, including:

- Fungal infections e.g. tinea, are prevalent due to the environmental factors of humidity,[74] overcrowding (often with infected animals),[75] inappropriate housing,[76] and limited access to early treatment.[39]
- Melioidosis is caused by the soil- and water-borne bacteria *Burkholderia pseudomallei*. Cutaneous disease may lead to potentially fatal septicaemia, with fulminant pneumonia and multi-organ abscesses. In 1997 the Kimberley region was affected by an acute melioidosis outbreak.[77-79]
- Leprosy, (Hansen's disease), was thought to have died out in Australia decades ago, but cases are still being reported throughout the Kimberley. Between 1986 and 2002, 28 new cases of leprosy were notified to the Kimberley Public Health Unit (KPHU).[80] The Department of Public Health was notified of 13 cases of leprosy in WA (2014-17), mostly originating in the Kimberley.[81]

The Derby Leprosarium (Bungarun), open from 1936 to 1986, holds great significance for the Aboriginal people of the Kimberley. Approximately 1200 people were residents of Bungarun while it was operational and many Aboriginal people in the region are related to or know someone who was a patient there.[82] As a result, mentioning skin infections can be a sensitive topic for many. During community consultation in the Kutjungka/Tjurabalan region of the Kimberley, one elder commented:

> *"You mob with that skin talk, they use to cut our skin, to test to see if we had that Leprosy, and then we got taken or our kids weren't allowed to go to the good schools."*

6.4 Summary of Skin Disease in the Kimberley

Comprehensive, sustainable skin disease control is urgently needed to improve child health and reduce the impact downstream of chronic diseases.[25,51,83] Skin infections are common in remote Australian Aboriginal communities. At any one time, 45% of children will have impetigo.[10,61] This translates to almost 5,000 children in remote WA, predominantly in the Kimberley. Despite this, skin infections frequently go untreated across all levels, including health staff and community members, due to an under-recognition and lack of awareness of their importance. It can be said that skin infections have become *'normalised'* across the Kimberley.[61] However, skin infections are not benign and if left untreated can lead to *Streptococcal*[84,85] and *Staphylococcal* sepsis,[86,87] skeletal infection[88-91] and further complications such as chronic kidney disease[12,92] and RHD. These complications of skin infections occur among Aboriginal and Torres Strait Islander Australian people at the highest rates in the world (Figure 12).[10,70,93,94]

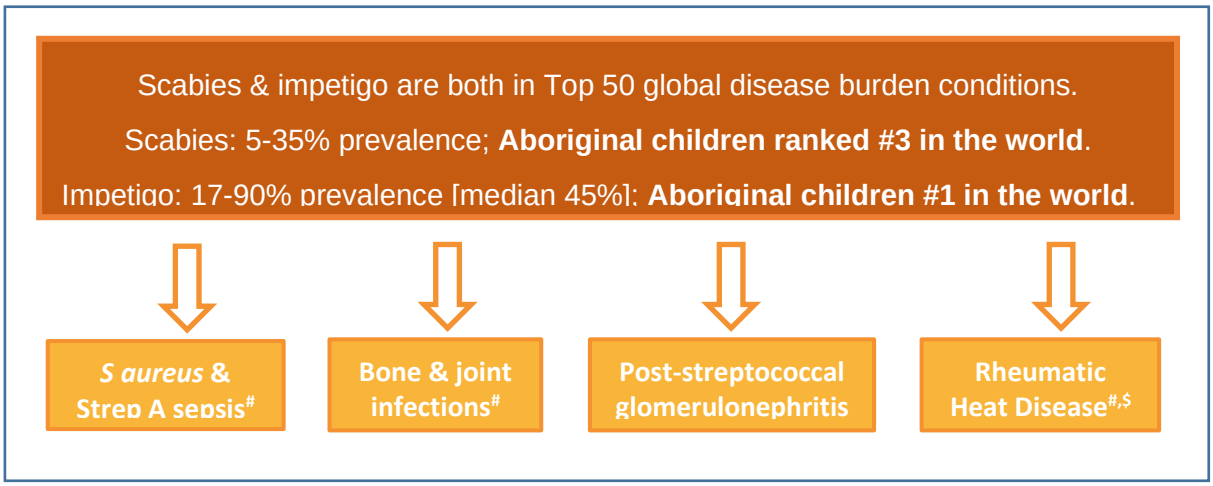


Figure 12: Global and local burden of skin infections with sequelae. Data extracted from Hay 2014, Romani 2015 and Bowen 2015.[10,70,93,94]

#Incidence in Aboriginal children surpasses non-Aboriginal children.

$Aboriginal Australian children have the highest reported burden in the world.

7 History and context of skin health complications, management, and treatment in the Kimberley

Historical presence of both high rates of skin infections and associated complications across the Kimberley have resulted in several responses aiming to reduce incidence.

7.1 The Kimberley Skin Health Protocol

The first Kimberley Skin Health Protocol launched in 2008 was instigated by the first Kimberley Maternal and Child Health Subcommittee (2006) in response to a four-case outbreak of APSGN in 2005. Three related issues identified by health service personnel warranted its development:

1. Concern about increasing reports of skin infections throughout the Kimberley.
2. Concern about the potential serious consequences of skin infections including sepsis, skeletal infections, APSGN and possibly ARF.[95-97]
3. Consensus that there was a lack of uniformity in the treatment and management of skin infections within the region (Prof David Atkinson, Head of the Rural Clinical School, WA, personal communication 2017).

The aim of the Protocol was to standardise the screening and management of skin conditions common in the Kimberley. It was updated in 2011 and again in 2014 following the 2013-2017 Kimberley APSGN outbreak.[54] In 2018, the National Healthy Skin Guideline[9] was launched in response to Kimberley stakeholders requesting a systematic review of the latest evidence for treatment of skin infections.[98,99] An updated Kimberley Skin Protocol aligned with the National Healthy Skin Guideline[9] was endorsed in late 2019 and published in the first quarter of 2020.[100]

7.2 Acute rheumatic fever outbreak, 2012-2013

Between 2012 and 2013, Aboriginal children in the Kimberley experienced the first documented ARF outbreak to have occurred in Australia;[101] and only the second to be documented globally in a region where ARF is endemic.[102] The number of ARF notifications in the Kimberley has decreased since 2012[103,104] (Table 2). Despite being <2% of the WA population, the Kimberley experiences more than 60% of reported cases of ARF each year. As of 2015, ARF and RHD are notifiable to the WA Health Department.[105]

Table 2: Annual ARF notifications in the Kimberley, WA and the Kimberley as a proportion of all WA notifications.[106]

Year	Total ARF in the Kimberley	Total ARF in WA	Proportion from the Kimberley
2012	66	84	79%
2013	54	82	66%
2014	36	52	69%
2015	38	68	56%
2016	38	60	63%

7.3 Acute post streptococcal glomerulonephritis outbreak and response, 2014

In late 2014, an APSGN outbreak was detected in the Kimberley, following the reporting of the first two cases to the KPHU on the same day in 2013 (from the communities of Wyndham and Beagle Bay).[107,108] Prior to this, the last diagnosed APSGN cases in the Kimberley was 2007. The outbreak peaked in 2015 and continued into 2017, with 120 cases reported between 2013 and 2017.[55] The outbreak was geographically spread across the Kimberley and resulted in the formal notification of APSGN to the WA Communicable Disease Control Directorate (CDCD) due to the advocacy of Kimberley clinicians.

Figure 13: The Kimberley Skin Health Regional Partnership.

To stem transmission of APSGN and facilitate disease control, an APSGN Taskforce was established in 2014 by the KPHU in conjunction with WACHS-K, KAMS and Kimberley Paediatric services. This taskforce directed attention towards developing resources to standardise practice throughout the region, including a revision of the Kimberley Skin Infection Protocol[54] with specific diagnostic criteria for skin infections, the addition of Strep A as a causative agent of impetigo, use of evidenced based treatments and an updated segment on scabies treatment.[55]

As a result of the outbreak, the *APSGN Kimberley Control measures*[107] were released in November 2014. This resource incorporated public health strategies specific to the Kimberley region with sections on the role of the clinician in cases of APSGN, contact identification/ tracing and epidemiological criteria for initiating population wide community screening. As part of this, an APSGN Round Table was held in December 2014 including representation from (WACHS-K), KPHU, KAMS and Telethon Kids Institute.[54] In December 2014, KAHPF established an Environmental Health Subcommittee with the overarching goal to improve understanding across the Kimberley of the link between environmental conditions and health.[54]

The Kimberley Skin Health Regional Partnership was signed in 2015 by all KAHPF members (Figure 13)[109] with the aim to reduce skin infection in Aboriginal children.[54,54] Stakeholders highlighted the strengths of these Kimberley initiatives and those who led them to improve skin health and tackle APSGN during the situational analysis interviews. The updated Skin Protocol and the APSGN Kimberley Control measures (which were produced rapidly once health service providers recognised the presence of an outbreak) are a testament to the strength and responsiveness of local health service providers. These health service providers had no surge capacity within their workforce to deal with the outbreak and yet managed to absorb the extra workload and tackle the issue while continuing in their regular roles. This scenario is unsustainable and surge capacity in future outbreaks needs consideration and planning.[66]

Accurate monitoring of diseases can direct appropriate public health responses and provide Aboriginal campaigners with the advocacy tools needed to demand action.[25] Only recently in late 2017 did APSGN become a notifiable disease in WA, with the publication of updated Public Health Regulations.[110] Despite the accelerating APSGN outbreak described above, there were significant delays in achieving this notification. In November 2014, KPHU sent a submission to the CDCD, supported by members of the APSGN Taskforce and roundtable, calling for the mandatory notifications of APSGN in WA (Jonathan Carapetis, Director of the Telethon Kids Institute, personal communication) to ensure alignment with the NT and Queensland.[111,112] May et al. also urged Australia to follow New Zealand's lead in prioritising diseases that disproportionally affect Aboriginal people and called for Strep A infections to become nationally notifiable.[25] While APSGN was notifiable to the KPHU at the beginning of the 2014 outbreak, the recent development in making APSGN notifiable in WA (2017) will help epidemiological tracking of this disease.

7.4 *S. aureus* sepsis

The link between Strep A infections and the development of both APSGN and RHD,[113] and as well as the high burden of S. *aureus* colonisation, transmission, skin and soft tissue infection including abscesses requiring incision, drainage and resulting sepsis in Aboriginal Australians is well established.[114]

Preventing S. *aureus* infection by reducing the high burden of skin infections is important to decrease the overall rates of sepsis and other invasive complications affecting Aboriginal people in the Kimberley.[114] In the last decade *S. aureus* infections in the Kimberley have increased dramatically, including the rise of methicillin resistant *S. aureus* (MRSA) infections to now represent approximately 50%, as according to PathWest data.[115] This rise in MRSA has changed the standard treatment options for *S. aureus*, accompanied by increased virulence.

The link between Strep A infections and the development of both APSGN and RHD,[113] as well as the high burden of S. *aureus* colonisation, transmission, skin and soft tissue infection and resulting sepsis in Aboriginal Australians highlight the large impact that reducing skin infections today will have on chronic disease, life expectancy and wellbeing in the future.

7.5 Acute Kidney Injury (AKI) and Chronic Kidney Disease (CKD)

A retrospective cohort study spanning seven years and carried out in the Kimberley, found that skin infections and in particular cellulitis were the second most common diagnoses associated with kidney disease.[116] The current literature supports a link between Acute Kidney Injury (AKI) and development and progression of Chronic Kidney Disease which disproportionately affects the rural and remote Aboriginal and/or Torres Strait Islander population.[92] Awareness of this link between skin infections and AKI further supports interventions to improve skin infection control within the Kimberley.

7.6 Key actions driving the management of skin infections and complications across the Kimberley

While there are many components needed to successfully reduce the burden of skin infections in Kimberley Aboriginal children, the overall strategic direction that Kimberley stakeholders have agreed to focus on is: **'***lasting elimination of environmental contributions to poor skin, subsequent infections and their complications for Aboriginal people in the Kimberley, particularly children*' (Box 3).[54]

Box 3: Key achievements/initiatives in Kimberley skin health.

- Drafting and dissemination and subsequent updates of *The Kimberley Skin Health Protocols* (2008, 2011, 2014 and 2020).[100,117]
- Development of skin infection prevention resources including *No Germs On Me*, *Mabu Buru*.[118]
- Production and dissemination of the 2014 *APSGN Kimberley Control Measures*[107] and associated resources.
- Establishment of the KAHPF Environmental Health Subcommittee in December 2014.
- Development of the Kimberley Skin Health Partnership in September, 2015.
- Kalumburu 'Proof of concept' project to reduce the incidence of APSGN (2016).[55]
- Design and dissemination of the Kimberley Environmental Health Referral Form in 2017.[119]
- APSGN becomes a notifiable disease in WA (2017 Public Health Regulations)
- Completion of a systematic review of the treatment, prevention and public health control of scabies, impetigo and tinea.[99,120]
- Amendment to the Plumbing Regulations (effective from December 2016).[121]
- Amendment of the Public Health Bill in 2016 with implications for public health activities across the state.[122]
- Roll out of the *Squeaky Clean Kids* initiative delivering soap to remote community schools.[123,124]
- Initiation of the SToP Trial aiming to See, Treat, Prevent Skin Sores and Scabies across the Kimberley.[1,2]

8 Visual Mapping and description of skin health services and activities in the Kimberley

Utilising the information provided by stakeholders in interviews throughout 2017, the following maps were developed to highlight where various service provision with regards to skin health were occurring. Each map can be overlain on one another to show how service provision occurs and are available as a PowerPoint set that can be updated or adapted. Figure 14 outlines the regional shires for the Kimberley and names many of the communities that are in each of these shires.

8.1 Primary Health Care Provision

Primary health care provision in the Kimberley is complex with a number of providers including WACHS-K, KPHU or one of the six ACCHOs (KAMS, BRAMS, DAHS, NCHS, YYMS and OVAHS). In 2017, WACHS-Kimberley provided the services of the 6 hospitals in the region (Broome, Derby, Kununurra, Wyndham, Fitzroy Crossing and Halls Creek) as well as five remote health clinics (Warmun, Looma, Djarandjin/Lombadina and One Arm Point) and visiting services to four communities (Wankatjungka, Noonkanbah, Bayulu and Yiyili, Figure 15).

Figure 16 shows the service provision in the Kimberley by the ACCHOs in 2017. The exception to this is in the Fitzroy Valley where, under the authority of the Fitzroy Valley Partnership, clinical services are provided by KPHU and the RFDS, while NCHS focuses on HP and prevention. Royal Flying Doctor Services in 2017 were provided to five communities (Figure 17). These are Yakanara, Kadjina, Koorabye (Millijiddee), Djugerari and Gibb River Road communities.

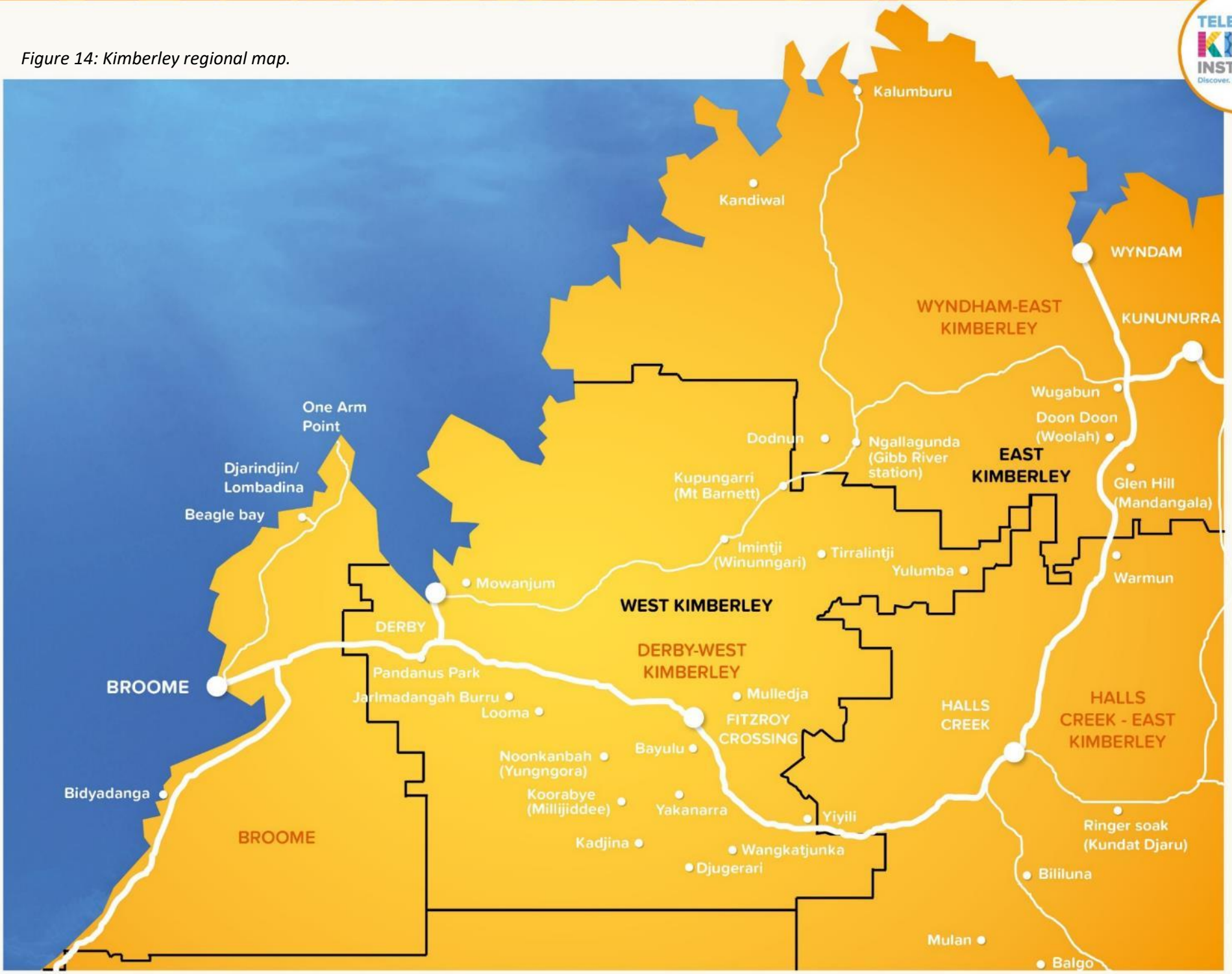
8.2 Environmental Health service provision in the Kimberley region

Figure 18 shows the EH service providers in the Kimberley in 2017. It is important to note that the Environmental Health Service (EHS) organisations often work in partnership to provide services, especially in situations when EHS are unable to fill a position or access an area especially in the wet. Also it is not uncommon for EHS to work based on cultural boundaries rather than local government boundaries. Appendix 2 provides a description of HP resources developed or used by health service or EH service providers in the Kimberley.

8.3 Schools in the Kimberley Region

There were three education providers for primary and secondary schooling in the Kimberley in 2017. These include the Department of Education of WA, Catholic Education Office and the Independent schools (Figure 19).

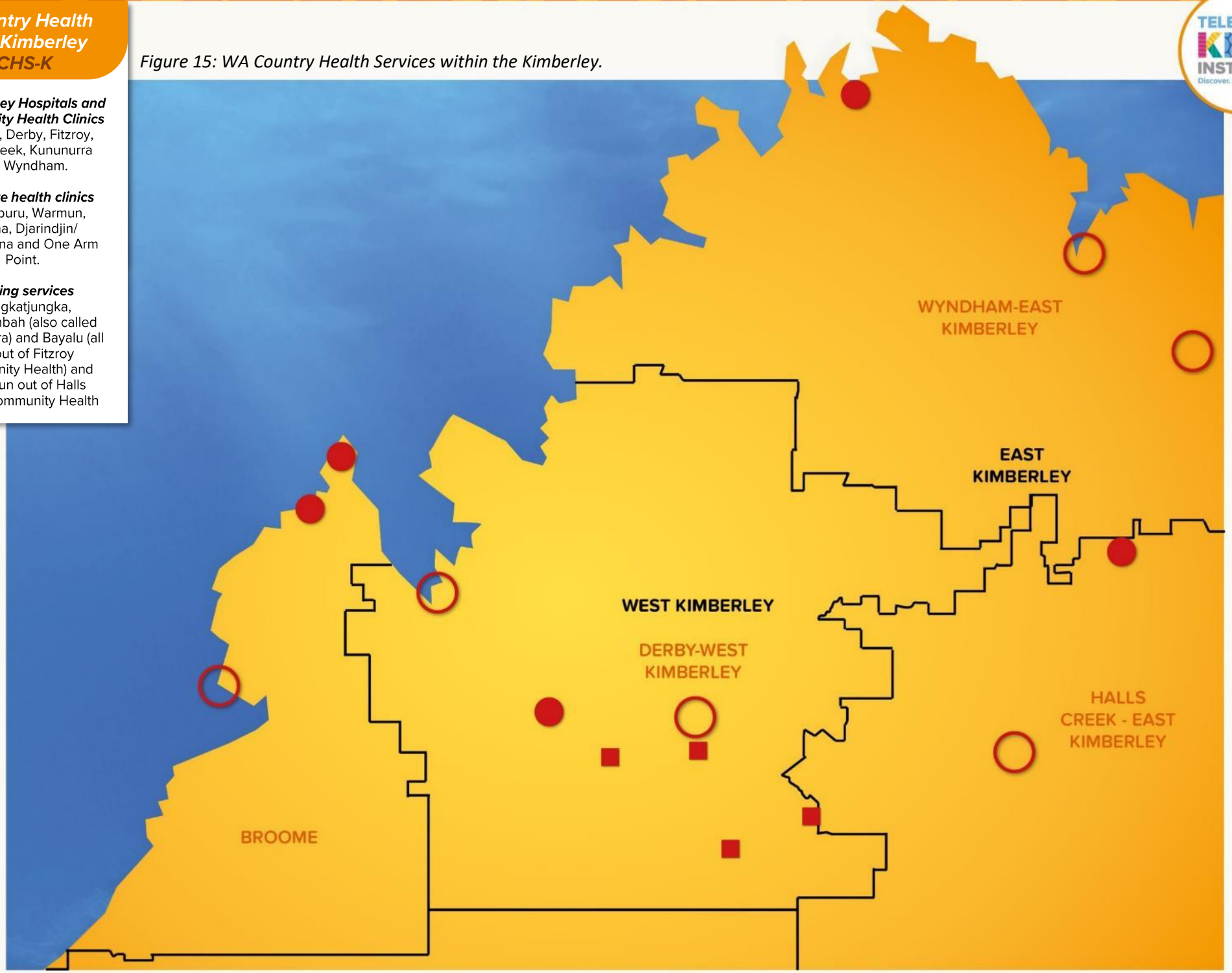
Figure 14: Kimberley regional map.



WA Country Health Service Kimberley
WACHS-K

- ***6 Kimberley Hospitals and Community Health Clinics*** Broome, Derby, Fitzroy, Halls Creek, Kununurra and Wyndham.
- ***5 remote health clinics*** Kalumburu, Warmun, Looma, Djarindjin/ Lombadina and One Arm Point.
- ***Visiting services*** Wangkatjungka, Noonkanbah (also called Yungngora) and Bayalu (all run out of Fitzroy Community Health) and Yiyili (run out of Halls Creek Community Health

Figure 15: WA Country Health Services within the Kimberley.



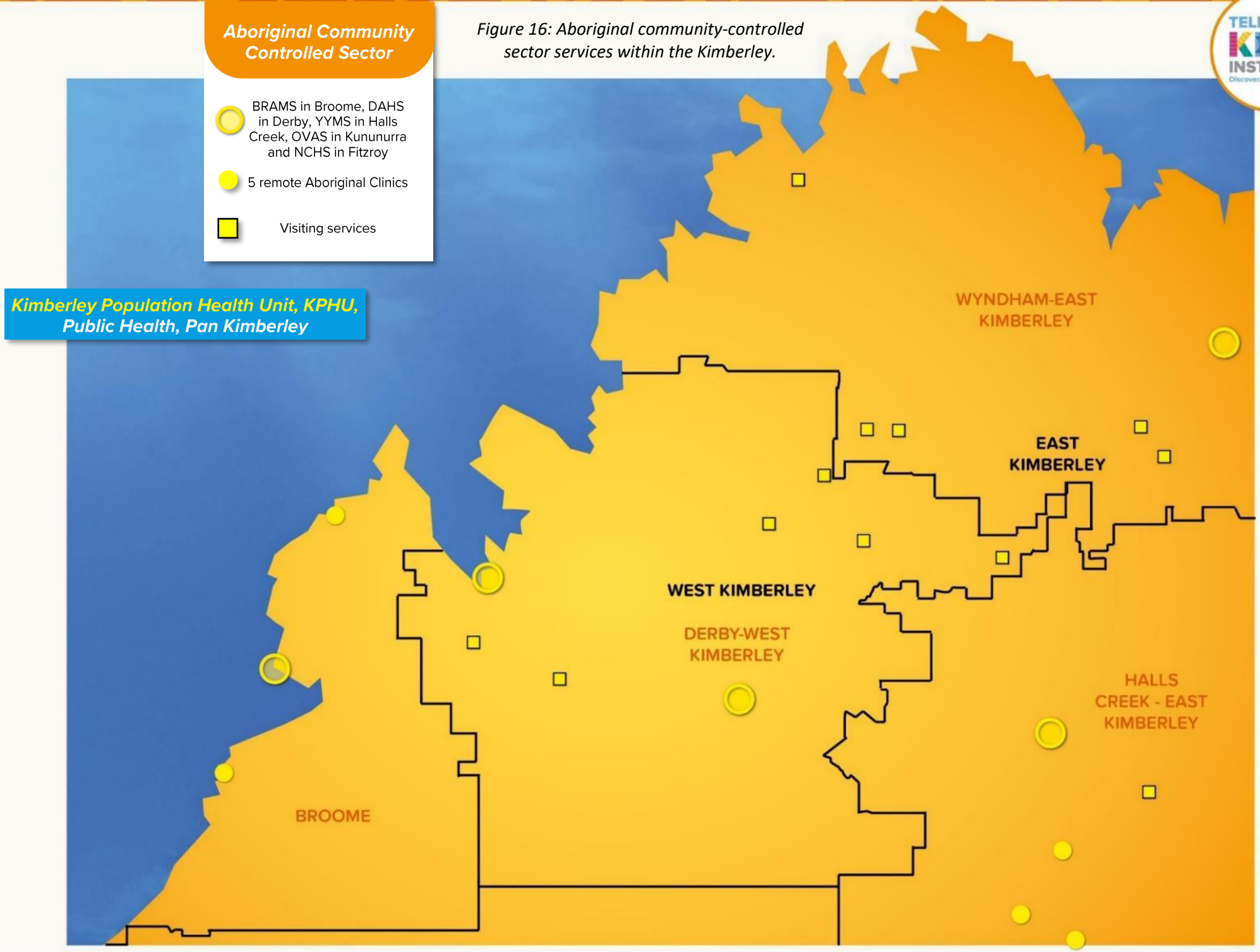


Figure 16: Aboriginal community-controlled sector services within the Kimberley.

Figure 17: Royal Flying Doctor Services within the Kimberley

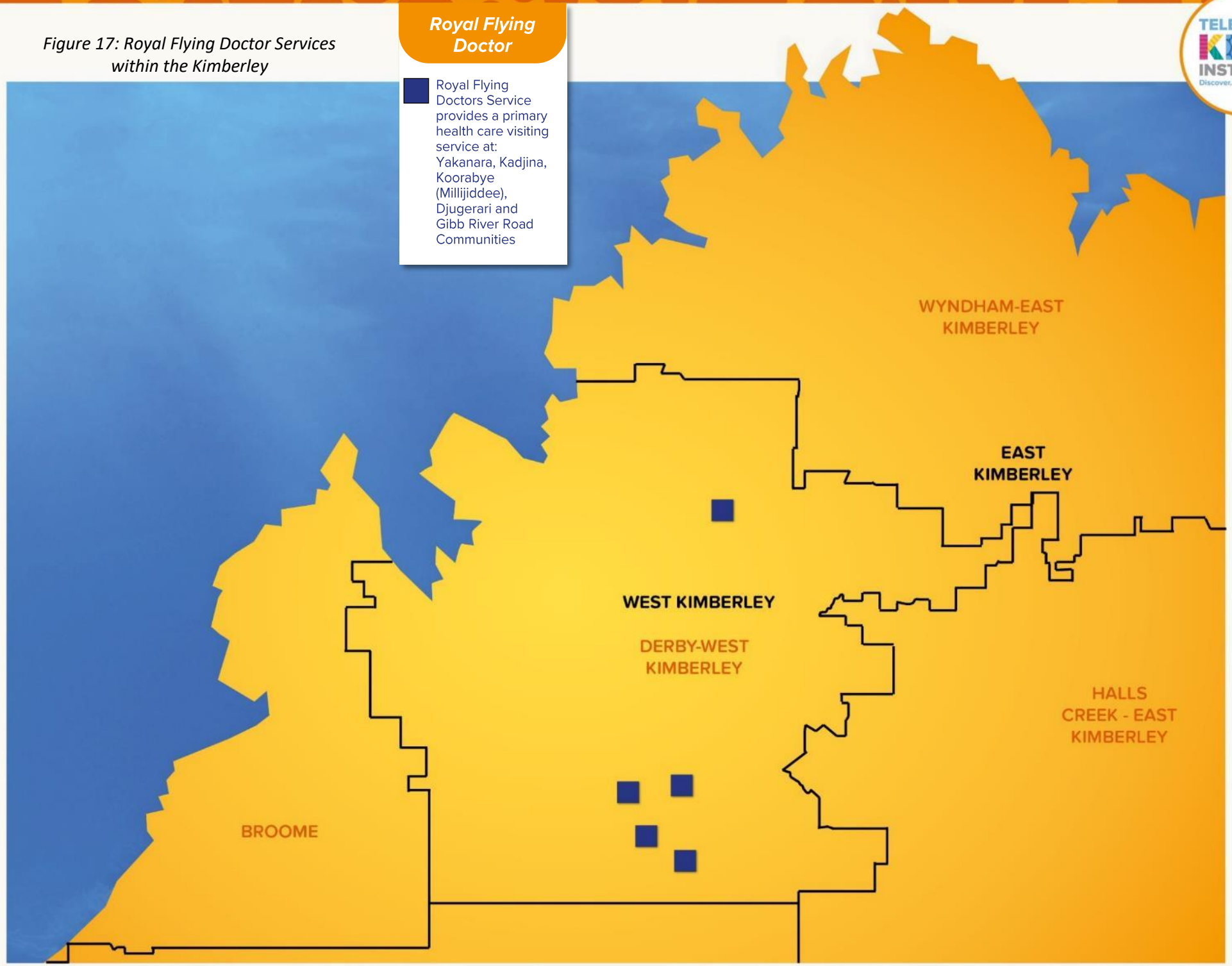


Figure 18: Environmental health services within the Kimberley.

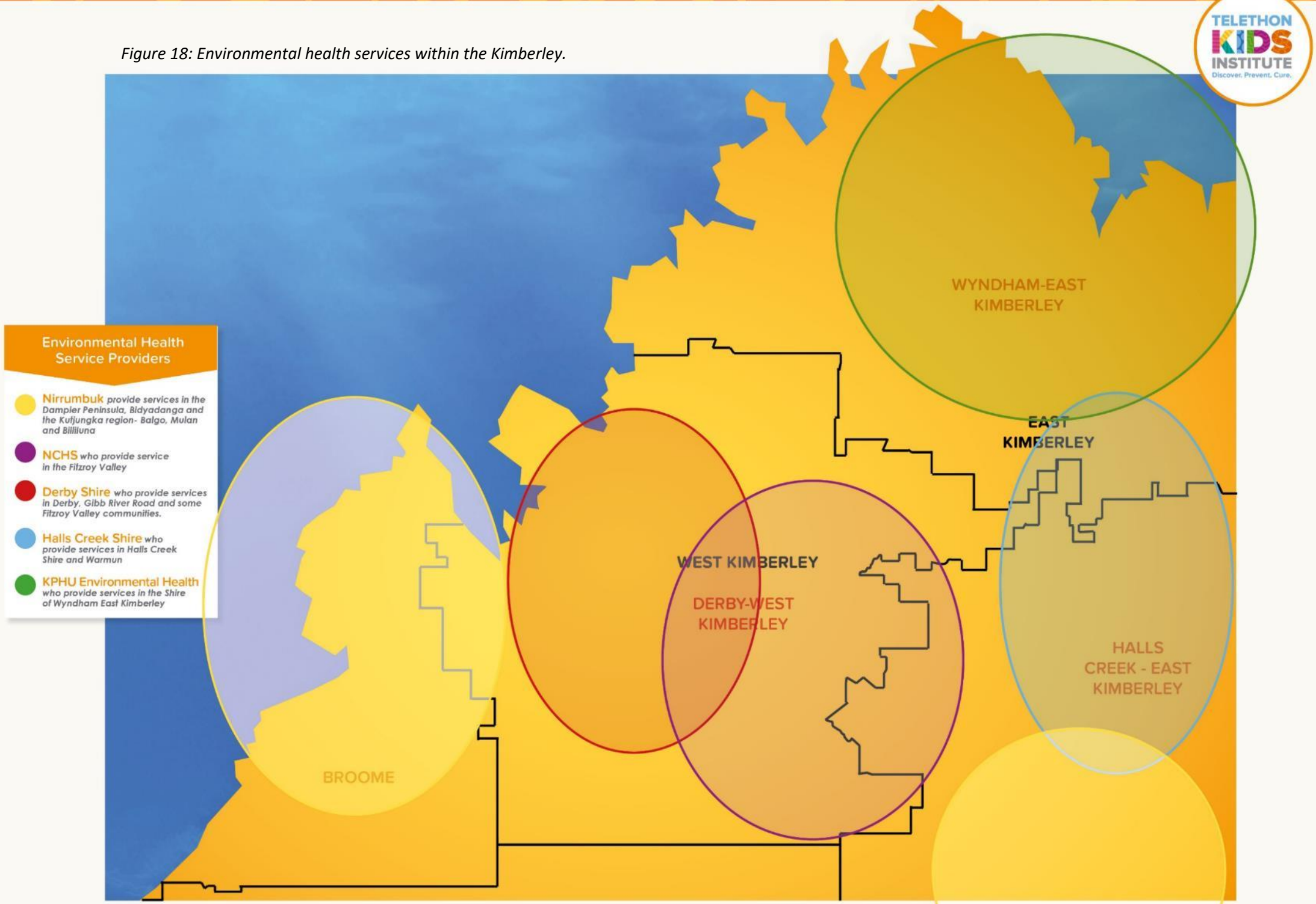
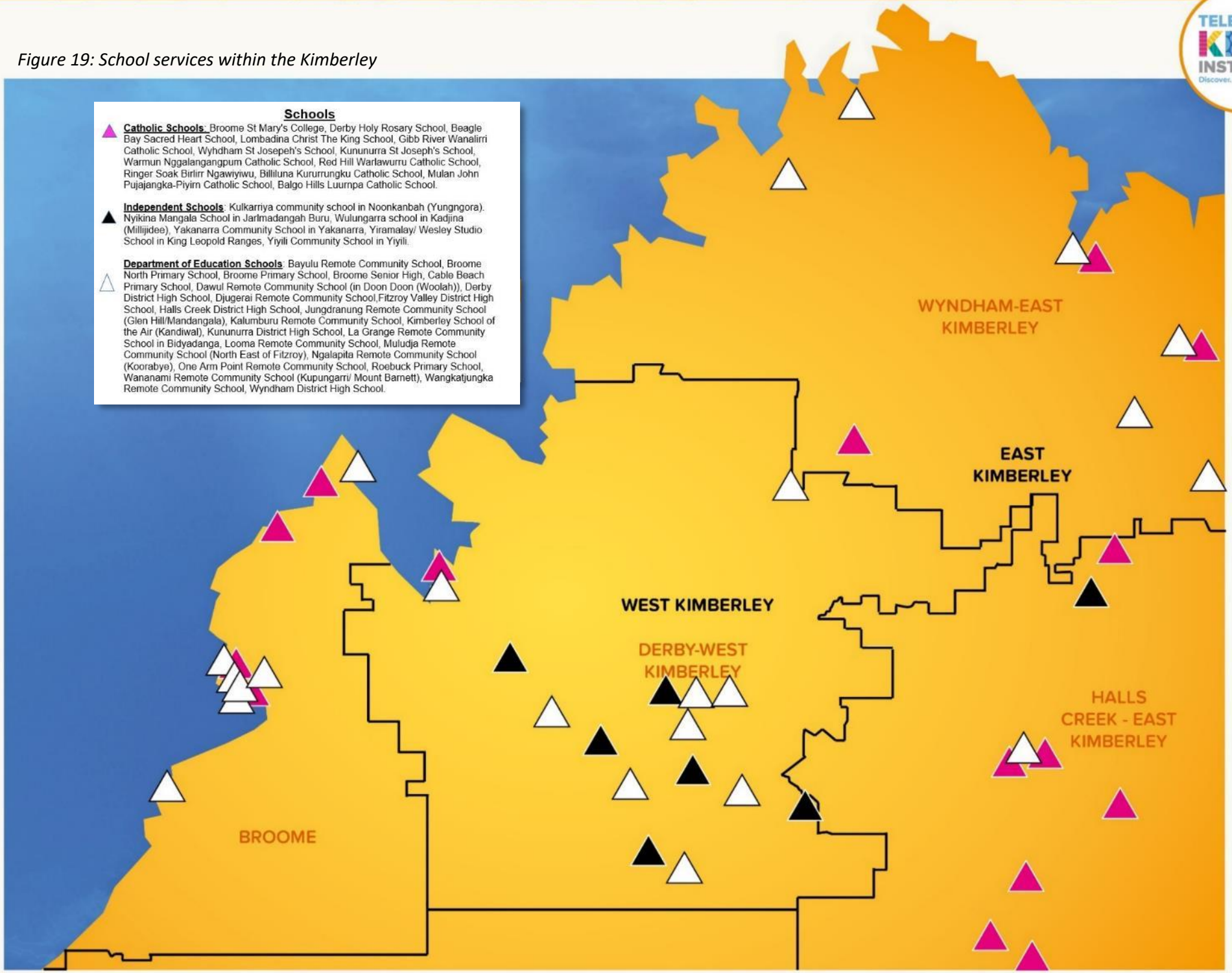


Figure 19: School services within the Kimberley



8.4 Swimming pools in remote WA communities and their impact on skin infections

In addition to the above maps described, it was necessary to also discuss the role that swimming pools in remote Aboriginal communities have in reducing the incidence of skin infections, while detailing the known knowledge and current infrastructure across the Kimberley region. Swimming pools provide many benefits. Most children enjoy playing in water, especially those living in very hot climates where there are often few alternative recreational opportunities. As showering is required in many locations prior to entering the pool, swimming pools can improve hygiene behaviour. Furthermore, in areas with a 'No School, No Pool' policy students are encouraged to attend school during the day to be allowed to utilise the pool in the afternoon; thus raising attendance rates.[125]

Hendrickx et al. (2016) carried out a systematic review of the evidence that swimming pools improve health and wellbeing in remote Aboriginal communities in Australia.[126] All studies that prospectively documented the prevalence of skin infections reported a decline in the prevalence of skin sores and their severity after the opening of swimming pools. Carapetis et al. (1995) found that children who swam more than once a week in a chlorinated pool had a significant reduction in the prevalence of impetigo, compared to children who did not.[95] Similarly, Lehmann et al. (2003) described the benefits and positive health impacts of swimming pools in the form of reduced skin infection prevalence in two unidentified remote WA communities in the Pilbara.[127] Prevalence of impetigo declined significantly from 62% to 18% in Community A and from 70% to 20% in Community B during the 18 months after the pools opened. The prevalence of severe impetigo also significantly in each community during the same period.[127] However, methodological weaknesses in the study design meant that the evidence was insufficient to support the installation of swimming pools in remote communities for the sole purpose of reducing prevalence of impetigo. This included the absence of a control community (one without a pool) and selective use of baseline years that could potentially give more favourable results.

Further support for the health benefits of swimming pools is data demonstrating that in areas with a high disease prevalence, pools are also associated with reduced rates of antibiotic prescriptions for skin, middle-ear and respiratory tract infections.[128] The systematic review of Hendrickx et al.[126] has helped to overcome the methodological challenges of individual studies where a lack of a control group prevents the discernment of true causative effect or the influence of confounding factors. As examples, the presence of a swimming pool in a community does not necessary imply regular use, pool maintenance and management are difficult to measure and the proximity of other nearby 'natural' swimming locations may alter rates of skin infections.[126]

As of 2017, the Kimberley had five shire run pools in Broome, Derby, Halls Creek, Kununurra and Wyndham (Figure 20)[129] and three pools managed by the Royal Lifesaving WA (Remote Community Pools) in Fitzroy Crossing, Bidyadanga and Warmun. A smaller pool at the local school in Balgo, which had successfully utilized it to enforce the 'No School, No Pool' policy was noted by community members as working well for the older school-aged children, but with no effect in children under 5 years; the population which are at highest risk for skin infections.[48,130] In 2017 this smaller school pool also required a $10,000 repair and maintenance; an ongoing issue for other communities. However, as part of an election commitment, $7 million was awarded for the construction and maintenance of a pool,[131] opened in 2019 and also run by the Royal Life Saving Society of Western Australia

While the community of Balgo was pleased with the funding for the pool, Kalumburu was displeased to receive an identical grant for installation of a pool when they had instead requested the construction of a waterpark at a much cheaper price of $2.5 million.[131] Kalumburu community members' feedback was that few towns, let alone communities, can afford the pool's upkeep or maintain qualified pool attendants. Few Aboriginal people are qualified to supervise a swimming pool, and it usually depends on young white people in the helping professions who live in these extremely small communities (comprising just a few non-Aboriginal people) to take on this additional role. These are important considerations for what appears to be a resource amenable to the reduction of skin sores in a vulnerable population.

The *National Partnership Agreement on Remote Service Delivery*, a key component of the Council of Australian Governments (COAG) Closing the Gap Strategy[132] is designed to support a framework ensuring Aboriginal people have equitable access to the same services as other Australians.[133] There is no requirement to demonstrate direct health benefits to justify building a pool in non-Aboriginal communities and the same standard should be applied for disadvantaged Australians living in remote communities.[126]

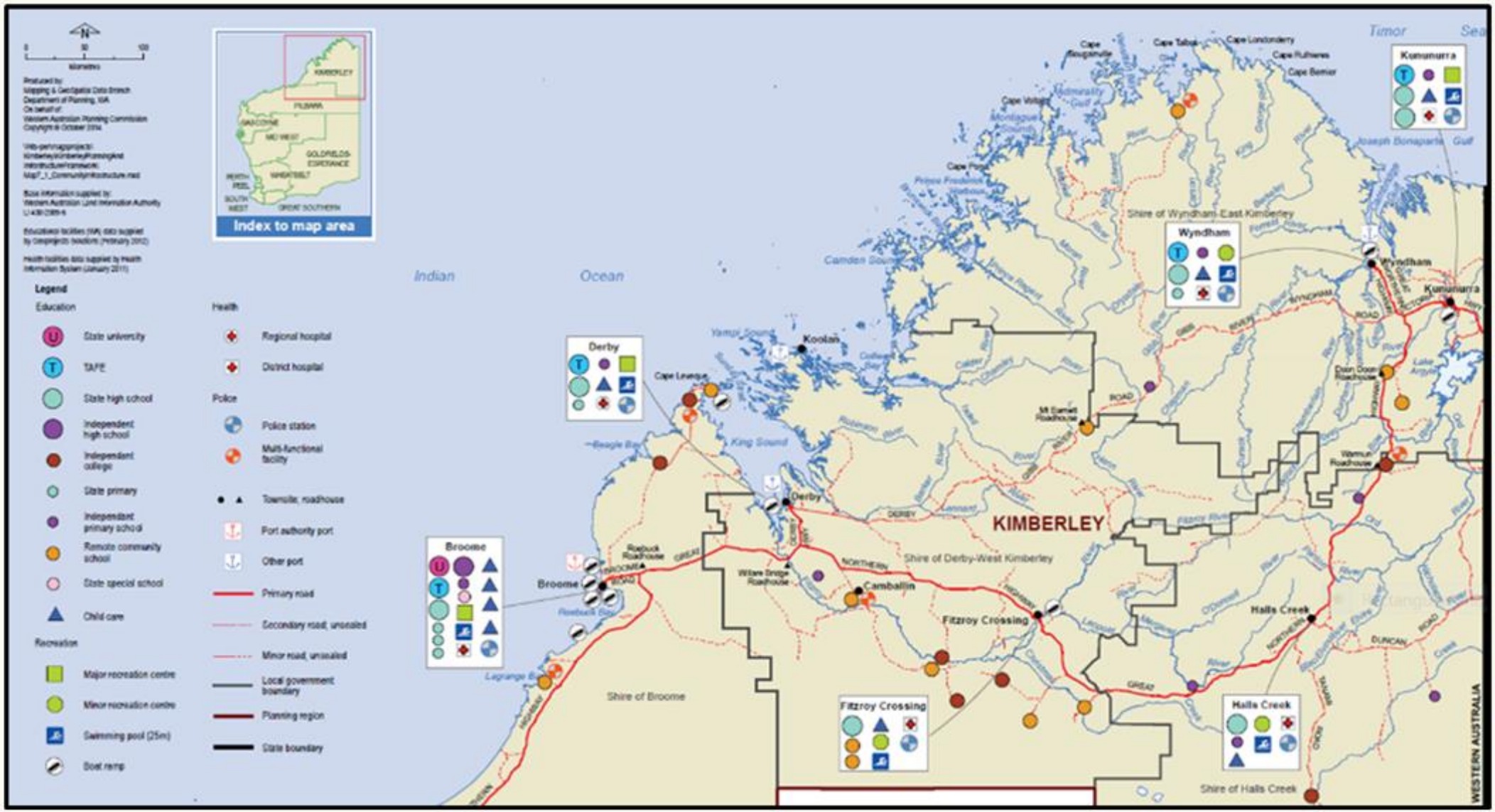


Figure 20: Kimberley Regional Infrastructure map as of 2017.

9 Health service delivery in the Kimberley and its impact on skin health in 2017

9.1 School health programs

Skin infections are currently treated as part of the school health program by school health nurses employed by WACHS-K, KAMS and DAHS. The logistics of providing nursing staff in remote locations and high levels of absenteeism in schools are just some of the challenges to the effectiveness of school-based skin health strategies in the Kimberley.

Recent changes have improved access to school health nurses for some communities. The lack of school nurse provision to Beagle Bay, Bidyadanga and the three Kutjungka schools of Balgo, Billiluna and Mulan has recently been filled with the employment of two permanent KAMS school nurses; one based in the West Kimberley who travels weekly to Beagle Bay and Bidyadanga and one based permanently in Balgo in the East Kimberley, who travels weekly to Billiluna and Mulan. KAMS have increased the number of flights each week to Bidyadanga which means less time driving and more time on the ground for the school health nurse. This increase in service provision in these areas provides the opportunity and more time to focus on prevention.

WACHS-K provide child and school health services to surrounding Aboriginal communities in the larger centres such as Broome, Derby, Fitzroy Crossing, Halls Creek, Kununurra and Wyndham. The exceptions are the remote clinics of One Arm Point, Lombadina/Djarindjin, Looma, Kalumburu and Warmun where Remote Area Nurses (RAN's) cover this program from the clinic. Until recently, one school nurse was responsible for providing school health to nine schools across the vast area of Fitzroy Crossing (approximately 127,000km^2), viewed as untenable and a gap in service provision. Another nurse has recently been hired to help cover this large area.

During community consultation as part of the SToP Trial, many school principals and staff highlighted the preference for a full-time school nurse. Sending clinic nurses in rotation to the schools from remote services teams was the current arrangement in many remote communities and while this worked well occasionally, the feedback was generally that the lack of continuity of care was an issue, especially given the high turnover of RAN's. Principals and teachers said that defining and making the referral pathways from school to clinic clearer and easier would be helpful.

Also highlighted in interviews was the fact that RAN's need to be qualified in acute emergency care but may not necessarily have a background or focus on community or PHC.

"Clinic based nurses have a lot of competing issues to deal with i.e. acute care needs, crisis management. It isn't easy to walk out and leave colleagues with a waiting room full of patients to go to the school."

"A school nurse, especially a visiting one, can't fix everything in one go, usually you have to pick the worse issue and deal with that, it is overwhelming all the issues with many of these kids, realistically skin infections often get missed as there are too many other competing and more urgent issues to deal with."

At present, DAHS employ one remote school health nurse who visits Kupungarri every 2-3 weeks, Ngallagunda every 2-3 weeks, Jarmadangah every 2-3 weeks and Kandiwal every 6 weeks. Limitations to visiting remote schools such as those on the Gibb River Road include their remoteness and inaccessibility in the wet season or during bad weather, when these areas cannot be accessed by road or air. Referrals and follow-up are logistically challenging in these areas. Most school health nurses do not administer medications when at the school.

Another limitation, more broadly, to the school health program is school absenteeism. Often when the school health nurse finally makes it to these remote schools, there may be very few pupils in attendance.

"It took a huge effort to plan the trip, with the road conditions etc. and unfortunately when I got there only four kids had turned up to school that day, everyone else had gone fishing!"

Derby Shire EH Department have organised three to four 'Healthy Skin Days' in the last few years, including in Mowanjum, 10km south-east of Derby in 2017. This event was an opportunity for the shire and other stakeholders to provide HP to kids during a day of fun activities. A jumping castle and barbeque enticed the kids to participate, whilst local doctors and nurses used this event to opportunistically screen the kids for skin infections.

9.2 Primary health care delivery to remote Kimberley communities

Primary health care services to remote Kimberley communities are provided either by KPHU or one of the six ACCHS (KAMS, BRAMS, DAHS, NCHS, YYMS, OVAHS). The exception to this is in the Fitzroy Valley where, under the authority of the Fitzroy Valley Partnership, clinical services are provided by KPHU and the RFDS while Ningilingarri Cultural Health Services focuses on HP and prevention. This Fitzroy Valley Partnership was the result of extensive community consultation and as a result NCHS hold the authority for health in the Fitzroy Valley.[58] The model of PHC service delivery used in the region is described in the Kimberley Aboriginal Health Plan 2012-2015[39] and the 2015 KAHPF Implementation Plan.[41] The Holman Report endorsed the quality, effectiveness and impact of the current Kimberley Health Service provision in 2014.[134]

The 2014 *Holman Report*[134] noted that many more Aboriginal communities are able to access health care since the establishment of Aboriginal Community Controlled Health Services (ACCHS), however highlighted that resourcing levels for individual health providers compared to the high demand for their services has resulted in a focus on treating symptoms rather than preventing future presentations.[134] Few resources are available for primary prevention activities or early intervention programs, and more focus on preventative medicine and HP is urgently required.[58] This has been strongly reiterated in interviews for this situational analysis. For example, the largest shire in the Kimberley, Halls Creek Shire currently has temporary funding to employ one graduate HP officer across a 140,000 square kilometre region. While WACHS-K and ACCHS staff based both inside and outside the region try their best to provide HP services to their clients, they are often hampered by the logistical challenge of travelling within the region or are entirely consumed with treating acute symptoms in their day-to-day capacity. The capacity of the one person employed by the Shire of Halls Creek to provide adequate HP services to such a logistically challenging area, and an area recently highlighted as having some of the worst health outcomes in WA, is wholly inadequate.[39,45]

9.3 Training and retaining staff

Less than half of survey respondents had had access to training in relation to skin infections (Figure 21). Interviews revealed that most stakeholders felt training of staff should be prioritised and needed to be improved to recruit and retain staff in the Kimberley. Many of those interviewed commented that this above all else, would lead to improved health outcomes for local Aboriginal children. Stakeholders said the current system was not working well which is reflected in high staff turnover. For example, WACHS-K experiences a staff turnover rate of 20% a month (Personal correspondence, Medical Director, WACHS-K). High staff turnover was often the result of burnout due to complex and high workloads, inadequate staff housing and exhausting travel to fulfil the requirements for outreach to some of the most isolated communities in Australia. Improved retention of staff is vital to retain knowledge and skills in the area and to build relationships with communities. Strategies to resolve this issue suggested by stakeholders included improving staff housing, increasing staff numbers, and building up local capacity and workforce.

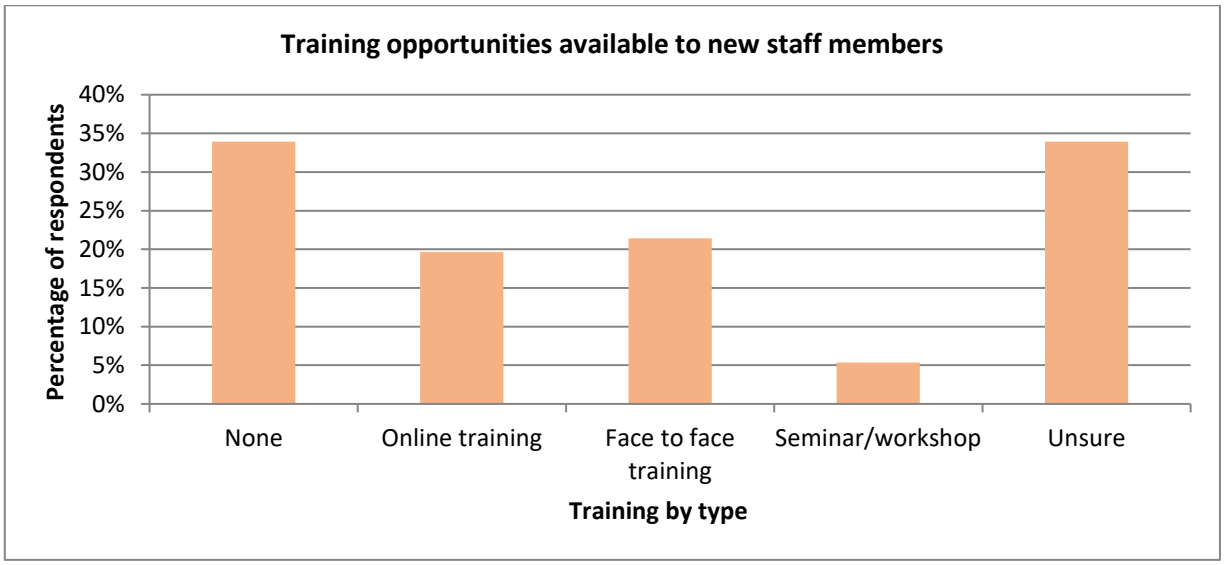


Figure 21: Training types available to new staff members.

Most new staff to the Kimberley region were overwhelmed by the many issues they encountered on starting work in the Kimberley. Few had contextual knowledge of common issues including Strep A, ARF/, RHD, APSGN, leprosy, domestic violence, or suicide. When questioned, few were aware of the more than twenty Kimberley specific clinical protocols. Many suggested it would pay future dividends if more time and money was invested in delivering training prior to commencing work in the Kimberley and at regular intervals throughout the year. Many stakeholders said this systematic change was viewed as necessary, as it was clear that the current system of handing over large complex 'orientation' packs was not working. Many people interviewed suggested a combined orientation developed and delivered collaboratively by health service providers in the Kimberley. People mentioned having a dedicated team of educators delivering ongoing education throughout the Kimberley, especially focusing on those involved in remote service delivery.

9.4 Service provision and frequency: gap in relation to skin infection management

The Kimberley Aboriginal Primary Health Plan[39] identifies, that remote communities of a similar size and distance from town-based services should have equal levels of services, regardless of who their preferred service provider is (Table 3).[39] However, the reality is that this is not the current situation in the Kimberley and there is a lack of skin assessment services across the region.

Table 3: Provision of services for remote communities.[39]

Population	Health Service	On Call Capacity
>250	Onsite Health Service	Yes
100- 250	Onsite Health Clinic staffed by two health professionals either Senior AHW or RN	Yes
50- 100	(Not in easy access of community of town clinic) Fortnightly visits by Health Team.	No
< 50	Serviced on an as-needed basis	No

Of seventeen communities that had either a confirmed, probable or possible case of APSGN from September 2013 to November 2014 during the Kimberley outbreak, fourteen of these communities had PHC service arrangements that met the minimum KAHPF criteria relevant to their size (Table 4 and Table 5) as of 2017. Three communities (Bayulu, Noonkanbah and Wangkajungka) did not.[41,66] While Bayulu is very close to the larger town of Fitzroy Crossing where services could be sought, the other two are distant with no alternative access to health services. To attempt to combat this, Noonkanbah had health staff flown in by charter, however Wangatjungka is currently only accessed by road; 15km of which is unsealed. Due to the lack of staff housing, nursing and clinical support staff traveled to these sites from Fitzroy Crossing four days a week; three hours of which are spent driving. This is both unsustainable and inefficient.

Table 4: Health Service Provision (related to skin) in Remote West-Kimberley Communities in 2017.

Population Yellow >500 Green >250 Blue 100-250 White <100	Travel Time (hours to the nearest town by road)	Clinic Staffing (resident/visiting)		GP Visits (days per week)	Specialist Visits		Visiting Service	
		Nurse (FTE)	AHW (FTE)		Paeds visit (times per year)	Physician (times per year)	School Nurse	Child Health Nurse
West Kimberley								
Beagle Bay	2	4R	5R	V2/W	V4/Y	V8/Y	V1/W	V1/W
Bidyadanga	2	6R	4R	V4/W	V6/Y	V9/Y	V2/W	V2/W
Dodnun#	4.5	V1/W	0	V1/W	V2/Y#*	V1/Y#*	V2/ 4/M	V1/3M
Imintji#	3	V1/W	0	0	V2/Y#*	V1/Y#*	V2/4/M	V1/3M
Kupungarri	4	1R	1R	V1/F	V2/Y	V1/Y	V1/2/4M	V1/3M
Jarlmadangah	1.5	V1/W	1R	V1/F	0	0	V1/2/4M	V1/M
Pandanus Park	1	V3/W	0	V1/W	0	0	V1/M	V1/M
Lombadina/Djarindjin	3	2R	1R**	V2/W	V4/Y	V8/Y	RAN	V1/2M
Looma	1.5	3R	2R	V1/W	V4/Y	V7/Y	RAN	V1/F
Milligidee/ Kadjina#	3	0	0	0	0	0	V8/Y	0
Muludja	0.4	0	0	0	0	6	V16/Y	AN***
Ngallagunda#	5	0	0	0	0	V1/Y	AN***	AN***
One Arm Point	3.5	2R	1R**	V2/W	V4/Y	V8/Y	RAN	V1/2M
Wangkatjungka*	1.5	2V/4/W	0	V1/W	V6/Y	0	V/16/Y	AN***
Yakannarra	2	0	0	0	V4/Y	0	V/4/Y	AN***
Noonkanbah/ Yungngora*	2	2V/4/W	0.4	V1/W	V6/Y	0	16/Y	V2/W
Djugerari #	1.5	0	0	0	0	0	V4/Y	AN***
Koorabye/ Ngalapita#	2.5	0	0	0	0	0	4/Y	AN***

*RAN housing being built and plans to have RAN's living in community in 2018/2019
Conditional on AHW qualifications/training AN*=asneeded # =May change in 2018
R= Resident, V= Visiting, W= per week, M= per month, V 2/W= Visiting service twice a week, V 2/4M= Visiting service 2 to 4 times per month, V 1/3M= Visiting service 1 to 3 times a month, 1/Y= once a year and so on
# for smaller population's visits by GP/Nurse is dependent on current population numbers which fluctuates due to population mobility, cultural events, sorry business, and time of year.
There are 45 communities in the Fitzroy Valley. Some communities receive no visiting services.
Nursing positions are often vacant, leave relief is generally not available.

Table 5: Health Service Provision (related to skin) in Remote East-Kimberley Communities in 2017.

Population Yellow >500 Green >250 Blue 100-250 White <100	Travel Time (hours to the nearest town by road)	Clinic Staffing (resident/visiting)		GP Visits (days per week)		Specialist Visits		Visiting Service	
		Nurse (FTE)	AHW (FTE)			Paeds visit (times per year)	Physician (times per year)	School Nurse	Child Health Nurse
East Kimberley									
Doon Doon#	1	0	0	V3/M	0	0	0	V2/Y	
Glen Hill#	1.5	0	0	V3/M	0	0	0	V2/Y	
Kalumburu	12	3R	1R	V3/M	V4/Y	V5/Y	RAN	O#	
Bililuna/ Mindibungu	2	3R	1R	V1/W	V4/Y	V5/Y	V1/W	V1/W	
Mulan	4.5	3R	1R	V1/W	V4/Y	V5/Y	V1/W	V1/W	
Ringers Soak	2.5	1R	0	V2/W	0	0	0	V3/M	
Warmun	2	4R	1.5**	V2/W	V4/Y	V5/Y	RAN	O#	
Balgo/Wirrimanu	3.5	6R	1R	R3/W	V4/Y	V5/Y	R3/W	R3/W	
Yiyili	1.5	V1/W	0	V1/W	0	0	V8/Y	V3/W	

*RAN housing being built and plans to have RAN's living in community in 2018/2019
Conditional on AHW qualifications/training AN*=as needed # =May change in 2018
R= Resident, V= Visiting, W= per week, M= per month, V 2/W= Visiting service twice a week, V 2/4M= Visiting service 2 to 4 times per month, V 1/3M= Visiting service 1 to 3 times a month, 1/Y= once a year and so on
# for smaller population's visits by GP/Nurse is dependent on current population numbers which fluctuates due to population mobility, cultural events, sorry business, and time of year.
Nursing positions are often vacant, leave relief is generally not available.

Box 4: Challenges to staff retention and service provision in remote communities (current in 2017).

The Fitzroy Valley: a case study of Noonkanbah – 2017

The Fitzroy Valley is approximately 127,000km^2. Travelling vast distances is part of the 'normal day' before staff can commence work at their clinics as there are no resident nurses in any of the communities.

Noonkanbah is a community in the Fitzroy Valley with a population of > 500 people where an onsite clinic would be expected based on the *Kimberley Aboriginal Primary Health Plan 2012 – 2015.*[39] However in 2017, Noonkanbah only had clinical services on four days per week, with no services on weekends or public holidays. The clinic hours on these four days were restricted to approximately 4 hours a day due to travel constraints, with staff flying to and from the community. The staff would see their first patient at 9:45am, and close the doors again by 2pm to be ready to fly out at 2.30pm. The flight to and from Noonkanbah, eight times a week, would be exhausting for clinical staff. The plane was small, the journey bumpy and temperatures exceeded 45C for many months of the year. There were no after-hours or on call service, and families sought care outside of clinic hours via telephone to contact Fitzroy hospital where a RFDS emergency flight or a halfway ambulance from Fitzroy might be organised in an emergency; neither of which may be timely.

* At time of writing, this gap had been rectified and Noonkanbah now has in-community clinical care every day, at all hours (24/7).

Most (67%) of survey respondents were unsure which communities or areas in the Kimberley were most at risk of missing skin assessments, either through the school health program, as part of routine health or child health checks, or integrated into regular clinic practice (Figure 22).

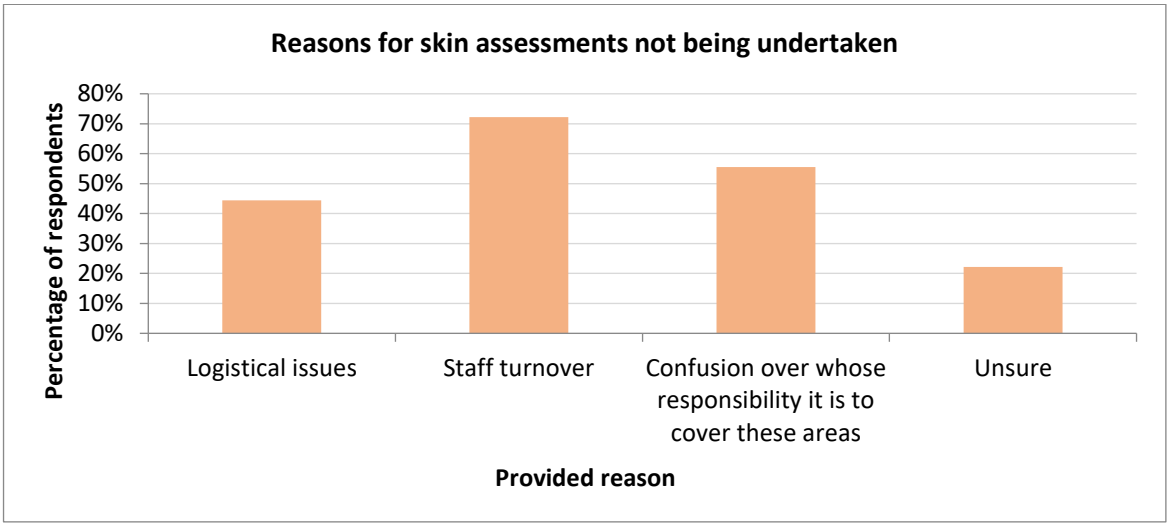


Figure 22: Response to question: "Which of the following are reasons for areas/communities missing these(skin) assessments?"

Stakeholders interviewed cited areas currently without onsite health service but large enough to merit one: Noonkanbah, Wangkatjunka and Bayulu. Stakeholders also mentioned areas with insufficient staff or high staff turnover, namely Derby, Derby's outlying communities and those further up the Gibb River Road, Halls Creek, and Fitzroy. They believed improvements in staff retention could help. Some respondents mentioned smaller outlying communities without a regular onsite service. However, this assumption was challenged during interviews with some stakeholders saying that it is often particular communities that have a skin infection problem. Further stakeholders postulated that in smaller communities with less frequent health service provision, children are in much better health than in larger communities that have significantly worse social issues.

"It is communities outside bigger towns, such as Mowanjum or Muldja and places like Balgo where almost every kid has these issues, it has a lot to do with the social issues, in the smaller communities the kids are healthier – of course there are always exceptions."

"Nookanbah and Wangkajungka represent a gap, there is a need, given the size of these communities to have permanent staff living out there."

10 Skin Infection management and treatment in the Kimberley

While treatment guidelines and known approaches to skin health management exist across the Kimberley, a number of challenges with these methods were identified by those interviewed or surveyed as part of this Situational Analysis.

10.1 Treatment guidelines

Survey respondents overwhelming agreed with the statement that their organisation provided treatment for skin infections (80%), using a policy or guideline. The majority (75%) of respondents adhered to the *Kimberley Skin Infection Protocol* for the treatment of skin infections. Others were less clear, citing the CARPA (Central Australian Rural Practitioners Association) Manual[135] or the APSGN guidelines[11,107,136] The CARPA Manual was preferred by some respondents as it was easy to understand and familiar. Most respondents indicated that skin sores would most likely be treated if multiple sores were present (Figure 23).

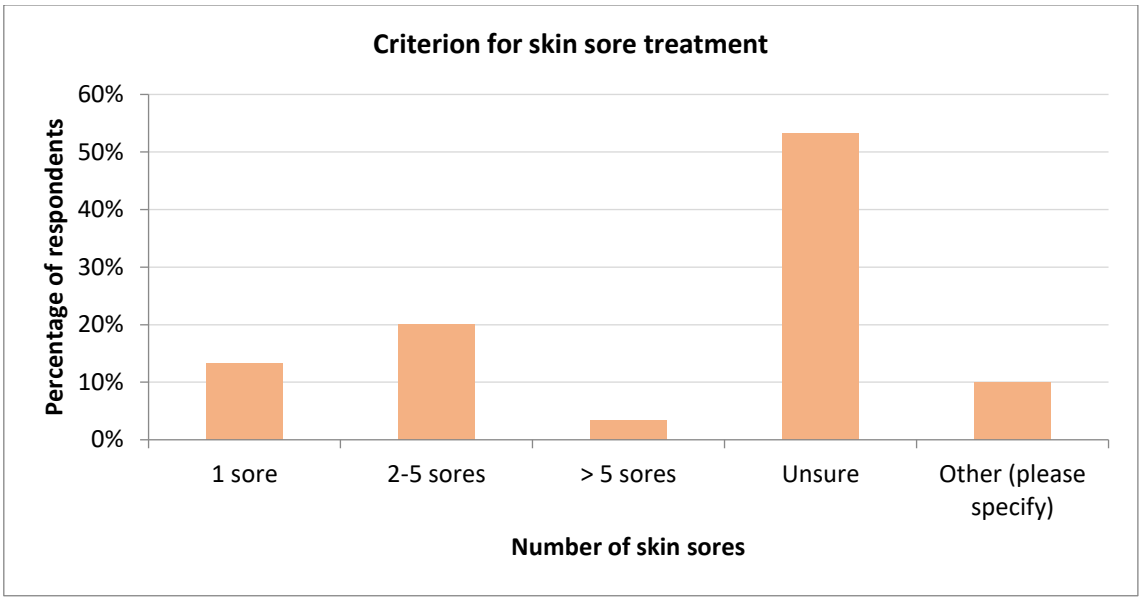


Figure 23: "What is the current criterion that your organisation uses for treatment of impetigo (skin sores/school sores)?"

10.2 Current approaches to skin health management

Survey respondents were asked about the way in which skin infections were managed within their organisations. Most respondents indicated that skin infections were treated as part of regular clinic practice, as part of routine health or child health checks programs and conducted as part of a school health program. Only 27% noted skin assessments formed their own program. Respondents indicated that skin health checks could be conducted by doctors, nurses, visiting clinic nurses and AHWs; no single category emerged as the most frequent, instead it appeared that all involved in remote healthcare had a responsibility to play in skin care treatment. Most respondents were aware of one or more services targeted at skin health including the school health program related to/including skin health, outreach nursing service related to/including skin and EH referrals related to skin (Figure 24).

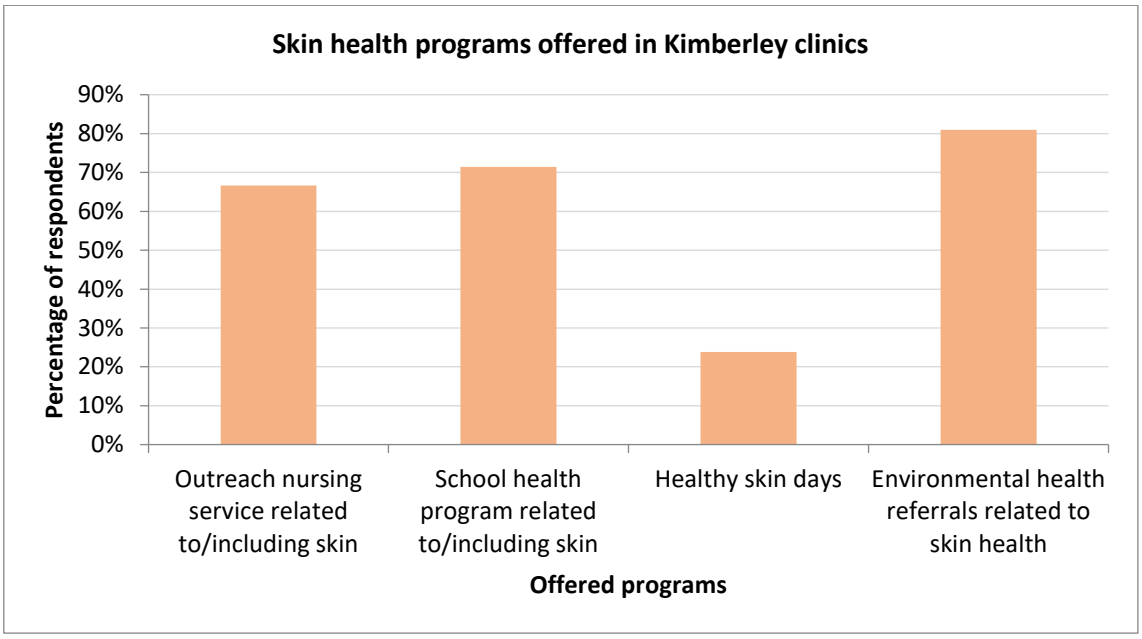


Figure 24: Skin programs known to respondents. More than one option able to be selected.

10.3 Antibiotics for impetigo treatment

While impetigo is predominantly caused by Strep A infections, recent studies have demonstrated that more than half of patients hospitalised in Western Australian had concurrent *S.pyogenes* and *S.aureus* infections, with high rates of MRSA detected, especially in the Kimberley region.[137] In the 1980s, a search and destroy approach had been adopted in WA to prevent hospital-MRSA overwhelming the city hospitals. As such, MRSA was made notifiable in WA in the mid-2000s and a comprehensive program to monitor the molecular epidemiology throughout WA developed.[138,139] Community-associated strains of MRSA (CA-MRSA) were first noted in Western Australia in 1984, and became a particular problem in the Kimberley region by 1989.[140] By 2004, it had become clear that a number of new clones of CA-MRSA had emerged over the years in WA, with WA-1 (ST1-IV) dominating in WA and spreading to almost all other states and territories.[141-143] The Kimberley Region is now in the unenviable position of having the highest rates of CA-MRSA in Australia.[143,144]

Benzathine penicillin G (LA-Bicillin) injections have historically been the preferred treatment for impetigo in the Kimberley, but LA-Bicillin is ineffective against *S.aureus*. In 2014, short-course co-trimoxazole was shown to be a non-inferior, alternative treatment to LA-Bicillin for impetigo. Importantly, co-trimoxazole is palatable, pain-free, practical and easily administered compared to LA-Bicillin.[11,145] Despite this evidence base developed specifically for Aboriginal children, LA-Bicillin was used by 42% of respondents to treat impetigo, while 36% said they would use co-trimoxazole (Bactrim). Other responses noted using flucloxacillin or cephalexin. During interviews, most stakeholders said that LA-Bicillin was preferred in remote Aboriginal communities in the Kimberley for three reasons;

1. There is a belief that giving LA-Bicillin protects the patient from ARF whereas this is uncertain when Bactrim is used.
2. Stakeholders were concerned about persistent infections and believed LA-Bicillin was a more effective treatment as they believed it was *active* for 28 days.
3. Bactrim may have compliance issues i.e. the low likelihood of oral antibiotic therapy being followed and completed.

Some respondents mentioned using the topical antibiotic Bactroban, but this is no longer advised for use in WA in remote Aboriginal communities[146] and there is a long history of its use leading to resistance, particularly in the Kimberley.[147-151]

"I have had kids come in with skin sores, or sore throats and I have given them Bactrim, then a few weeks later they have ARF, this has happened a few times to me, so I don't give Bactrim anymore when I know the parents won't make the kids finish the course twice a day for three days, better to give them the needle and save them from potentially getting ARF or APSGN."

"Kids don't like the taste of Bactrim and they won't take it, and it seems to be a cultural thing that parents don't force them to take it, like happens in the cities, the kids have a lot more power, what they say goes."

"Now parents come in, they wait until the kids get pretty bad, then they come in saying give the needle, they think it fixes everything, they rely too much on the needle and won't take on the responsibility themselves."

10.3.1 MRSA resistance to co-trimoxazole

In December 2015, the Kimberley Antimicrobial Stewardship committee asked the KAHPF to review the current (2014) *Kimberley Skin Infection Protocol*, in particular the section on prescribing for impetigo using co-trimoxazole. The 2014 update in the midst of the ASPGN outbreak had incorporated the recommendation to use co-trimoxazole for impetigo based on The Lancet paper described above.[152] The impetus for this came from a reported increase in MRSA resistance to co-trimoxazole from 9% to 18% from the PathWest Antibiograms from July 2014 to June 2015.[115] A report was produced by the Antimicrobial Stewardship committee recommending co-trimoxazole be removed as first line oral alternative to LA-Bicillin in the region, based on this perceived increase in MRSA resistance and recommended the use of cephalexin instead.[153,154] The *Skin Infection Protocol* was never updated to reflect this.

However, subsequent research[155] has found the PathWest Antibiograms overstated the rate of resistance to co-trimoxazole. The explanation was that most skin swabs from Kimberley hospitals were being sent to Perth for processing due to the rapidly increasing workload associated with the increase in skin and soft tissue infections. In Perth, the automated antimicrobial resistance platform (Vitek2, BioMerieux) was being used and the algorithms in this platform overreported co-trimoxazole resistance for MRSA.[155] A change of methodology back to the manual disc diffusion for cotrimoxazole for any isolate that tested resistant to cotrimoxazole on the Vitek2 platform occurred in December 2017 in Perth to address this. Co-trimoxazole is a combination of two antibiotics: trimethoprim (TMP) and sulfamethoxazole (SMZ) and resistance to both components is required before the drug is ineffective. Isolates were found to be resistant to TMP but importantly *not* resistant to SMZ. TMP resistance has been defined genetically as the dfrG gene which can transfer between bacteria.[155] Current research is investigating whether dfrG can mutate and evolve to produce co-trimoxazole resistance. Co-trimoxazole treatment failure has been suspected clinically but has not yet been defined genetically. Despite inclusion of co-trimoxazole in skin guidelines since 2017, AMS audits in 2017 did not show it to be the dominantly used antibiotic.[156]

The sequence of events described above means many Kimberley stakeholders in 2017 were confused about the use of co-trimoxazole for impetigo, as reflected in interview responses.

"As a RAN I am concerned about the Bactrim resistance, we need to leave some drugs available to treat MRSA, and if we are saying impetigo is driven by StrepA why treat with Bactrim and risk more antibiotic resistance?"

"After the AMS report, the paed (paediatric) team switched to using cephalexin as first line alternative therapy, it has been working well, the BD for 10 days is a challenge but we are very concerned with Bactrim resistance and cases that didn't clinically resolve on Bactrim."

"The main thing is health service are really, really confused around this, and this latest news that the antibiograms were wrong and there isn't an increase in cotrimoxazole actually just muddies the waters further."

10.3.2 Supportive treatments for Impetigo

While 33% of respondents use antibiotics only for impetigo treatment, topical paw paw (25%) and hydrogen peroxide (10%) were reported by some stakeholders to be in use. More than 40% of respondents were unsure if alternative topical therapies for impetigo were in use. Respondents commented that often they would just use soap, washing and dressing, some respondents also reported using betadine or chlorhexidine. Many community members talked about using bush medicines for skin sores and commented on how previously in the Kimberley babies' skin was kept clean and free from sores by using the resin in the leaves of certain eucalypts.[48]

10.4 Scabies control

As well as impetigo, scabies remains common in Aboriginal communities with overcrowded housing and few washing machines and driers. With limited health hardware, early infection and reinfection is common. Scabies control is important as it contributes to the ongoing burden of bacterial infections, through secondary infection. Despite permethrin being the first line treatment for scabies, however, many Kimberley stakeholders stated that ivermectin was in fact being used as first line treatment in the Kimberley in recent years, citing the inconvenience, unpleasantness, and impracticality of topical treatment in a tropical setting as reasons. This contrasts with the recommendations in the Kimberley Guideline and prescribing rules.

"The creams don't work anymore, people don't apply them correctly, no matter how many times you tell them to put it all over, they use it just on the itchy parts."

"I think there must be resistance built up to the cream, it's been used so much, you see tubes of it all over the tip. I go straight for the ivermectin."

"If you go to the tip in any remote communities that is what you will see there, 1000 of unopened tubes of Lyclear."

A recent systematic review looked at the evidence for strategies to achieve skin integrity for people in resource limited settings, which include Aboriginal peoples in the Kimberley.[99] Using the approaches identified in this review we asked stakeholders which public health co-interventions[157] were occurring in their organisation. Promotion of regular bathing and or hand washing was most common (86%), which has been supported by good evidence.[158] A similar number of respondents (72%) cited skin health education. More than 50% also cited washing of clothing and bed linen, treatment of contacts or putting mattresses in the sun (Figure 25).

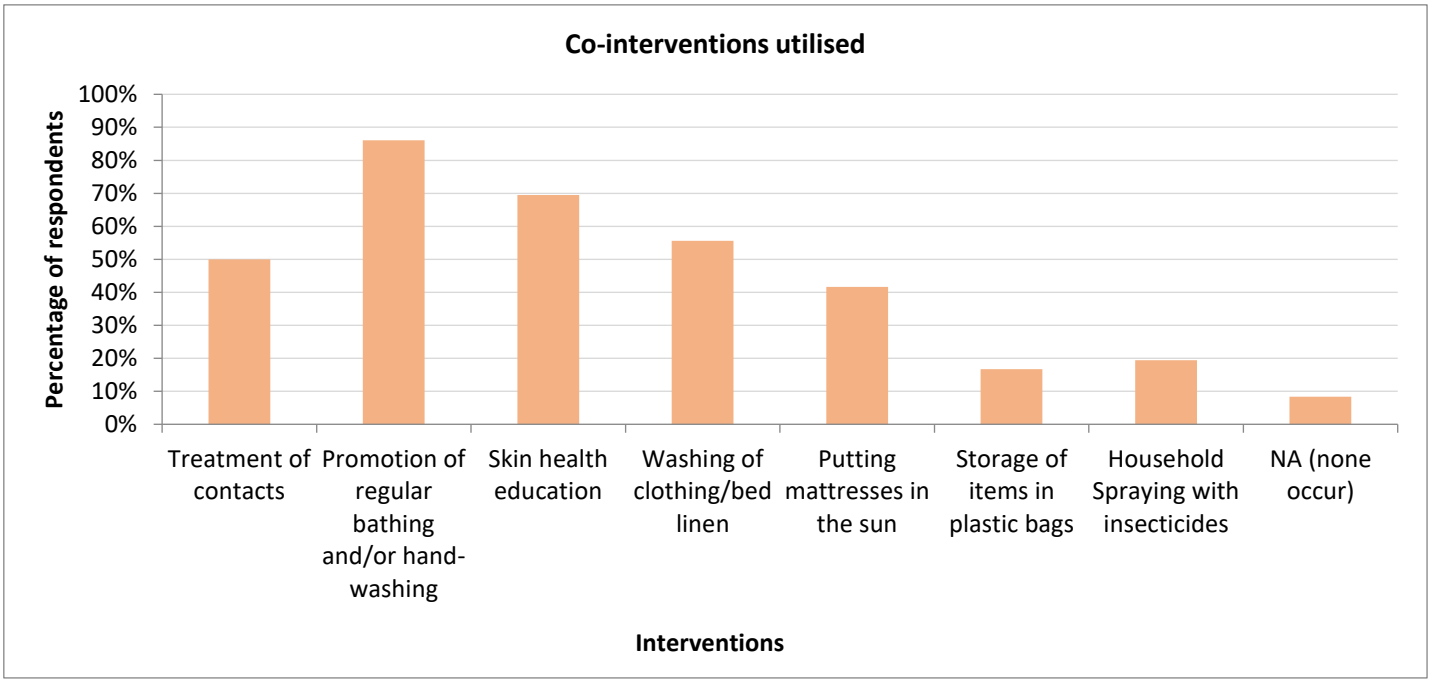


Figure 25: "With regard to skin infections, which of the following public health co-interventions occur in your organisation?"

10.4.1 Management of crusted scabies

At present in the Kimberley, clinicians use a combination of clinical experience, the Kimberley Skin Health Protocol and the CARPA Manual[135] to clinically diagnose crusted scabies cases. The Kimberley Skin Protocol[117] advises health service personnel dealing with a case of crusted scabies to seek specialist input (paediatrician or physician as early as possible).[146] However, only 32% of survey respondents indicated that they would seek specialist advice from a paediatrician or physician and most (44%) would expect local clinicians to deal with such cases (Figure 26). Access to specialist dermatology services is extremely limited in the Kimberley; a visiting dermatologist from Perth spends one week every three months travelling for a day only clinic in Broome, Derby and Kununurra and Fitzroy Crossing or Halls Creek alternatively. Therefore, Fitzroy Crossing and Halls Creek, where the need is greatest, is only visited by dermatologist once every 6 months. Anecdotally the rates of scabies are worse in these two areas. Most crusted scabies cases referred to the dermatologist are either referred as 'query, unknown rash' or not queried as potentially crusted scabies, but rather as some other diagnosis, indicating a lack of awareness and problems diagnosing this disease. (Personal correspondence Kimberley Regional Visiting Dermatologist).

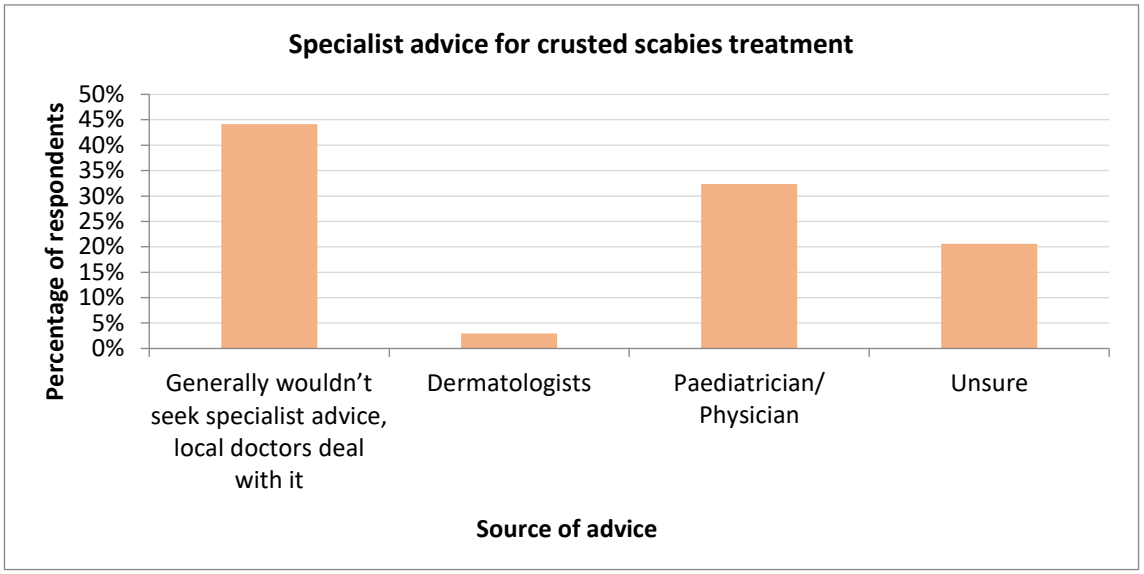


Figure 26: "Would you seek specialist advice for management of a case of crusted scabies?"

Several comments made around this issue also reflected that crusted scabies is mainly dealt with in the Kimberley without specialists.

> *"This is not usually the patients' main problem, we find this when we are treating them for sepsis or alcoholism."*

> *"I have tried to treat a person with this (crusted scabies) but they refused treatment, there was nothing I could do."*

In addition to scarce specialist support, currently no formal processes or a register are in place in the Kimberley for the long-term follow-up and management of crusted scabies cases. This is of concern given the fact that almost all of these patients will be returning to scabies-endemic areas and if not in long-term management will quickly become re-infected. Passive surveillance for recurrences leads to likely under-detection of crusted scabies in scabies-endemic areas.[34] After treatment in hospital, ideally a patient would then be enrolled in a preventative care regimen. This would involve regular skin checks looking for signs of recurrent crusted scabies, frequent use of a keratolytic cream combined with a moisturiser and regular use of a scabies cream, preferably benzyl benzoate, due to the limited risk of resistance developing with use of this agent.[32,159] This would also include treatment of household contacts and home inspections encouraging cleaning and use of pesticide bombs.

During stakeholder interviews it was very apparent that there are many inconsistencies in knowledge and awareness levels regarding the treatment, management, and follow-up for crusted scabies patients in the Kimberley region. Almost all (90%) survey respondents confirmed that they were unsure, or did not know, of any

formal crusted scabies education/orientation program for staff within their organisation. Past iterations of the *Kimberley Skin Health Protocol* devoted only a few lines to crusted scabies. Stakeholders believed a separate protocol might be warranted for this rare but highly infectious disease. Over 70% of respondents agreed that there were inconsistencies in knowledge and awareness levels regarding crusted scabies in the region and only 3% were aware of a process for long term follow-up of crusted scabies patients.

"I think a lot of people are confused because there is a whole gradation if you like to crusted scabies, and it is relatively easy to pick up the really advanced cases with the obvious crusts falling off, but what about the in between cases where it is turning into crusted scabies, but you are not sure, it could just be crusts of impetigo, more education around this is needed."

During community consultation many clinic staff brought attention to the fact that head lice are also endemic in remote Aboriginal communities and staff are often confused by crusts in the scalps of community members. Comments similar to those below were numerous.

"I have seen horrific crusts on kids heads, and I always thought this was just lice but maybe these crusts might be from scabies, you can find scabies in the scalps of babies so why do we think they move out of the hair as the kids grow?"

Some Kimberley Health personnel mentioned that they don't very often see healthy adults with scabies in remote communities.

"You do see a lot of children and a lot of the older people who have compromised immune systems, but not many of the adults? We think this may be due to the fact that adults who as children grew up in a scabies endemic community may have gained immunity."

Adding another level of complexity to the management of crusted scabies, a child with frequent bouts of disfiguring scabies, skin sore and weight loss can result in referrals to the Department of Child Protection and Family services over concerns of parental neglect.[32] However, in contacts of patients with crusted scabies it is more likely to signify ongoing disease transmission from an untreated family or community member with crusted scabies, rather than parental neglect.[32] Recurrent infections can lead to weight loss as a result of altered metabolism, nutrient loss and decreased appetite.[160,161] In turn malnutrition lowers immunity and susceptibility to infections.

10.5 Barriers to skin infection management

Survey respondents were asked questions concerning the priority of skin infections in their organisations, as well as factors that impacted on the management of skin infections as a high priority.

Skin infections were considered a high priority by most respondents (68%). Over a quarter (28%) considered them of moderate priority and the remainder (8%) perceived them to be of low priority. The normalisation of skin infections and competition for resources were the main factors that prevented skin infections being treated with more urgency (Figure 27).

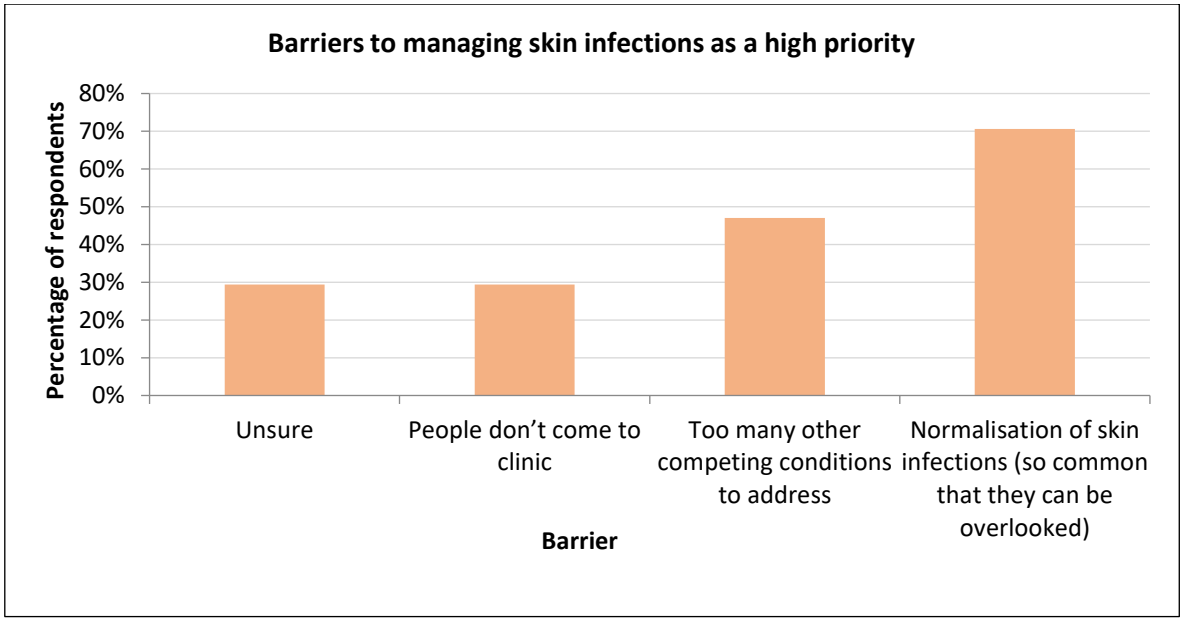


Figure 27: Barriers impeding the management of skin infections (more than one option available).

The downstream sequelae of untreated skin infections with the recent APSGN outbreak in the Kimberley, and the high rates of ARF and RHD were foremost in the minds of interviewed stakeholders.[66] However, many stakeholders noted that often there were multiple competing and usually highly complex and more urgent conditions to address first. Due to the high work loads of doctors and nurses, and the demand for treatment from patients, many admitted that skin infections would often fall down the list of priorities and fail to be consistently addressed. Clinic staff needed to prioritise acute care issues, leaving limited time to address chronic care conditions. This view was pervasive among many respondents, especially those working in remote PHC clinics. Clinics were increasingly busy and time available to deal with less urgent conditions and for HP activities to be conducted in the community were almost negligible.

"We (RAN's) use to close the clinic for a few hours in the morning and go for a walk out in the community, this was a great opportunity to build up relationships, do a little bit of HP under the guise of friendly advice and help with chronic and less urgent matters, now we are stuck in the clinic, with heaps of paperwork and don't have time for any preventative health education."

"Often, you have a waiting room full of people, and when a patient comes, in almost all cases have multiple complex issues, you just can't get everything done in that one visit. You pick the worst things, better to deal with a few well than a lot of issues badly, yes sometimes skin infections get ignored."

"This could be an area or portfolio AHW's could take on, if we trained them up, trained them better, they could deal with this, and it would give the Doctors/RAN's more time to deal with other issues."

"We need to increase the awareness of the seriousness of skin infections in the community, educate the kids and parents not just service providers."

Box 5: De-normalisation of skin infections is a critical step towards effective treatment and prevention.

Dr Asha Bowen is a paediatric infectious diseases specialist and clinician researcher. She completed her PhD leading a large randomised controlled trial (RCT) on the treatment of impetigo in remote Aboriginal children to find a better treatment option. At Telethon Kids Institute, she is involved in Group A streptococcus research and leads the skin team. She is the lead investigator on the SToP Trial: See, Treat, Prevent Skin Sores and Scabies which will be rolled out in nine Kimberley communities in 2019.

"When Aboriginal children are assessed at hospitals, it's often for a more acute condition like pneumonia or gastroenteritis, and that tends to be what the clinicians focus on. Also, skin infection can be so common in these communities they are regarded as normal, both by health workers and the community. It means the underlying skin problem isn't always noticed or treated – paving the way for serious complications later on."

Dr Bowen said it was something researchers had suspected but couldn't previously demonstrate with solid data.

"Now, after conducting a clinical study where we assessed new hospital admissions and compared the results to past records, we have the data to back it up – and that means we're in a better position to do something about it."[162]

Associate Professor Steven Tong, infectious diseases physician with the Victorian Infectious Diseases Service and Co-Head of the Translational and Clinical Research and Aboriginal Health at the Doherty Institute, said efforts to denormalise skin infections in Aboriginal children were an important first step in prevention.

"In some Aboriginal communities, 40–50% of kids at any one time will have skin sores, they are just seen as a normal part of life; we would not accept that if it was happening in our schools in Melbourne or Sydney, there would be an outcry. We need to work towards denormalising these skin infections by encouraging parents to take their children to clinics and encouraging clinics to recognise that this isn't normal and that these infections should be treated and prevented. We need to get the message out that skin sores aren't something kids just normally have. A minority of children who have Strep A infections currently present for treatment," he said. *"But if we could make a dint in that, as well as improving housing and living conditions, it would definitely help Close the Gap for Aboriginal kids."*[163]

The under-recognition and under-treatment of skin infections in settings where prevalence is high was recently addressed in a cross-sectional study carried out in two regional hospitals in Western Australia - Broome Hospital and Hedland Health Campus. This study found four times greater recognition of skin infections in the 'prospective assessment compared to the retrospective review'. In other words, when health care professionals were prompted and reminded to look for skin infections, they found them in a much larger percentage of children, as opposed to not documenting these conditions when they were not prompted.[61] These findings were validated with clinicians during interviews. Over 70% of respondents agreed with the statement *'skin infections are so common they are often overlooked.*' It was also agreed by 40% of respondents that children do not complain about skin sores and their parents or caregivers seldom take them to the clinic for treatment. This was suspected to be as many parents grew up with constant skin sores themselves which would invariably heal, making it harder for them as a caregiver the seriousness of the condition in their own children.

Strategies to overcome this under-treatment of skin infections could include increased numbers of staff to lessen the high workload of those in the clinical settings, as well as training of Aboriginal Health Care Workers in this area. Many respondents thought skin infections could be an ideal portfolio for AHW management, specifically as most ACCHO's in the Kimberley region have a 'See AHW first policy.' This in practice however rarely occurs, due to low AHW numbers and a lack of training. Community dermatology training models such as proposed in the SToP Trial could begin to address this gap. New HP or education campaigns addressing the '*normalisation*' of skin sores by kids, parents, community members, teachers, Aboriginal Health workers (AHWs), nurses, doctors, EH providers and other relevant stakeholders may also improve this situation.

10.6 Bush medicines

In the Kimberley, strategies that build on the community's culture and connection to country are more likely to succeed[164-166] and therefore the use of traditional or bush medicines are also being explored for the treatment of

skin infections. The current Kimberley Skin Infection Protocol advises health service staff to promote the use of bush medicine.[146]

Dr Kim Issacs, a local Yawuru woman and General Practitioner (GP) in Broome is currently researching the use of local bush honey for skin sore treatment. The antibacterial effects of Manuka honey have been established in vitro and the antibacterial activity of other honeys has also been reported.[164,167] In communities such as the Walmajarri, women Elders make bush medicine to pass on knowledge to the younger generation. A successful bush medicine program is ongoing in a partnership between KAMS and local communities in the Kutjungka region. In this program local Elders work with KAMS to harvest and then produce bush medicines. Clinic staff stock some fridges with bush medicine and locals come to the clinic to access this stock. This arrangement has also provided an opportunity for clinic staff to recommend a person visit the nurse or doctor too if they thought the bush medicine would not suffice.

10.7 Treatment follow-up

A key gap in the successful treatment of skin sores and scabies is ineffective follow-up after treatment. Only half of respondents said that follow-up did occur in cases of impetigo and scabies and thought there was a way to ensure follow-up within their organisation (Figure 28). When further queried about who was responsible for contact tracing household contacts for cases of impetigo and scabies, most responses were unsure or thought no one in their organisation had this responsibility (Figure 29). In interviews, many stakeholders mentioned the greatest challenge to be trying to get patients to return. Patients were either transient and had moved on, were uncontactable or refuse to return; regular reasons for a lack of follow up in the region. Clinic staff tried to ensure contact tracing was carried out but said it was very often beyond the scope of the clinic limited due to the volume of work within the clinic. Contact tracing can also be looked upon as '*a shame job*' by community members, especially if its initiation is poorly explained.

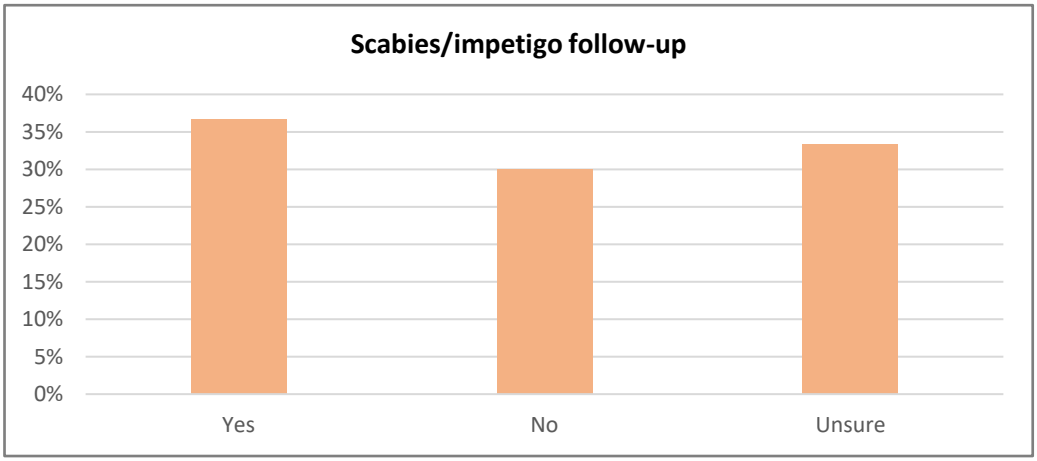


Figure 28: Follow-up occurs in half of the cases of impetigo and scabies.

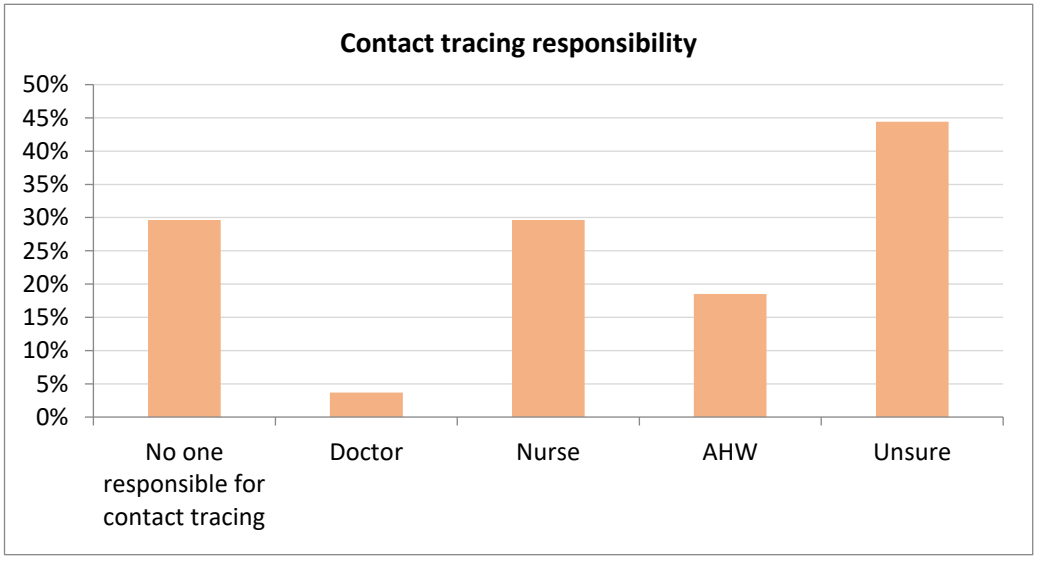


Figure 29: "Who (if anyone) in your organisation is responsible for contact tracing / treating household contacts in cases of impetigo and scabies?"

Identifying mechanisms and processes to share data more effectively between different service providers was also highlighted as a gap in service. Different computer systems in different health organisations, for example *Communicare* in WACHS and *MMEx* in AMS, presented problems for clinic staff in sharing data or checking patient medical histories. This was particularly challenged by high population mobility.

A common theme from stakeholders was the lack of continuity between different PHC services and within the hospital sector. Continuity of care is an important aspect of providing best practice health care. While it is not generally practical for a PHC provider to physically follow a patient into another PHC service or the hospital system, it is essential that the PHC provider's knowledge of the patient is transferred to other PHC providers and/or into the hospital system with the patient. Conversely, it is important that information from the hospital or other PHC provider returns home with the patient. Due to the lack of integrated data systems in the Kimberley, too much reliance is still placed on failure-prone systems to exchange information e.g., written discharge summaries or telephone calls. Discharge planning is of particular concern. Too often, patients arrive back in their community or aged care facility with no advance notice of their arrival, medications have been changed and no discharge notes are available advising what follow-up treatment is required. This gap has been previously alluded to in the *Kimberley Aboriginal Health Plan 2012-2015*.[39]

11 Health promotion resources in the Kimberley

As with the treatment guidelines for skin infections and scabies, the availability and usage of HP resources across the Kimberley varies.

11.1 Availability of health promotion resources

Survey respondents were moderately aware of a variety of HP resources currently available within their employing organisation specific to skin health (52% aware of specific guidelines). Figure 30 shows the educational resources available at point of survey. However, most respondents (82%) believed these resources could be improved and emphasised a need for more HP in this area. Other stakeholders mentioned showbags containing soaps and packets of washing powder were available at some clinics in 2017.

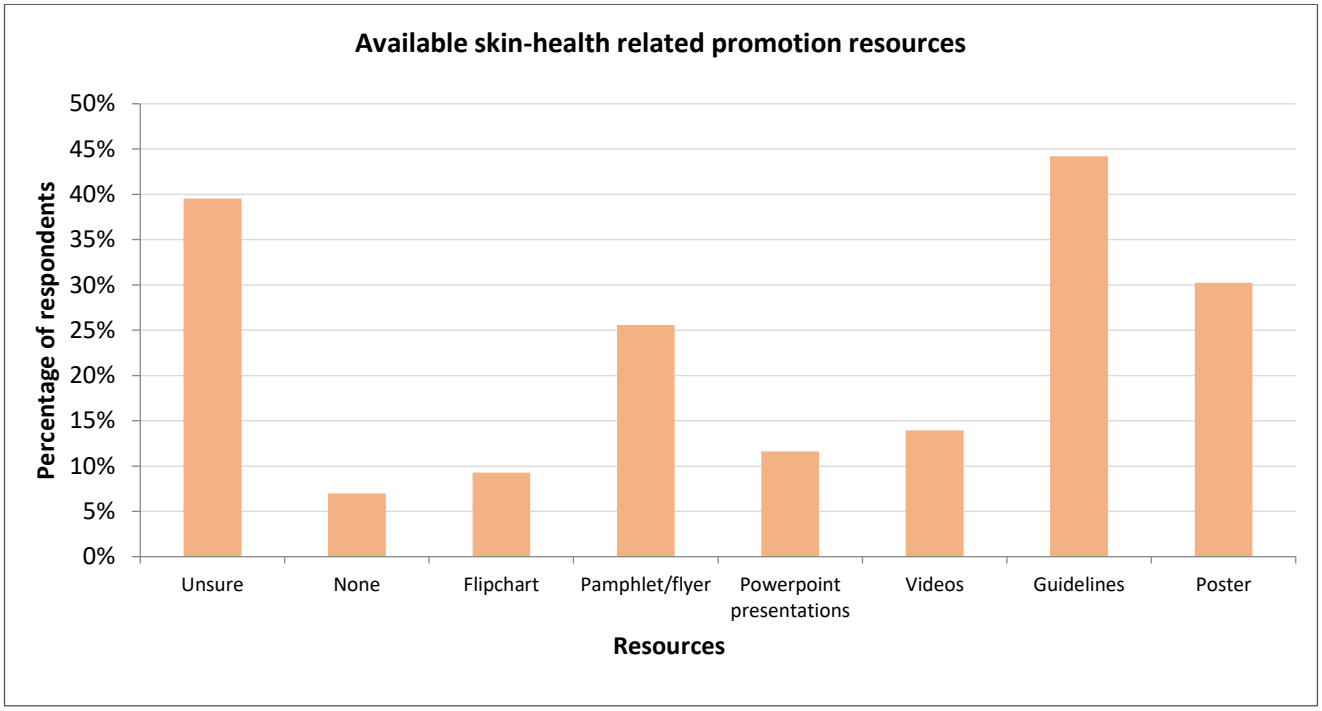


Figure 30: Available skin health resources (more than one answer available).

Funding for HP has decreased over the last decade in the Kimberley,[41] most likely due to a decline in funding and the fragmentation of HP resources. Most stakeholders interviewed thought regionally developed and jointly implemented programs could improve the situation. In this regard, a start has been made with the formation of the regional HP Network, providing a forum for local agencies delivering services to Broome and the West Kimberley communities. Members include KAMS, WACHS-K, Boab Health Services, Headspace and KMHDS. The network aims to improve coordination of local HP initiatives, identify and address community needs and provide a forum for the development of partnerships and projects to deliver consistent HP messages.[41]

When we asked respondents to specify how HP in the Kimberley could be improved most stated that increasing the number of staff employed in HP is key. In addition, respondents expressed a need for improved education at the health professional and community level and appropriate tailoring of these messages.

> *"We used to have a big team in HP that has completely wilted away over the last 10 years, there are only a few of us here now trying to cover this huge area, we need way more people in health promotion team to cover schools, day care centres, play groups, mums groups and be able to do 'health drive days' like we used to."*

In was noted that further education for clinical staff to look for, identify and treat skin infections was needed with a locally developed flipchart that targeted the Kimberley.

> *"We need more targeted specific resources for Kimberley mob, made by Kimberley mob."*

A yearly roadshow that combined aspects of HP and EH for community members was also suggested and a focus on personal and community hygiene was very important.

"We need more environmental health resources, flipcharts to help educate household members when we are referred to the house, doing a yearly roadshow with health promotion would be good"

"Cleaning up houses & community needs more resources to emphasise the importance of cleanliness and the conditions it can lead to if not."

The messaging at the community level is also important. For example, telling people who only own one towel in a household 'not to share towels' is ineffective. In this situation it would be more effective to tell people to wash towels more frequently. The below comment illustrates how different Aboriginal and non-Aboriginal world views are and how consulting with communities prior to developing resources is crucial if they are to be successful.

"I don't want to smell like a Gardia (whitefella)! Telling me to stay squeaky clean is a bad message, I don't want to smell like that."

11.2 Prevention activities at home for skin infections

Stakeholders reported that there currently exists a lack of facilities and basic resources to support families in the prevention and early management of skin infections. Improved community education, along with facilities to support families in prevention and early management of mild skin infection were also highlighted i.e. not needing to be seen at clinic to access materials for home management of minor skin infection. Parents reported lack of access to bandages or other first aid basics for home management of minor skin infections, and in any case the cost of these items in remote shops is prohibitive. It was suggested that community members could have access to free dressing trolleys so they could dress and care for their own mild wounds. However, some health service providers had stopped providing dressing trolleys in their clinics because of vandalism and waste. Having resources such as this available more widely within the community and not necessarily in the clinic was suggested. Relocating these trolleys to community council buildings or other community locations was suggested, so community members can dress and treat their own skin sores but take responsibility for the supply and stock of the trolley.

"Parent's don't have access to the basics: bandages or betadine so they can take care of minor grazes- need to get these basics out to remote communities especially those without clinics- or set up a trolley supplied with these in e.g. the local store."

11.3 Current health promotion initiatives

Despite the need for further HP in the Kimberley there have been several successful programs. KAMS have also developed a very useful resource: *A ten step guide for the development of HP and health education resources in the Kimberley*[168] (Box 6) to guide development. See Appendix 2 for a comprehensive list of HP resources currently used or produced in the Kimberley. The following are some examples.

- ***No Germs on Me*.** This social marketing campaign has been used to promote handwashing with soap to reduce high rates of infection among children living in remote Aboriginal communities and has been ongoing in the Kimberley since 2007.[118]
- ***'Mabu Baru' program*.** 'Mabu Buru' comes from the local Yawuru word meaning a 'good place or healthy environment.' This resource was developed by a local Aboriginal EH Promotion officer at KPHU and has been used in the Kimberley to promote good personal hygiene, healthy homes and dog health.
- ***First-Aid Kits*.** After community consultation NCHS developed First Aids Kits specifically designed for people living in the Fitzroy area. The distribution of these First-Aid Kits saves people living out of town from having to visit the hospital in town for minor ailments. They are also important for when remote community access to health services is cut during the wet season.[169] Originally, the kits distributed by NCHS came with a mainstream St Johns First Aid booklet. However, local NCHS staff revised the booklet sent with the kits for easier interpretation and use. Specifically, the revised booklets relied on the use of simpler text and more step-by-step diagrams and visual aids. The contents of the First-Aid Kits are unique to the Kimberley. In response to community needs, the kits contain a snake-bite kit, Vicks or some other rubbing ointment,

antiseptic ointment, swabs, ear drops, cough mixture, ringworm cream, scabies cream, band- aids and bandages, tape, scissors and treatments for boils, snake-bite, gastroenteritis and head lice.[169]

- ***Kalumburu project*.** This successful service-based 'healthy skin initiative' was implemented during the APSGN outbreak in the Kimberley. Four consecutive visits to this remote Aboriginal community combined EH, HP and public health alongside onsite PHC over a 6 month period in 2016.[55,170] 176 children were seen for skin checks and 44 housing assessments were completed by the environmental health team identifying 242 household issues requiring urgent repair. Before this initiative, the percentage of all PHC presentations in the clinic for children aged 0-17 years in which scabies was coded as either 'primary' or 'additional' reason for attendance was 9.5%. After this initiative, the percentage was significantly reduced to 2.2%.
- ***Squeaky Clean Kids.*** A HP campaign by WACHS, *Squeaky Clean Kids* aimed to reduce the incidence of trachoma and skin infections in regional Aboriginal communities. It partnered with *SoapAid*, an Australian not-for-profit organisation that collects, sorts, cleans and reprocesses soaps from hotels into new bars. Most Kimberley communities were involved in initiative upon its launch in 2018 which also included bathroom assessments to identify problems with 'health hardware'. These bathroom checks were carried out by local Kimberley EH Service Providers.[171,172]
- ***The SToP Trial*:** See, Treat, Prevent, Skin sores and Scabies is a stepped RCT that will be rolled out in nine Kimberley communities in 2018 and will evaluate an intervention program intended to enhance sustainable skin health practices. The key aim of the trial is to partner with local health care providers to achieve a sustainable reduction in the burden of skin infections, demonstrating that this approach is effective, and should be rolled out into similar communities throughout WA and Australia. The study relies on a business as usual model with a wrap- around service to provide the knowledge (HP, training), resources (online manuals and side-by-side training) and scientific (streamlined, evidence-based treatment recommendations) input to achieve this.

Box 6: KAMS guide for the development of HP resources.

A ten-step guide for the development of HP and health education resources in the Kimberley

Step 1: Identify the area of interest
Step 2: Check for existing resources
Step 3: Define the message and target audience
Step 4: Create a working group
Step 5: Complete an evaluation plan
Step 6: Produce resource in draft form
Step 7: Test the resource with members of target group
Step 8: Re-draft your resource
Step 9: Distribute your resource
Step 10: Evaluation your resource

12 Environmental health in the Kimberley

Health in the Kimberley can be influenced by a wide range of community and municipal functions. The key factors in the physical environment which impact on the health and wellbeing of Aboriginal and Torres Strait Islander communities include water treatment and supply, access to affordable and healthy food and food safety, adequate housing and maintenance and minimisation of overcrowding, rubbish collection and disposal, sewage disposal, animal control (including insects), dust control, pollution control and personal hygiene.[173]

The prevalence of skin infections is influenced by access to water for hygiene purposes, by heat, humidity, insect bites and crowded living conditions[51] (Figure 31) primarily modifiable environmental health factors. While an exhaustive enquiry into these social determinants of health, specifically environmental health is beyond the scope of this review, this section presents an overview of the current situation in the Kimberley.

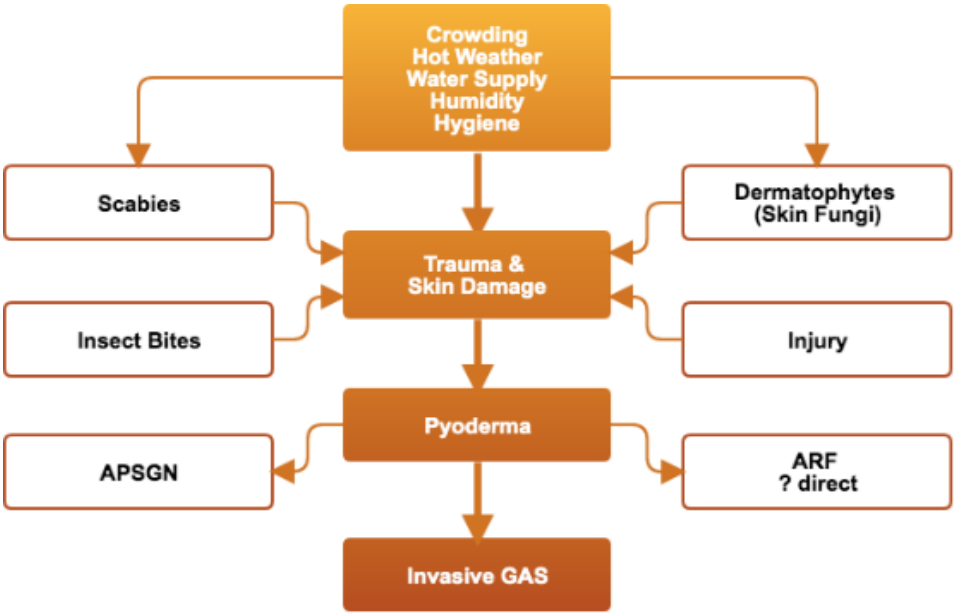


Figure 31: Factors affecting skin disease in Aboriginal communities.

In 1987, the *Uwankara Palyanyku Kanyintjaku* (UPK) report, an environmental and public health review within the Anangu Pitjantjatjara Lands, reached the conclusion that nine healthy living practices are necessary for improved health.[174] Between 1987 and 1990 UPK became regarded nationally as a yardstick for environmental intervention in Aboriginal communities.[175] The nine healthy living practices which were the focus of UPK are presented in Box 7.

Box 7: Nine Healthy Living Practices that underpin Environmental Health.[76]

The Healthy Living Practices

1. Washing people
2. Washing clothes and bedding
3. Removing waste safely
4. Improving nutrition
5. Reducing overcrowding
6. Reducing the impact of animals, vermin and insects
7. Reducing dust
8. Controlling the temperature
9. Reducing trauma

12.1 The Environmental Health Needs Survey

The 2008 *Environmental Health Needs Survey*[47] (EHNS) report presented an EH analysis on more than 15,000 residents of some 232 occupied communities across WA. A new similar survey is currently under way.[176] It was the third in a series surveying housing, services, utilities, community infrastructure and the immediate living environment in discrete Aboriginal communities in WA.[177] The majority of these communities are located in the

remote east, central and northern parts of WA. Some of these communities exist within or on the fringes of remote towns and are generally referred to as 'Aboriginal Town-Based' communities, while all other communities are generally referred to as 'Remote' communities. All of these communities are distinguishable from WA's remote or regional towns by the fact that they rely on separate funds for the provision of some or all of their essential and municipal services.

The main EH concern of all communities surveyed in the report was housing and overcrowding (69% of communities). The adjusted population density measure, or people per permanent dwelling (for all communities), has declined from 7.0 in 1997 to 5.7 in 2008, consistent with observed increases in permanent dwellings (from 2,119 in 1997 to 2,836 in 2008). The EHNS report revealed that 106 communities in the Kimberley were identified as having inadequate home design and insufficient equipment for healthy living in 2008.[47] The report found that the 15,112 average population of Aboriginal communities live in some 2,836 permanent dwellings and 303 temporary dwellings, equating to an average of 5.7 people per permanent dwelling. This figure is higher for Wyndham-East Kimberley (6.6), Halls Creek (6.0), Derby-West Kimberley (6.4) and Broome (6.7) which are also the four region groups with the highest usual populations.[47]

The state of housing has taken a heavy toll on the health of these communities. Living in unhygienic conditions is a significant contributing factor to the high rate of impetigo and scabies in communities. To date, KAHPF advocacy to address the social determinants of health has not resulted in change to living conditions in these communities.[41] It is important to note that these social determinants are modifiable and may be addressed using relatively simple, cost-effective changes in community infrastructure. Addressing housing and infrastructure is highly likely to reduce their cumulative negative effects on individuals across the life course and result in significantly improved health in remote Aboriginal Australian communities.[178]

12.2 Environmental Health Referral System

In 2009 OVAHS doctors approached KPHU in the East Kimberley regarding the frequent and repeated presentations of clients with scabies and other skin infections.[179,180] Clinicians were seeking input from public health to address this problem, despite it not being a notifiable disease. Due to this, there were often delays between diagnosis of skin infections and discussion with public health. OVAHS found when reviewing statistics, many present health issues could be traced back to an unhealthy home environment and overcrowding. There was no adequate referral or follow-up system in place. Following this, services started to work together to develop an EH referral form. Other EH service providers in the Kimberley already had their own versions of this form which included client details, EH concerns noted by the clinicians and many diagrams to identify the parts of the septic tank, toilet system, external tap or household plumbing system that should be checked by the EH workers to locate any potential causes of the disease being presented by the patient.[180]

The system in the East Kimberley KPHU started with KPHU EH staff having a pigeonhole in OVAHS with a manually filled-out referral form, or sometimes a phone call or a fax. The EH worker, upon receiving a referral form, would contact the family and if consent was provided, they would inspect the household plumbing and septic systems for maintenance issues. The EH worker would also use the visit to provide some basic education about household and hygiene practices. After leaving the house the EH worker would report faults to the appropriate agency, determine a follow-up date and then complete the referral form identifying all actions taken.

This EH referral system has now developed into a strong community education tool which has given families and individuals an awareness of how their home and surrounding environment impacts on their health. Of the respondents, 67% used the EH referral form within their organisation. It has also been the springboard for many additional services being offered to communities, including trailers being provided for waste and rubbish collection, permanent bin bags being provided to communities, access to funding to provide clothes lines and implementing a dog health program to assist in de-sexing and caring for dogs.[179]

12.2.1 Kimberley Regional Clinical Environmental Health Referral Pathway process

Building on the success of the OVAHS/KPHU and other EH activities in the Kimberley, in 2016 the KAHPF EH subcommittee designed a generic EH referral form to be used throughout the Kimberley.[57] This form is available online on the Kimberley Clinical Guidelines webpages and can be uploaded in to clinical information systems

(MMEx/ Communicare). The exception is that NCHS have a separate form for use in the Fitzroy Valley. There are five organisations providing EH services in Aboriginal communities across the Kimberley (Table 6, Figure 32).

Table 6: Kimberley Environmental Health Teams.

Nirrumbuk	Derby/West Kimberley Shire	NCHS	Halls Creek Shire
Bidyadanga, Dampier Peninsula, Balgo, Billiluna, Mulan, Halls Creek.	Derby Shire and outlining communities (along Gibb River Road and Fitzrpy Valley).	Fitzroy Valley (42 communities)	Halls Creek and town communities; Mardiwah Loop, Red Hill, Nicolson Block, Koonjie Park, Kutjungka, Ringers Soaks, Warmun, Yiyilli

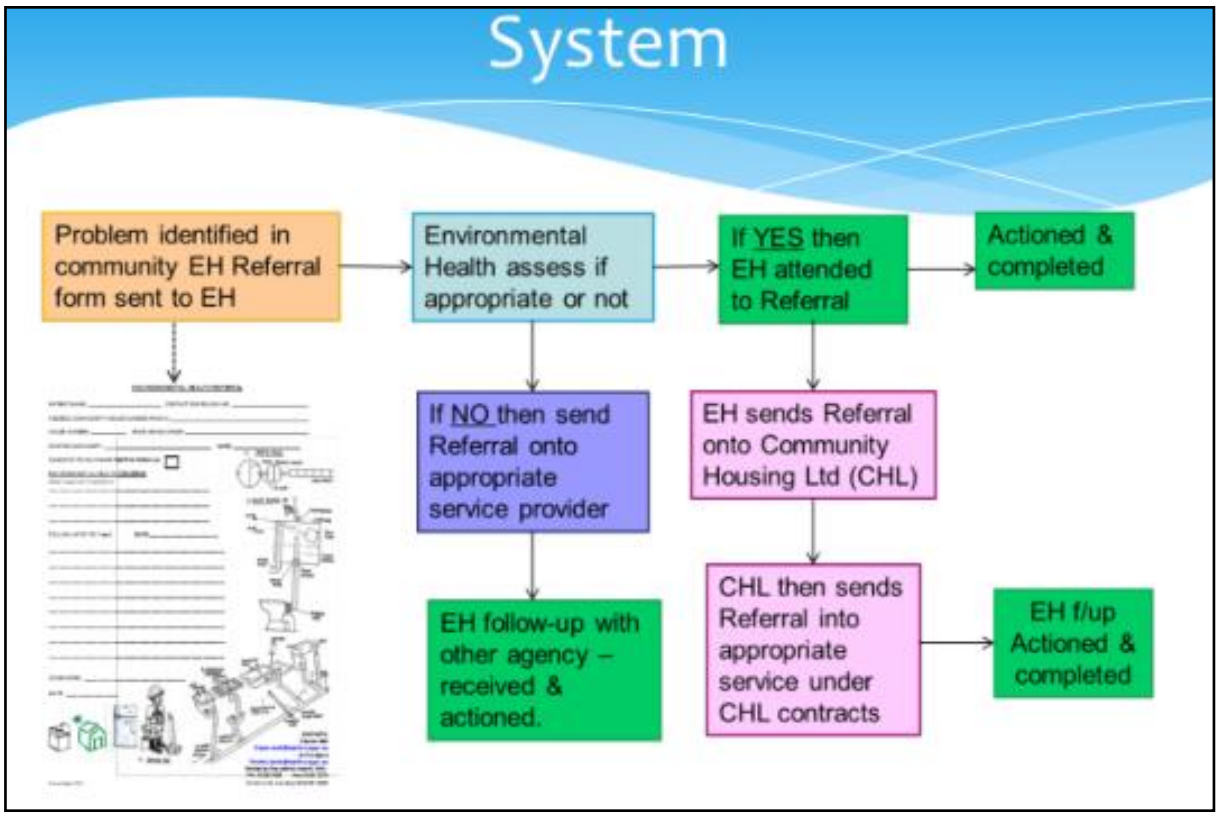


Figure 32: Kimberley Population Health Environmental Health Referral Form process.

In the latter half of 2016, the KAHPF EH Subcommittee assessed the baseline use of EH referrals between clinics and the local EH service.[57] In April 2017 an EH survey was sent out by the KAHPF EH Subcommittee to clinic staff asking questions such as:

- 'What does environmental health mean to you?'
- 'Do you know what services the environmental health team provide?'
- 'Do you know how to contact them?'
- 'Do you know how to refer to them?'

This survey targeted clinical staff and aimed to gather baseline information regarding knowledge in relation to a number of EH issues. Having identified gaps in knowledge and services, the next step is to develop continuous improvement activities to address the gaps identified.

One recommendation from this survey was for better integration with clinics. The suggestion was for EH service providers to inform all health care providers in locations that they serve of when and how to contact their service for assistance or referral, and the range and types of services that can be provided. Promotional activities and information/ education may need to be provided to achieve this aim. In the report, 92% of respondents believe

that housing is the biggest EH issue facing their clients. Pest control, dog control, health hardware and rubbish disposal were also rated highly. More than one third of respondents (38%) stated they had an average or low understanding of EH issues.[57] In 2018 the KAHPF EH Subcommittee will progress resources to help clinicians identify when to consider an EH referral (clinical triggers).[57]

In situational analysis interviews, many stakeholders commented on the usefulness of EH referrals and were pleased at the strengthening of links between EH services and clinics. Of the respondents, 26% were unsure where to find the EH referral form and many commented that it was hard to locate. Clinic staff commented it wasn't always easy to get patients to consent to an EH referral and they thought it would be useful if EH services communicated to communities more broadly about the services they provide. Many clinic staff stated that patients often erroneously thought EH referral forms could lead to their houses being taken away from them or condemned. Of the interviewees, 68% were unsure about the process for follow-up and whether it was their responsibility since they initiated the referral or whether this was the responsibility of the EH service. Interviewees were unsure of likely turnaround times and felt overall, they needed EH services to come to clinic more regularly to update staff on the kinds of EH services they can provide and on the process of the EH referral. Stakeholders clearly saw the value of EH services in the area of preventative health. Prevention of the EH triggers of skin infections was viewed as equally or more valuable than trying to reduce transmission of skin pathogens after the fact. EH services are underfunded and have extremely busy workloads with very few staff. This is a relatively new system and process (the current EH referral form was only finalised in 2017) and providers are working on these issues with the KAHPF EH Subcommittee and their health service providers to improve the system.

12.3 Housing provision and maintenance

Housing is managed in remote Aboriginal communities directly by the Housing Authority, or in certain locations in the Kimberley subcontracted out to regional service providers (for example Emama Nguda in the West Kimberley, Community Housing Limited (CHL) in the East Kimberley, and Marra Worra Worra in the Fitzroy Valley region (as described previously in Table 6). When a person has a maintenance issue, such as a leaking tap, they can contact either one of the regional service providers or the Housing Authority directly.[181] The issues are categorised according to a priority level on a four-point scale. Maintenance issues regarded as Priority 1 are generally considered to be life-threatening, i.e. electrical hazards, and are required to be fixed within 8 hours.[181] Priority 4 maintenance issues (also considered 'Routine Work Orders', such as a damaged exhaust fan) must be completed within 28 days of the work order being received by a contractor.[181] However, this could be difciult to achieve in a remote community, and therefore problematic, as delays often result in the problem becoming worse. For example, the leaking tap that could have been fixed by replacing a washer may turn into a gushing tap by the time it gets fixed – which may flood the home, waste water, or cause other health hazards.

Some of the larger communities will have a resident Housing Authority office, while other communities are required to call Perth Housing Authority to log maintenance issues. One such community is Nicolson Block, which is located just outside Halls Creek (within walking distance). Nicolson Block community members are unable to visit the Housing Authority office in Halls Creek to report maintenance issues and are required to call the Perth office. Residents of such remote Aboriginal communities in the Kimberley have long maintained that this situation is completely unsuitable due to the language barrier. Community members report that they are often misunderstood, and tickets are frequently issued for the wrong job. Another issue is lack of phone credit or the means to make a phone call to Perth. The result of this often confusing and difficult-to-navigate system is that housing maintenance issues do not get reported or acted upon promptly.

In remote communities most of the essential services are managed by the Remote Aboriginal Essential Service Program and most of the municipal services are managed by the Municipal Services program.[47,182] Parsons Brinckerhoff, under Kimberley Regional Service Providers (KRSP), currently hold the contract for the provision of Remote Area Essential Services Program services in the Kimberley. Service provision under the program involves rotating visits every 6-8 weeks to Aboriginal communities to check and repair (if necessary) water, power and waste management infrastructure.

Key services provided include:

- Planned and unplanned maintenance of essential services;
- Emergency breakdown services;

- Water quality testing;
- Monitoring and reporting, and;
- Advice on capital works priorities and scopes.

The Kimberley Regional Service Providers are responsible for all major maintenance, water testing and upkeep of mains assets such as water pumps, bores, water mains outside the boundary of the home. The tenant, the Housing Authority and their contracted homes maintenance provider, (currently Lakes Maintenance), are responsible for repairs and maintenance inside the boundary of the home.

Tenants are responsible for the normal care and maintenance of the property and are required to keep the house and grounds in a decent, safe, and sanitary condition.[183] Tenants are required to inform the Housing Authority of any maintenance problems that arise. The Housing Authority will schedule and pay for repairs unless the problem is determined to be caused by abuse by the tenant or any person the tenant allows into the house. In such cases, the tenant is required to make repairs at his/her own expense. Failure by the tenant to correct the problem will result in the Housing Authority correcting the problem and billing the tenant for the costs of the repair. The Support and Tenant Education Program (STEP) is a Housing Authority initiative, delivered in partnership with non-government organisations.[183] STEP aims to increase the capacity of Housing tenants to independently manage their tenancies. The STEP providers, in partnership with the Housing Authority, deliver support through intervention and education to tenants who have been identified to be at risk of potential eviction. They offer their services to Housing Authority tenants in the metropolitan, regional and remote regions of WA. STEP service providers in the Kimberley include Nirrumbuk Aboriginal Corporation, Marra Worra Worra Aboriginal Corporation and Ngunga Women's resource centre. Participation in STEP is voluntary. As a tenant, you can ask to join the program or a housing services officer may suggest you join.

12.3.1 The issue of Binding the Crown

Remote houses are Crown properties - that is, they belong to the Commonwealth of Australia and come under the control of the Government. *The Public Health Act (1911)*, which has only recently been updated, has in part contributed to the variation and inequity in Public Health Standards that exist across Australia.[184] The introduction of the new *Public Health Act (2016)*, which came into effect in 2017,[185] may help to address some of these inequities. The new Bill provides for binding of the Crown, that is, that all persons are entitled to the same public health standards irrespective of whether the land or buildings that affect them are owned, managed or controlled by the Crown. This means, for example, it is much easier to put a lawful condemn notice on a house that is not fit for human inhabitation.[41] It also ensures there is a standard level of authority available to protect other basic health standards including public buildings, food premises, waste water disposal, drinking water quality and waste disposal. Under the new act, Local government is primarily the agency responsible for enforcing the Act on Crown land.

In accordance with the Act, an Authorised Officer can serve an improvement notice on the Crown, although the Crown cannot be prosecuted or issued with an enforcement order. Additionally, the Minister for Health may issue Crown authorities with an exception from immediate compliance with the Act, recognising that the Crown may be incapable of achieving immediate compliance with the Act. This allows incremental measures to be implemented to achieve staged compliance with the Act,[122] because many of the required improvements to infrastructure (housing) and service delivery can only be achieved in the medium to long term and may require additional funding. Exemptions cannot be provided for the following: notifiable infectious diseases and related conditions, serious public health incident powers, Public Health emergencies, Inquiries, powers of entry, inspection and seizure, liability, evidentiary and procedural matters or miscellaneous matters.[110]

12.3.2 The Remote Housing Strategy

The Commonwealth Remote Housing Strategy, aims to reduce significant overcrowding, poor housing conditions and severe housing shortages by assessing jurisdictions' performance against key objectives of the strategy (Table 7).[186] With the exception of Western Australia, each jurisdiction met or exceeded its original COAG targets in 2017.[186] While WA met the target for refurbishments, a residual demand for 940 new houses remains. WA was ranked poorly in terms of housing quality, where many serious design and safety issues were recorded, with 14 Kimberley communities included as part of the review.[186] Improved living conditions during the 20th century in the wider Australian population have resulted in a decline in Strep A disease, however this has not been the case for

Aboriginal Australians.[187] Overcrowding is the main factor driving the transmission of scabies and Strep A in remote communities.[188] Improving housing quality is a key factor in improving the health of remote-living Aboriginal people. Figure 33 shows the distribution and management of homes around WA.

Table 7: Assessment of Jurisdictions' performance against key objectives of the Strategy.[186]

Issue	QLD	WA	SA	NT
New Builds*	1,144 (+0.26%)	841 (-16.90%)	256 (+6.22%)	1,504 (+3.30%)
Refurbishments*	1,490 (+22.53%)	1,742 (+35.25%)	330 (+60.19%)	2,929 (+42.74%)
Housing quality	**Good**: After some early challenges	**Poor**: Construction quality consistently reported to be poor	**Good**: Also well designed for communities	**Good**: With a strong focus now on housing resilient
Cyclical maintenance	**Good**: System is robust and working well	**Poor**: Repairs are taking too long to fix and there is no capacity for proactive works	**Average**: Some is in place. Rental arrears are extremely low but rent charges are also very low	**Poor**: Needs further effort. Starting to bundle works but little evidence of proactive maintenance
Community engagement, and employment and business initiative	**Good**: Engagement with local councils resulting in strong local employment.	**Very limited**: Short term, often menial local employment opportunities reported by communities	**More work needed**: On local employment and business but initiatives are being put in place to improve these outcomes	**More work needed**: To focus on local employment. This should improve with new longer term contracts and the Remote Jobs Contracting Policy

*Achievement against Strategy targets

12.3.3 Plumbing repairs

In the past, Kimberley EH workers carried out plumbing repairs, such as leaking taps, blocked drains and pipes in remote Aboriginal communities. In 2010 the WA Plumbers Licensing Board restricted plumbing work to licensed plumbers only,[121] effectively making it illegal for a person who was not a plumber to change a tap washer in their own home or for Aboriginal EH workers to do minor plumbing repairs. Consequently, locally trained Aboriginal EH workers who were not trained as licensed plumbers could no longer carry out these simple household repairs and services. Examples of minor repairs included leaking taps, blocked toilets, blocked and broken drains, cracked or broken pipes and broken fixtures. Although these are minor repairs, if left unattended they will present a genuine risk to the health of the communities and sustainability of quality housing.[66,169,189] As a result of this change to the plumber's regulations, the response times for basic plumbing repairs in remote communities increased significantly by 2011. For example, the community of Bayulu in the Fitzroy Valley, only 20 km by bitumen road from Fitzroy Crossing, waited 8 weeks in 2010 for a plumber to attend to a burst water pipe.[39] A report prepared for the Plumbers Licensing Board in 2011[190] provided evidence that, due to the remoteness of some communities and the cost associated with bringing a plumber to them, in some cases plumbing repairs were taking weeks to months to repair or were not done at all. Jobs were deferred until an emergency occurred or the number of repairs logged made the visit to the remote community cost effective for the maintenance provider.[190] This lack of responsiveness, while it may have made financial sense to the maintenance provider, was causing substantial environmental degradation in communities.

Recent amendments to the *Plumbers Licensing and Plumbing Standards Regulations 2000* (the Plumbing Regulations) which came into effect in December 2016, allowed suitably qualified EH workers, based in or close to remote communities where ready access to a licensed plumber is not available, to undertake a limited range of simple plumbing repairs.[169,189] To be eligible to carry out work under this new scheme, EH workers must hold either a Certificate II in Population Health or a Certificate II in Aboriginal Environmental Health, including three plumbing units.[189]

While this change is welcomed, many Kimberley EH workers now must first complete training before they are deemed competent to carry out plumbing repairs under the scheme – which will take time. The first training commenced in 2016.[189] Communities covered by the scheme include remote Aboriginal communities classified as either 'remote' or 'very remote' on the list of remote communities kept by the Department of Aboriginal Affairs.[191] As the scheme is intended to complement, not replace, the role of the licensed plumber, the scheme can only be used in emergency situations and when a plumber cannot 'reasonably' attend in 'a timely manner.' An 'emergency situation' means a situation where the plumbing work is required to prevent a risk to human health or safety or prevent a significant waste of water. Many Kimberley stakeholders believe that if Aboriginal people in their own communities were trained to carry out more of this work, it would not only build capacity within the community but would also give people an increased sense of worth within the community.

Community members interviewed as part of community consultation highlighted the fact that even when plumbers did arrive in remote communities there was no flexibility in the tasks completed beyond what was on their ticket or list. Maintenance staff could not respond to any additional jobs that were present, if these were not already on their worklist. Members of the community were unanimous in their criticism of the current situation,[169] commenting that the current model of housing maintenance, (a one service contract model) is unsustainable, culturally inappropriate and lacked capacity building.

"That maintenance guy, the FIFO, from Queensland way, he walked right past me, he could see all the water rushing out and all over the garden, he wouldn't help me, he said it wasn't on his ticket and laughed and said he'd be back in few months, it should be our mob who are doing these things not strangers making big bucks out of it!"

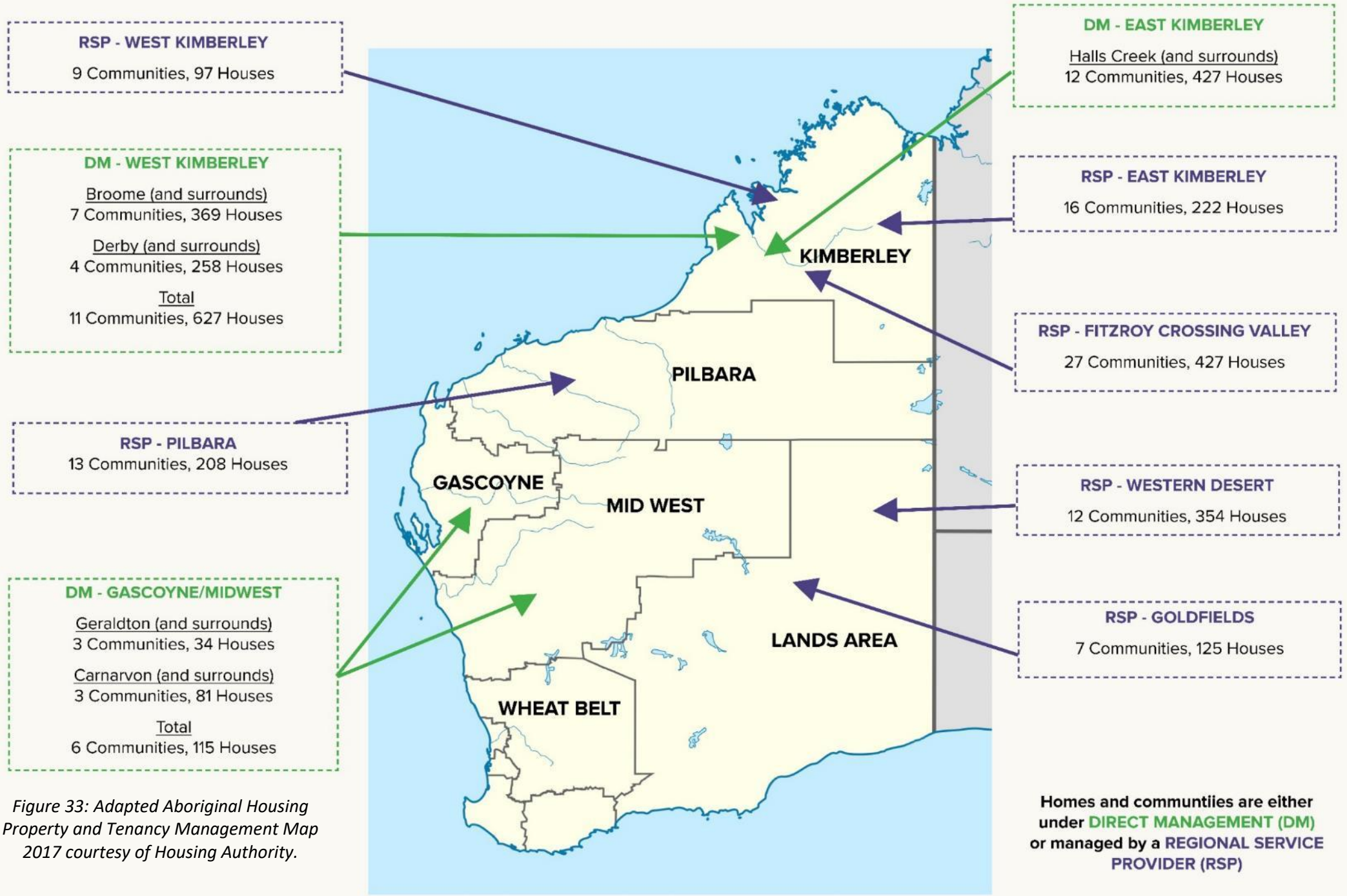


Figure 33: Adapted Aboriginal Housing Property and Tenancy Management Map 2017 courtesy of Housing Authority.

EH workers at Nirrumbuk recently did a survey of houses with leaking taps on the Kimberley. It was estimated that 22,000 litres of water a day was running through the overflowing sewerage pipes (Figure 34).

> *"We did the maths. We had a tap leaking outside a house. We measured the amount per minute and times it to an hour, 600 litres an hour, talk about a breeding ground for mosquitos, not to mention wasting water, a precious resource up here. All these things impact on environmental health. A leaking tap is not just a drain on the water supply and potable water going down the drain, it's all the expensive chemicals you need to treat the water, electricity needed to run the system."*

> *"The current system is just not responsive enough, and assets are being left too long in this state so eventually you can't even repair and you need to replace. Only when there is a diabolical breakdown will things get done, instead of putting funding into prevention so these disaster situations don't keep occurring."*

Figure 34: Before and after pictures of blocked sink. Courtesy of Nirrumbuk Healthy Housing hardware.

12.3.4 Water testing

Clean water is important for maintaining skin health. Handwashing with soap has been shown to reduce skin infections in situations of poverty elsewhere in the world.[158,192] Despite this, access to clean water that has been regularly tested on a monthly cycle to confirm meeting potability standards is uncommon in the Kimberley. Of the 173 communities in the Kimberley not connected to town water and analysed in the 2008 EHNS, half (52%) of these communities (equating to 11% of the Kimberley population) were living without regular monthly testing. This was worse in Wyndham-East Kimberley, where two thirds of communities in the region were living without regular monthly testing of water.[47] Most of the population living in communities not connected to town water have water that is treated (89%) and tested (88%) regularly. One third (35%) of all communities and one quarter (25%) of the population recorded unsatisfactory water supplies. The reason for dissatisfaction relate to pressure (41% of communities), supply (35%) and maintenance (32%).[47] Ideally, where water standards are inadequate or supply insufficient, drinking water will be supplied by the Housing Authority in the form of bottled water to each house.[193] This however is dependent on adequate testing and assessments.

Inadequate testing of wastewater systems is creating health risks. Blockages causing overflows are a common problem in communities. Some examples of the health risks relating to water quality include:

- Jarlmadangah Burr in the Kimberley, between Derby and Fitzroy has about 60 permanent residents. Its water supply failed microbiological quality tests for five consecutive months in 2013-2014. The community were concerned about the length of time it took for notification of failed microbiological quality testing to get back to the community. In many cases community members had been drinking the contaminated water for one to two weeks before being alerted to the fail notice.[194]
- Pandanus Park near Derby has unsafe levels of nitrates in the water supply.[195] Excessive nitrates in the diet reduce the blood's ability to carry oxygen. In infants, this can cause the potentially life-threatening Blue Baby Syndrome, where the skin takes on a bluish colour and the child has trouble breathing.[196]
- The Kimberley community of Mowanjum experienced eight sewer system overflows in 11 months in 2014 and 2015.[194]

12.3.5 Electricity

The 2008 EHNS found that three quarters (77%) of communities and one third of the population (31%) are not connected to a town electricity supply. Of these communities with no connection to a town electricity supply, the majority (74%) experienced regular power supply interruptions. The key reasons were equipment breakdown (59%), lack of fuel (45%), equipment damage (13%) and no maintenance (10%). Interruptions occur either daily (31%), weekly (15%) or monthly (20%).[47] Of the communities that report unsatisfactory power supply, most (66%) have a community generator as their power supply or a solar hybrid system (15%). Kalumburu (Wyndham-East Kimberley) and Balgo (Halls Creek) are the highest priorities (among communities with a usual population ≥100) with respect to electricity source and interruption of electricity.[47]

12.3.6 Sanitation and sewerage

Communities receive managed sewerage services from either the town sewerage system or the Remote Area Essential Services Program. Within the boundaries of a house, sewerage and sanitation issues are the responsibility of the occupants. Outside the boundaries of a house these issues fall to the responsibility of the Kimberley Regional Service Provider's.

In the 2008 EHNS, nearly all communities (97%) had an adequate sewerage treatment/disposal system. However, of those using septic tanks/leach drains to dispose of sewage, two thirds (66% or 101 communities) reported not having access to appropriate pump-out equipment. Of the communities using sewage lagoons, just over one quarter (29%, 18 out of 63 communities) reported having inadequate fencing. One in ten (8%) communities report their sewage lagoons have either excessive or high overflow. This overflow affects 5% of the usual population of Aboriginal people. When asked their satisfaction with the maintenance of their sewage lagoon, just over one quarter (28%) of communities recorded it to be unsatisfactory. Around one third (31%) of communities indicated that their current sewerage system did not meet their needs.[47]

12.3.7 Solid waste disposal

In the 2008 EHNS nearly all communities (96%) reported using an appropriate rubbish tip, which is a dug trench, dug pit, town tip or another community tip. However, the report indicated mixed results for community tips: only 36% of them were fenced but the majority (64%) had a capacity of 12 months or more and most communities (77%) were satisfied with the management of their tips.[47] Rubbish collection was not always reliable with one third (33%, 75 communities) of communities experiencing a time, during the 12 months prior to the survey, where their rubbish had not been collected.

12.3.8 Dust suppression

Across all Aboriginal communities surveyed in WA in the 2008 EHNS, two in five communities reported they usually experience excessive (12%) or high levels (32%) of dust. This affects a total of 6,776 people (45% of the recorded population).[47] There was considerable variation in dust levels even for neighbouring communities, which would indicate that the survey question may not be able to consistently capture dust levels in Aboriginal communities. Three in five communities (63%) report they do not have dust suppression or revegetation programs and three quarters of communities (77%) report they have unsealed roads within their community.

12.3.9 Dog control programs

For many years, dogs have played an important part in the life of remote Aboriginal communities, as pets and hunting dogs, but recently the increased numbers, especially those with mange and worms, have affected the health of animals and humans.[197] In many Aboriginal communities there are quite a few 'community dogs' that are in contact with anyone or everyone, but are not individually cared for. These dogs can turn feral and pose a risk to children from bites and spread of disease. Dog control programs are of huge value to increase the health of animals and have also been proposed in the control of skin infections.

12.3.10 Emergency management

In the 2008 EHNS of the Kimberley communities that are prone to bushfires, 84% record not having firefighting equipment that works, affecting a total population of 7,714 people (66%). Of the communities that are prone to cyclones, two in five (40%) recorded not having an evacuation plan for cyclones, affecting a total population of 2,163 people (43%). One in eight (14%) communities reported being trained in emergency procedures (e.g.

firefighting). Two in five communities (38%) reported community preparation for emergency management being unsatisfactory, affecting a total population of 7,031 people (49%).[47]

12.4 The Healthy Community Assessment Tool

Recognising the described challenges with EH and housing needs, a new tool to support a systems approach to improve social determinants of health in rural and remote Australian communities has recently been developed for use. The Healthy Communities Assessment Tool (HCAT) was developed through Menzies School of Health Research[198] to assess whether a community had the infrastructure and programs considered important to promote and support good health and prevent chronic diseases. The HCAT aims to cover a broad range of important issues relevant to a community environment that supports achieving and maintaining good health.

The HCAT assessment covers issues such as water supply, air quality, solid waste disposal, electricity supply systems, healthy housing, community vibrancy and pride, community safety, sewerage systems, public toilets, community drainage, roads and footpaths, pest control, animal management, food supply, and promotion of physical activity. HCAT can be used as a continuous quality improvement program but is yet to be formally implemented in any environmental needs survey across the Kimberley.

12.5 Complexities in responsibilities, funding and management

Inequalities in health are not mainly attributable to failings in health service delivery but rather to many other social inequalities arising from colonialism influencing health including income, education, housing, diet, employment and conditions of work. In response to the identification of these social inequalities, the Black Report (1982)[199] recommended a wide array of social policy measures to combat inequalities in health that are particularly relevant to housing in the Kimberley.

Aboriginal people living in many Kimberley communities do not have the essential infrastructure and services required to support healthy living conditions and healthy lifestyle options. This has been compounded by successive government policies to fund and introduce single interventions programs which fail to address the complex mix of social, cultural, political and economic factors that underlie poor health and the social problems present in these communities.[41] Removal of funding from programs that were working well in the Kimberley, for example the demise of the Community Development Employment Program (CDEP), has further compounded this issue. There is no 'magic bullet' - which is why narrowly focused policies (such as providing new housing infrastructure but failing to address timely ongoing maintenance and repair, for example) do not deliver improvements in health. A more holistic approach is needed.[200]

Real opportunities to improve the health of remote-living Aboriginal people are contingent on improving the social determinants of health. A key challenge is that the responsibility for taking action to address these determinants is spread across a range of different government departments and agencies. A true solution to the complexity of issues underlying poor health will require coordination across multiple sectors. In addition, the drivers that influence improvements in social inequality operate on a number of levels of government and encompass operational, funding and policy issues. Underlying drivers in this area include, but are not limited to, changing political agendas and short political cycles, shifting policy priorities and vertical program models of funding. All these drivers provide obstacles to taking a more strategic approach to improving the social determinants of health in remote Aboriginal communities.

12.5.1 Rental Relief Policy and the effect on overcrowding

The Housing Authority's policy of rental relief is a system whereby families gain financially through rent reduction by putting up (temporarily accommodating) other family members. This policy can have untoward effects and result in poor health outcomes. When houses in remote communities need to be knocked down and rebuilt, the Housing Authority offers alternative accommodation somewhere in the community, be this a temporary site like a public building or in another family's home. Overcrowding caused by policies such as this has created scenarios where up to 30 people are living in one house.

Achieving scabies and skin control is a long term goal requiring community empowerment and attention to environmental determinants – difficult to achieve when policies such as the one described above lead to increases in overcrowding.[201] An example of this occurred in the Fitzroy Crossing Woolshed in 2013.[202] Figure 35 demonstrates

photos taken in the Fitzroy area in 2013 during the ARF outbreak. Up to 40 people were relocated to this woolshed while new housing was being built in their communities. However, as can be seen from the photos, basic EH issues in this temporary accommodation had not been dealt with prior to these families moving in. There was no air conditioning in this shed, rain could enter the building between the roof and the walls, and stagnant dirty water was pooling around the area. PHC providers noticed a huge increase in skin sores in the people inhabiting the woolshed and subsequently several of the children living in this woolshed went on to develop ARF. The knock-on effects of this rental relief policy may have saved money in one area but the blow out in costs (financial, health, wellbeing, quality of life) were incurred later in another area. Providing these children with medical care due to ARF, negates any savings through rental relief. Treating people and then returning them to housing conditions such as these, is an example of a band aid solution which continues to exacerbate health inequities.[202]

Figure 35: Woolshed Pictures. Fitzroy Crossing 2013, courtesy of Gail Freeman.

13 Conclusions

This situational analysis of the current Skin Health issues in the Kimberley in 2017 arises from desktop review, interviews, community consultation for the SToP Trial, focus groups and surveys of staff involved in delivering health and environmental health for the Kimberley. We are grateful for the input of all involved and hope this work reflects both the incredible resilience and hard work of community members and those providing services, as well as the challenges. It also reflects the vision and leadership in the Kimberley to acknowledge the burden and consider ways forward.

From a clinical perspective, recognition and treatment of skin infections are a key activity of the SToP Trial.

Health promotion is a well-established program in the Kimberley which benefits from the coordinated approach from service providers through the KAHPF.

Environmental Health challenges have been outlined including household overcrowding, maintenance of healthy homes, infrastructure, water delivery and quality and more. The strength in the Kimberley is the ability for environmental health to be viewed as a key part of delivering health care to communities and the hard work of the environmental health subcommittee to overcome challenges.

The social determinants of health, whilst affecting health outcomes, are much broader than just the health domain. Until we see the elimination of social determinants affecting health outcomes, it is unlikely that we will see the same health outcomes for Aboriginal Australians, particularly those living in the remote Kimberley, as those enjoyed by non-Aboriginal Australians who predominantly live in the metropolitan south-east of the country.

All of these aspects are needed to achieve healthy skin for all remote living Aboriginal children and to achieve elimination of scabies and skin sores as public health challenges in the Kimberley and throughout Australia. Until that day, we will continue to work together to deliver improvements in clinical care and prevention of skin infections.

The children of the Kimberley are our future. Healthy skin is one aspect of overall good health that will see them thrive and lead our communities forward.

14 Appendix 1: Survey respondent roles and organisations

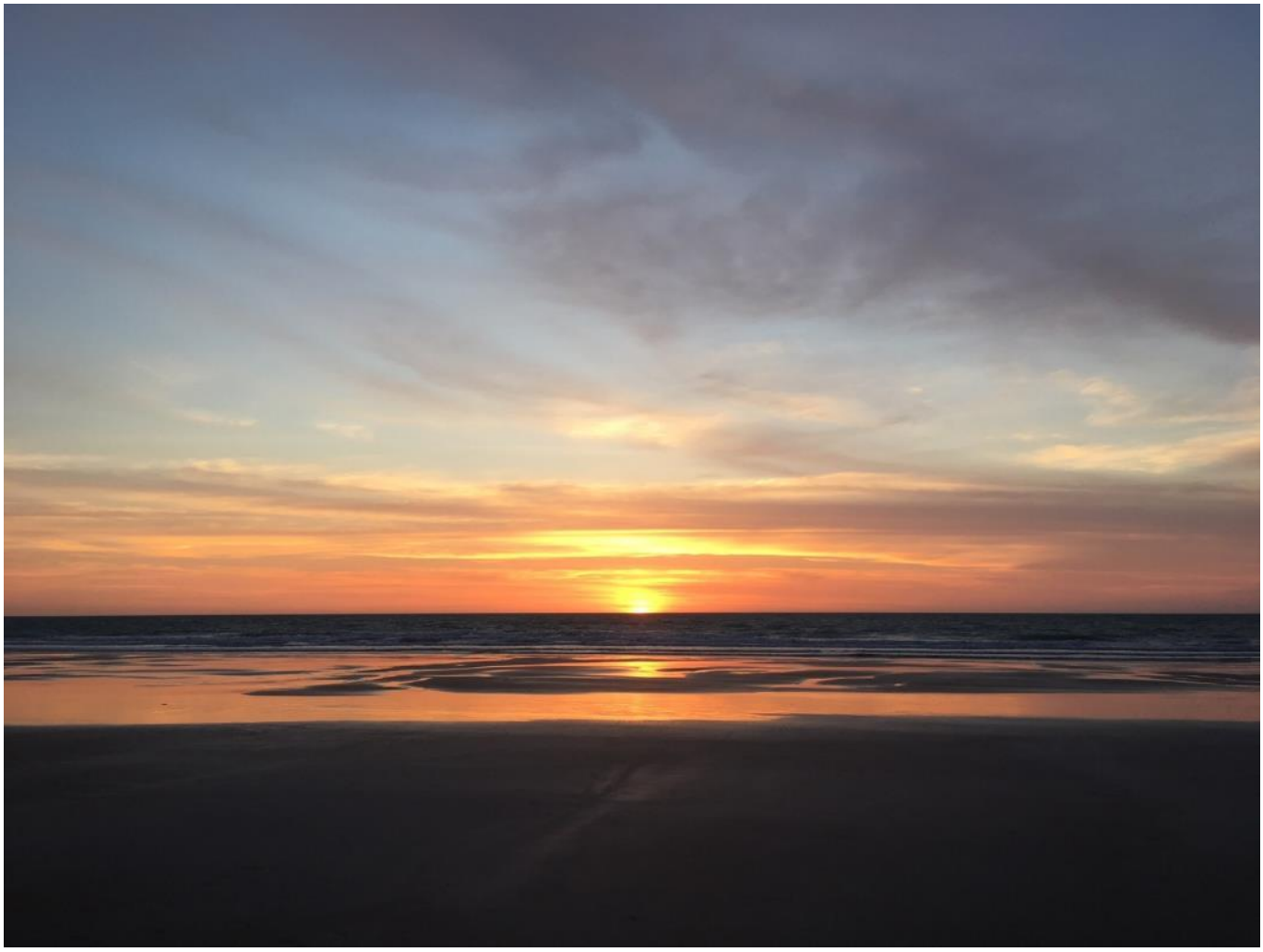
Eighty-seven respondents completed the online survey predominantly from the public hospital or government funded health system. Table 8 demonstrates that respondents came from a variety of organisations within the Kimberley, with larger numbers employed through WACHS-K as the largest health care provider in the Kimberley. Most respondents worked for organisations that specialise in the delivery of clinical or medical services although representatives from environmental health and HP organisations also completed the survey. Fifteen did not note their employing organisation.

Table 9: Survey respondents employing organisation.

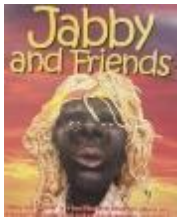
KAMS	KRS	BRAMS	DAHS	YYMS	KPHU	WACHS-K General	WACHS-K Hospitals	EH Directorate
11	3	3	2	2	14	23	13	1

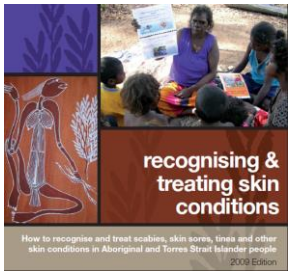
Of 42 face to face interviews carried out: 19 (45%) were with WACHS-K employees, 16 (38%) were with KAMS employees, 5 (12%) were with EH service providers, one (2%) was from Kimberley Pharmacy Services and one (2%) was from the RFDS.

A range of Kimberley based communities and geographical areas were covered by the respondents employing organisation. Some organisations (e.g. KPHU) have a regional presence. It is important to note that many Kimberley Aboriginal communities are known by several names such as the Kutjungka region is often known as the Tjurabalan Region or One Arm Point is also called Ardyaloon. This caused some confusion with some respondents listing alternative names to those used in the questionnaire.



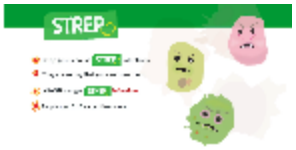
15 Appendix 2: Existing health Promotion resources

Year and image	Resource Type	Title and Year	Organisation	Details
	DVD	*Jabby and Friends,*[203] 2006	Desert Pictures and Big Mama Productions for Kimberley Public Health Unit	*Jabby and Friends* is a DVD which entertains and informs Aboriginal Kids and parents in Northern and Remote Australia about health issues and healthy lifestyle choices. '*Under your Skin'* combines a short story with songs to inform about scabies.
	Flipchart	*Healthy skin story: scabies, skin sores and tinea,*[204] 2007	Menzies School of Health Research	This flipchart provides clear and concise key facts, including pictures, for an understanding of scabies, skin sores and tinea. Information is given on identification, how infections are spread and the control and prevention of an infection.
	Posters/ Resource Package	*No Germs on Me,*[118] 2008	Northern Territory Department of Health and Families	The *No Germs on Me* campaign raised awareness of the importance of handwashing in schools, at home and in the community to prevent the spread of diarrhoeal and respiratory illnesses. The aim of the campaign was to motivate men, women and children to regularly wash their hands with soap after going to the toilet, after changing babies' nappies and before touching food.
	Children's Book	*Billy and the magical Boab tree: a fight with a nasty mite,*[205] 2009	University of Western Australia	Produced by Courtney Hodder with support by WoundsWest, this project aimed to develop a book for children throughout the Kimberley in an effort to reduce the prevalence and incidence of scabies among Indigenous and non-Indigenous children.

Year and image	Resource Type	Title and Year	Organisation	Details
	Flipchart	*Recognising and treating skin conditions*,[206] 2009	Menzies School of Health Research	This flip chart was developed to assist AHWs, health practitioners, and community workers with the recognition and treatment of scabies, skin sores, tinea, and other skin conditions in Aboriginal and Torres Strait Islander people. The development of the flipchart was a collaborative effort between Aboriginal communities, Menzies School of Health Research, the Cooperative Research Centre for Aboriginal Health (now the Lowitja Institute), and several other key organisations.
	Manual	*Environmental health practitioner manual: a resource manual for environmental health practitioners working with Aboriginal and Torres Strait Islander communities,*[207] *2010*	Environmental Health Standing Committee (enHealth)	This manual is a field reference for environmental health practitioners working with Aboriginal communities in remote areas. It is the second version of the 1991 *Environmental Health for Aboriginal communities* manual.
	Brochures	Mabu Buru Environmental Health Yarning Brochures, 2012	Environmental Health, Kimberley Public Health Unit	Produced by an Environmental HP officer at KPHU, the three brochures were themed around Healthy Homes, Personal Hygiene and Dog Health.[118]
	Guidelines	*Acute post streptococcal glomerulonephritis; Kimberley control measures*,[107] 2014	KPHU	This guideline aims to provide a framework for the public health response to outbreaks of APSGN in the Kimberley region of WA. Produced in response to 2013/2014 Kimberley APSGN outbreak.

Year and image	Resource Type	Title and Year	Organisation	Details
	Flyers/Posters	Derby Shire 'in-house' skin infection resources, 2014	Shire of Derby/West Kimberley	Available on request from Derby Shire Environmental Health Team.
	Concept Paper	*Kimberley Regional Skin Health Partnership*,[54] 2015	Kimberley Aboriginal Health Planning Form	This concept paper presents the philosophy of a regional partnership to improve the overall health of Aboriginal people in the Kimberley by a concerted focus to promote the health of their skin, particularly to remedy the poor skin of Aboriginal children.
	Report	*What caused the APSGN outbreak in the Kimberley in 2014? Public Health 'look back' and recommendations*,[66] 2015	Kimberley Population Health Unit	Researched and written by Dr Rushanthi Pereira on behalf of KPHU, this retrospective review assessed the causes behind the Kimberley outbreak, evaluated the processes applied for management and provided evidence-based recommendations should a similar outbreak occur in the region once more.
	Poster	*When to go to the Clinic; symptoms of APSGN*,[208] 2015	Kimberley Aboriginal Medical Service	Following the APSGN outbreak in the Kimberley materials were developed by KAMS with the aim of increasing health seeking behaviour for APSGN symptoms. This poster outlined the key symptoms present in children with the primary recommendation of attending the clinic/hospital as soon as possible.

Year and image	Resource Type	Title and Year	Organisation	Details
	Flipchart	*Acute Rheumatic Fever Patient Teaching Tool*,[209] 2015	Kimberley Aboriginal Medical Service	This A3 flipchart with culturally appropriate visual aids was predominately designed for patients with a new ARF diagnosis, providing education on causes, treatment and methods of preventing future infection. most
	Poster	*Look Out for Strep Infection Poster,*[210] 2016	Kimberley Aboriginal Medical Service	Designed for presentation in shared environments (i.e. the local clinic), this poster provides information on the signs and symptoms of Strep A, ARF and RHD, management of each condition and ways to prevent disease while detecting any illness early.
	Brochure	*Strep Acute Rhematic Fever Rheumatic heart disease Brochure*,[211] 2016	Kimberley Aboriginal Medical Service	This brochure uses the same messaging and images as the Strep A, ARF and RHD poster described above, but presented as a smaller medium for distribution among community members.
	Referral Form	*General Environmental Health Referral Form for Kimberley*,[119] 2017	Kimberley Aboriginal Health Planning Forum Environmental Health Subcommittee	General Updated Environmental Health Referral Form to be used by all Environmental Health Service Providers in the Kimberley who prior to this used different service specific form. The exception to this is NCHS who have an existing specific Referral Form that must be used by agencies within the Fitzroy Valley Health Services area.
	Report	*Increasing referrals to Environmental services in the Kimberley: current position and strategies for change,*[57] 2017	Kimberley Aboriginal Health Planning Forum Environmental Health Subcommittee	This report provided an understanding of the baseline use of Environmental Health referrals between primary health care clinics and the local Environmental Health Service with aim of increasing referral rates. It also identified areas of improvement, specifically awareness of the form, which were able to be addressed prior to the rollout of the new form in 2017.

Year and image	Resource Type	Title and Year	Organisation	Details
	Video	*Strep Infection*,[212] 2017	Kimberley Aboriginal Medical Service	Building on the resources developed previously by KAMS,[210,211] this two minute video describes Strep A, ARF and RHD infection, disease progression, prevention and management.
	Clinical guidelines	*National Healthy Skin Guideline,*[9] 2018	The Australian Healthy Skin Consortium	Driven by Telethon Kids Institute, Menzies School of Health Research and Hot North, the Guidelines emphasise impetigo, scabies, crusted scabies and tinea as priority conditions needing guidelines for prevention, treatment and public health control. The primary audience is health professionals including medical, nursing, allied health and Aboriginal healthcare providers.
	Clinical protocol	*Skin Infections in Children,*[100] 2020	Kimberley Aboriginal Medical Services Council and WA Country Health Service	This document outlines how to recognise and treat ringworm, tinea versicolor, impetigo and scabies in Aboriginal and Torres Strait Islander children. The resource provides guidelines on the diagnosis, treatment and management of these skin conditions. This version replaces those first crated in 2008 and updated in 2014.

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