Government of **Western Australia**
Department of **Health**

Review of the Western Australian Aboriginal Environmental Health Program

Final Report

March 2022

Disclaimer

All information and data included in this report provided by the Western Australian Department of Health (WA Health) and relevant stakeholders was presented to the Review Team as being accurate and reliable.

The use of the term Aboriginal is used in place of Aboriginal and Torres Strait Islander, in recognition that Aboriginal people are the original inhabitants of Western Australia. No disrespect is intended to our Torres Strait Islander colleagues and community.

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Appreciation is also extended to members of the Project Steering Committee, convened by the WA Health, for their input and assistance with the review process and this report.

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'The greatest improvement in environmental health conditions, particularly in remote communities must be treated as the single highest priority for Government programs. Some of the most basic improvements that we can make in Aboriginal health are through improvements in environmental health programs.'[1]

Kununurra WA, 20 July 2021

[1] Western Australian Government Task Force on Aboriginal Social Justice, Western Australian Government, Perth. 1994

List of Abbreviations

Abbreviation	Term
ACCHS	Aboriginal Community Controlled Health Service
ACCO	Aboriginal Community Controlled Organisation
AEH	Aboriginal Environmental Health
AEHW	Aboriginal Environmental Health Worker
AHCWA	Aboriginal Health Council of Western Australia
AHWF	Aboriginal Health and Wellbeing Framework
ALT	Aboriginal Lands Trust
AMS	Aboriginal Medical Services
ARF	Acute Rheumatic Fever
ATSIC	Aboriginal and Torres Strait Islander Commission
CEHAP	Community Environmental Health Action Plan
CDP	Community Development Program
COAG	Council of Australian Governments
EAF	Environmental Attributable Fraction
EHD	Environmental Health Directorate
enHealth	Environmental Health Standing Committee
ERPATSIEH	Expert Reference Panel on Aboriginal and Torres Strait Islander Environmental Health
KEAF	Kimberley Environmental Attributable Fraction
LGA	Local Government Authority
MVEV	Murray Valley encephalitis virus
NACCHO	National Aboriginal Community Controlled Health Organisation
NAHS	National Aboriginal and Torres Strait Islander Health Strategy
NEHS	National Environmental Health Strategy
NSFATSIH	National Strategic Framework for Aboriginal and Torres Strait Islander Health 2003 – 2013
NSW	New South Wales
NT	Northern Territory
PHC	Primary Health Care
Qld	Queensland
REMS	Remote Essential and Municipal Services
RHD	Rheumatic Heart Disease
RR	Rate Ratio
TKI	Telethon Kids Institute
UWA	The University of Western Australia
WA	Western Australia
WACHS	WA Country Health Services
WA Health	Western Australian Department of Health
WHO	World Health Organization

Glossary of Terms

Please refer to Appendix 1.

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EXECUTIVE SUMMARY

1. BACKGROUND

The need to address the social, cultural and environmental determinants of Aboriginal health to improve health and wellbeing is undisputed. The built environment (including housing, roads, water and air quality) is specifically recognised as having a major impact on the poor health statistics on segments of the Aboriginal population of Western Australia (WA). Given the diverse components of the built environment, many government sectors, agencies and funding streams outside of the WA Department of Health (hereafter referred to as WA Health) are responsible for providing services that impact this area. In addition, the withdrawal of the Commonwealth in 2015 from the provision of essential services in remote Aboriginal communities has significantly impacted state capacity to meet the needs of these communities and exacerbated the impact of poor environmental health.

1.1 Primary Objectives

To undertake an independent review of the WA Aboriginal Environmental Health (AEH) Program, funded by WA Health to enhance the effectiveness and sustainability of the Department's delivery of environmental health services to Aboriginal communities in the State. This Review has been guided by WA Health's Aboriginal Health and Wellbeing Framework 2015–2030 (AHWF) and Outcomes Framework for Aboriginal Health 2020-2030 across all elements of the evaluation (data collection, analysis and reporting of findings). The scope of the initial Response to Request for Quote for the AEH Program Review is included in Appendix 2.

1.2 Review Structure

The Review is presented in two sections:

1. A Main Report, including case studies and recommendations.
2. An Options Paper that draws from the recommendations in the Main Report.

This Report also includes the results of a 'pilot' project (Appendix 3) undertaken in collaboration with the Aboriginal Health Council of WA (AHCWA) (extending previous work undertaken by the WA Environmental Health Directorate (EHD) with some Aboriginal Medical Services (AMS)) to describe processes for extracting and analysing primary health care (PHC) data to examine environment-attributable health conditions treated in PHC settings. This pilot report will also be provided to AHCWA as a stand-alone document in alignment with data sovereignty principles.

Case studies on selected topics are incorporated into the Main Report as examples to synthesise the findings from the array of quantitative and qualitative data sources interrogated for the Review. Recommendations arising from the Review findings regarding WA Health's future delivery of the AEH Program are provided at the end of the Executive Summary and form the basis for the Options Paper. The Options Paper is provided to synthesise the Review results and recommendations and offer an initial starting point to guide co-designed future AEH Program reform and service delivery.

The Main Report outlines the methods used and findings from the following data sources:

- Literature review of peer-reviewed research, practice examples and policy in the field of AEH;
- WA population-level epidemiological data;
- PHC data;
- AEH Program service provider activity data;
- Costs of the AEH Program and environment-related health service provision;
- Stakeholder and community survey data; and
- Consultations with AEH Program service providers, stakeholders and community members.

While this report relates to the Review of the WA AEH Program, the remit of which is detailed in Section 2.5 of the Main Report, elements of the findings from the i) stakeholder and community survey data, and ii) consultations with service providers, stakeholders and community members also include data related to broader issues impacting AEH outcomes outside of the AEH Program's current jurisdiction. Such findings may reflect participants' varied understanding of the AEH Program.

Information on these broader issues AEH from survey and consultation findings has been included to provide additional contextual information regarding the many factors related to environmental health and the built environment, which are outside the remit (or control) of the AEH Program but have implications for its operation and ultimate success. Therefore, it is important to present findings on the macro-environmental health context within which the AEH Program operates to make appropriate recommendations as part of the Review. This also affords the opportunity to consider broader AEH issues impacting WA Aboriginal communities that are not formally auspiced under the AEH Program to determine any additional unmet needs to make appropriate recommendations related to future resourcing for addressing AEH in WA.

1.3 Review Methodology

This Review draws together information and recommendations on integrating approaches to transform WA Health policy and programs, as advocated through the National Agreement on Closing the Gap, Priority Reforms. Specific attention is paid to improving AEH, which has recently been embedded into the Closing the Gap reporting requirements.

This Review embeds Aboriginal leadership across all phases through the membership of the Steering Committee, the AHCWA and the Review Team. The subsequent depth of data from Aboriginal stakeholders, community members and service providers demonstrates the engagement of Aboriginal leaders and communities across WA who supported the need for the Review through their active participation. The Aboriginal project leadership was complemented by a multi-component mixed-methods approach, including policy analysis, epidemiology, and social sciences. The specific methodologies used for each of these aspects are included in the body of the Main Report.

2. KEY FINDINGS

Brief overview

The Review found extensive evidence demonstrating a strong need for the continuation of the AEH Program and recognition of the value of the Program to WA communities. While areas for improvement were identified, specifically related to processes for procurement of service providers, the need for greater levels of co-design in Program activities, and improved data collection for routine evaluation, there was widespread recognition that maintaining and optimising the AEH Program is vital for improving Aboriginal health and wellbeing in WA. As a result, ongoing procurement for this Program needs to be assured by WA Health.

In addition, extensive evidence highlighted the need for additional *new* financial resourcing to address needs currently outside the remit of the AEH Program. Many examples of good practice in the current AEH Program were identified. However, the findings suggest the need for co-designed system reform to meet the environmental health needs of the communities served. In particular, given the diverse government sectors, agencies and funding streams responsible for providing environmental health services in WA, there needs to be more formalised and targeted inter-sectoral strategy and communication, greater transparency, improved executive level engagement with the Aboriginal community-controlled sector, and greater high-level system-wide advocacy. The system-strengthening policy drivers outlined in the AHWF and the National Agreement on Closing the Gap confirm the mandate for putting in place recommendations from the AEH Program Review incorporating co-design principles.

2.1 Policy and Research Literature

- The national and international academic literature regarding environmental health generally employs a narrow conception of health, failing to consider First Nations peoples' connection to land, sea, culture, spirituality, family, and community. In particular, limited published research in the area of AEH was identified specific to WA.
- Reviewed publications describe a variety of environmental inequalities based on differences in exposure to environmental risks, access to amenities and associated health burden.
- Innovative community-led AEH interventions are making inroads but have not been implemented broadly.
- The impact of the built and natural environment on Aboriginal health and wellbeing is well documented. Consequently, policies increasingly emphasise the need to improve health system deliverables in relation to environmental health as it applies to the built environment and climate change.

2.2 Epidemiological Data from Routine Health Data Collections

- Age-standardised rates of environment-attributable hospital admissions were substantially higher for Aboriginal than non-Aboriginal Western Australians across all regions in the State, including the metropolitan area, irrespective of the method of environmental attribution used. The World Health Organization (WHO) method identified 3,215 environmental-attributable admissions in 2019 among Aboriginal patients, translating to 12,488 bed days and $22.82 million in hospital costs to the WA health system. The Kimberley Environmental Attributable Fraction (KEAF) method yielded substantially (up to three-times) higher environment-attributable admissions, bed days, and costs than the WHO method in regions where this could be applied (Kimberley, Pilbara, Mid West and Goldfields), mainly due to the WHO method not including important conditions relevant to AEH in the State (e.g. skin infections). This under-ascertainment of the hospital burden and costs attributable to the environment using WHO estimates suggests a lack of suitability of this method for application to WA regions.
- In 2020, 393 communicable disease notifications involving Aboriginal Western Australians were estimated as attributable to the environment, with the Kimberley, Perth Metropolitan and Goldfields regions the largest contributors.
- The WA Rheumatic Heart Disease (RHD) Register recorded 1,044 Aboriginal people with a history of acute rheumatic fever and/or RHD, with 41% under 25 years of age and 57% living in the Kimberley region. The prevalence of RHD is 60-times higher in Aboriginal people under 55 years than other Australians of similar age.

2.3 Primary Health Care (PHC) 'Pilot'

- Using KEAFs, almost 25,000 clinical items were recorded over 12 months in six participating PHC services for conditions deemed ≥80% attributable to the environment. Approximately 4 in 10 clinical items were for treatment of young people (0–24 years). Unintentional injuries were the highest-ranking environmental-attributable conditions for which Aboriginal patients attended participating Kimberley-based PHC services. Skin infections ranked highly in all PHC services across all ages (highest for 1–14 years).
- While PHC data extraction is highly feasible, with the health information workforce motivated and competent to undertake data extraction, further robust mapping between different health information software and clinical items is required to ensure reliable estimates and comparisons for routine reporting of PHC as part of future evaluation of AEH in WA.

2.4 Service Provider Activity Data

- Community Environmental Health Action Plans (CEHAPs) or AEH Program activity data were available for 180 communities (77.8% permanent, 65.6% remote, 46.1% Aboriginal Land Trust (ALT) holdings).
- Excluding travel, the most common AEH activity types related to housing and solid waste removal in all regions, particularly in the Mid West (50% of all activity). Animal management was common in the Kimberley and Pilbara. Other than the Kimberley, demands during the COVID-19 response saw many AEH providers distributing resources to communities in addition to providing AEH services.
- Health promotion was a greater focus of AEH services in the Kimberley and Pilbara (19% and 14% of tasks, respectively) than other regions (Goldfields 5%, Mid West 2%). Pest control was highest in the Mid West and Pilbara (16% and 14%, respectively) compared with the Goldfields and Kimberley (5% and 3%).
- Services were regularly provided by more than one agency (most commonly by Local Government Authorities (LGAs) and Aboriginal Community Controlled Organisations (ACCOs)); often involving the same activity or being the result of collaborative projects within the region.

2.5 Program Costs

- The reliability of AEH Program service cost data was difficult to assess and should be interpreted with caution. This is in part due to activities outside the remit of the AEH Program being commonly reported by service providers and no systematic process in place to differentiate these activities and costs.
- Costs for service provider contracts and grants funded through the AEH Program totalled $7,697,409, accounting for 95% of total Program costs ($8,108,254) for the 2020/2021 financial year. The remaining 5% of costs comprised EHD staffing to support 2.5 FTE to run the Program.
- There were differences across service provider types in the number of contracted hours, number of reported hours, and FTE employed in the activity and costing data provided to the EHD. Of the total contract funds in the 2020/2021 financial year, 44.9% were allocated to ACCOs, 40% to Aboriginal Community Controlled Health Services (ACCHS) and 15.1% to LGAs.
- The proportion of reported hours across all service providers in 2019/2020 was 61% of the total number of AEH Program contracted hours. The percentage of contracted hours provided was similar for ACCO (73%) and LGA (79%) providers but lower for ACCHS providers (37%). Similar differences between provider types were observed in 2020/2021.

2.6 Survey Data – Service Providers

- All service providers, representing the 19 contracted organisations, reported regularly working with other services, most commonly Housing and AMS, with 1 in 5 respondents reporting that they worked with AMS and local clinics.
- Of the 26 service provider respondents, 21 (81%) reported facing barriers in operationalising services for AEH, including workforce issues, lack of training and inadequate resourcing.
- Twenty-five (96%) respondents reported being aware of CEHAPs (with 19 (73%) indicating they had developed a CEHAP). A total of 69% of respondents reported that CEHAPs were somewhat to very effective (n=9 ‘effective or very effective’, n=9 ‘somewhat effective’).
- Six in 10 service providers reported that they currently provide AEH services not funded by the AEH Program, with the most commonly reported activities being routine basic plumbing, electrical maintenance, rubbish removal, yard and house clean-ups, advocacy, and joint work with other agencies (e.g. environmental health safety and education campaigns).

- Some of the activities were reported as being in response to needs or gaps in the provision of services from other agencies and therefore exceeding the remit of the AEH Program (e.g. electrical), while other services are incorporated into AEH Program contracts, potentially indicating different in levels of understanding with respect to contract responsibilities across service providers.

2.7 Survey Data – Stakeholders

- The 45 (13 Aboriginal) respondents comprised senior and frontline staff, with stakeholders predominantly from the community-controlled and government sectors.
- Almost two-thirds (n=29) of respondents reported not knowing or being unsure about CEHAPs in their community. However, those reporting an awareness of CEHAPs indicated they had a good relationship with their environmental health providers and communities.
- Around half (51%) of stakeholders reported a perception that, overall, the AEH services of which they were aware in their community were somewhat effective, with 32% expressing the view that available services were not effective.
- Consistent with service provider survey responses, stakeholders highlighted a range of internal and external factors that they perceive impact the effectiveness of environmental health service delivery in their regions, including a lack of resources, lack of training, inadequate funding and workforce issues. However, the degree to which all stakeholders understand relevant Program details is uncertain.

2.8 Consultations with Community Members, AEH Service Providers and Stakeholders

Specific areas of AEH Program responsibility

- Most stakeholders and community members viewed the AEH Program as holistic and aspiring to be culturally embedded. While there was some criticism and a perceived lack of clarity within the community about the program offered by service providers, the AEH Program is also highly valued by a wide range of participants across the regions.
- In most communities, aside from the CEO and Chairperson, approximately 50% of community members and most of the stakeholders consulted, including local clinics, reported not knowing or being unsure about CEHAP.
- All participants emphasised the importance of health promotion and education, with some providers reporting a belief that there was insufficient funding to engage effectively with communities for health promotion.

Issues arising outside of the AEH Program jurisdiction

- The use of PHC and other referral processes, while strongly supported, is unevenly applied across regions, with the Kimberley identified as most effective in PHC for AEH referrals.
- Numerous factors outside the AEH Program's remit (or control) affect the ability to improve AEH and related health outcomes, including confusion and lack of clarity about AEH service responsibilities, lack of infrastructure, funding and service deficiencies. Limited services for ALT communities, breakdown of community governance in some locations, and people living in overcrowded and poor quality housing are significant barriers impacting AEH outcomes in WA.
- The complex interrelationships between the cultural and social determinants influencing AEH outcomes have cross-sectoral implications for service delivery.

Systems perspectives

- While many organisations are working collaboratively, a lack of formalised communication channels and inter-agency partnerships was reported to compromise transparent, accountable, efficient and effective Program delivery. In addition, high staff turnover, particularly in non-local agencies, contributes to inconsistent knowledge and lack of performance in maintaining relationships, affecting service providers' ability when preparing CEHAPs to collaborate effectively with stakeholders that have influence and input into the environmental health conditions in communities.
- Several respondents identified the need for Aboriginal leadership to drive the AEH Program in the regions. The need for a stronger commitment to building the Aboriginal community-controlled sector was evident throughout the consultations. It was also echoed in service providers' presentations at AHCWA's 2021 AEH forum, highlighting the need for a stronger emphasis on AEH health promotion and early prevention strategies in communities to reduce infectious and chronic diseases in the PHC sector.
- Training and staff retention and recruitment remain challenges across the health, environmental health and social services sectors, with frustration and burnout reported in the workforce.
- The centrality of local knowledge to ensure culturally safe services was raised; improved cultural competence and responsiveness of non-Aboriginal staff working across all sectors involved with AEH was seen as important by stakeholders and communities.
- Challenges and inconsistencies were perceived to exist in the way in which contracts are allocated and monitored, such as documentation, selecting preferred providers and performance management.
- The importance of relevant health information for monitoring, accountability and funding was raised, including measures of environmental health related outcomes.

2.9 Conclusions

This Review documents the AEH Program evolution from filling gaps in municipal services (e.g. rubbish removal) to a more proactive health promotion and disease prevention approach combined with facilitation and advocacy related to coordination across agencies. Consultations confirmed the complex interrelationships between cultural and social determinants influencing the effectiveness and safety of the built environment for Aboriginal people living in remote WA communities. These have cross-sectoral implications, specifically the multiple and cumulative environmental health risks that impact Aboriginal people living in regional and remote towns and communities. The interdependent nature of many environmental risk factors requires a range of skills and expertise and the resources of key agencies and service providers. The AEH Program provides an integral resource in this network of service providers.

Drawing together the findings from all available data sources, this Review found extensive evidence for continuing the AEH Program to WA communities. Ongoing financial resourcing needs to be assured by WA Health, with additional *new* funding is required to address needs currently outside the remit of the current AEH Program. This new funding should not be drawn from other existing programs within WA Health's Public and Aboriginal Health Division but should represent new investment by WA Health in line with the Enduring Strategies 1 and 3a of the WA Sustainable Health Review.

This Review identified many examples of good practice in the current AEH Program, however the findings suggest the need for a co-designed system and organisational reform to meet the environmental health needs of communities served. The Review findings are synthesised below in terms of a proposed model and corresponding service contract requirements. The recommendations presented in Section 3 are organised according to these categories.

1. Proposed model

This model (outlined in detail in the Options Paper) represents an evidence-informed guide to facilitate future co-designed reform, supporting the Review's findings that a best-practice AEH Program model should be one that:

- Involves robust co-design with the Aboriginal community-controlled sector;
- Identifies and addresses adverse local environmental health risks;
- Integrates across sectors and providers and advocates to address service provision gaps;
- Formally embeds CEHAPs (or an appropriate similar planning tool) using co-design to identify and address placed-based community environmental health needs;
- Embeds the nine Healthy Living Practices and Safe Bathroom and Healthy Homes AEH assessment, as advocated for in the Expert Reference Panel on Aboriginal Environmental Health (ERPATSIEH) Action Plan;
- Embeds clinic referrals to promote AEH assessments as part of the early prevention of infectious and other environment-attributable diseases;
- Ensures tailored, culturally responsive, regionally-based training and workforce development;
- Develops and applies quality outcome indicators and a robust reporting framework to capture service delivery activity based on program logic; and
- Develops and uses program logic to establish an outcomes-based reporting framework for ongoing evaluation and service co-design.

2. Service contract requirements

Service Contracts for AEH activity should be based on the following to ensure effective delivery of the proposed model for AEH presented in the Options Paper:

- Appropriate monitoring of outcomes and outputs using service, PHC and hospital data, as defined in the proposed AEH Program Logic Model (see Options Paper);
- Genuine involvement of Aboriginal people in co-designed service design and delivery within WA Health, according to the WA Closing the Gap jurisdictional plan and commissioning strategy;
- Service design that uses human-centred design principles[2] where service satisfaction is determined through culturally responsive mechanisms for community feedback;
- Strong partnerships and clear lines of communication between the EHD Policy Directorate, WA Health Procurement Teams and the Aboriginal community-controlled sector (as well as Aboriginal peak bodies) that optimise commissioning and contract management processes; and
- Service agreements that allow for culturally responsive activities with accountability by service providers, recognising and supporting Aboriginal people's cultural identity, cultural continuity, connection to country, and right to be self-determining.

[2] Human-centred design principles: Loudon, G. 2021. "Indigenous research methodologies: The role of human-centred design in indigenous research" In: Heritage, Paul, (ed.) Indigenous Research Methods: Partnerships, Engagement and Knowledge Mobilisation. People's Palace Projects, London, UK, pp. 54-70. ISBN 978-1-3999-0787-3

3. RECOMMENDATIONS

Recommendations arising from the Review of the AEH Program are made within the context of:

- Alignment with the AHWF Outcomes Framework for Aboriginal Health 2020-2030, and AHWF Implementation Guide 2015-2030, and Closing the Gap reform priorities to 'promote better health systems', using the framework in Figure 1.
- Embedding the principles of co-design in future Program reform.
- WA Health's request for advice in relation to:
    i. a strategic program logic model and reporting framework (see Options Paper);
    ii. procurement and contract management;
    iii. the EHD in its AEH Program management role; and
    iv. working in partnership with Aboriginal stakeholders to share decision-making and improve environmental health outcomes.

Figure 1: Elements that support system transformation in Aboriginal Environmental Health

Further, the recommendations from the Review are structured in two parts relating to:

Part A. Procurement and contract management (changes at the system level change)
; and
Part B. The AEH Program policy and management.

Overarching recommendations are presented followed by specific recommendations.

Part A: Recommendations related to Procurement and Contract Management

The Review recommendations are not presented on a short-, medium- or long-term timeline. This can only occur after the recommendations have been accepted and considered in terms of resource availability and allocation, access to required data and information, and policy priorities. These recommendations are provided as areas requiring action by WA Health and related agencies, emphasising co-design and engagement with ACCOs and ACCHS. The decisions related to an appropriate timeframe and prioritisation is a matter for WA Health in conjunction with input as part of the recommended co-design process. In addition, input from the Aboriginal Health Policy Directorate, within the Public and Aboriginal Health Division of WA Health, must be considered for all recommendations and in the context of the WA Closing the Gap program, particularly Target 14b (currently being developed).

FINANCE

Recommendation 1. WA Health commits to sustained investment for ongoing funding of the AEH Program, with increased funding to strengthen current Program activities and Aboriginal leadership and address needs outside the remit of the current AEH Program.

1.1. WA Health assures continued funding, procurement and support for the AEH Program with a formal commitment for sustained investment to support the Program.

1.2. WA Health fund additional FTE for dedicated senior Aboriginal personnel within the AEH Program team to provide greater Aboriginal leadership with Program decision-making and delivery.

1.3. WA Health increase funding for the AEH Program, and more broadly the Public and Aboriginal Health Division of WA Health, to strengthen prevention and health promotion in AEH, in alignment with Enduring Strategies 1 and 3a of the Sustainable Health Review[3] and the Climate Health Inquiry[4], comprising:

- a designated budget that enables a greater focus on targeted culturally secure prevention efforts for Aboriginal people as determined through co-design; and
- tender assessments are undertaken at a regional level, with Aboriginal participation.

1.4. Expand funding to additional regions (e.g. South West, Wheatbelt, Great Southern and greater Perth Metropolitan areas), with specific targets (determined through co-design with the Aboriginal community-controlled sector) based on need, population size, service access levels, and nature of environmental health conditions.

1.5. Co-designed AEH Program Service Agreements include contract management processes undertaken by Purchasing and Systems Contracting Unit for governance support and capability development.

[3] (1) Increase and sustain focus and investment in public health, with prevention increasing to at least 5% of total health expenditure by July 2029; (3a) Reduce inequity in health outcomes and access to care, focusing on Aboriginal people and families in line with the WA Aboriginal Health and Wellbeing Framework 2015–2030

[4] Department of Health. Climate Health WA Inquiry Public forums summary report. Perth (WA): Government of Western Australia; https://ww2.health.wa.gov.au/~/media/Corp/Documents/Improving-health/Climate-health/Climate-Health-WA-Inquiry-Final-Report.pdf

LEADERSHIP AND GOVERNANCE

Recommendation 2. Establish a clearer delineation between (i) AEH Program coordination and operations and (ii) AEH service provider contract procurement and management within WA Health, and incorporate greater levels of Aboriginal leadership in identifying areas for essential service procurement.

2.1. Define clear roles and responsibilities through co-design for the WA AEH Program (and related policy teams) and the Purchasing and Systems Contracting Unit in WA Health to commission AEH service providers through contemporary best-practice procurement and contract management activities.

2.2. To leverage cross-sectoral strategic and implementation structures, the WA Health Director-General advocates for a greater focus on whole-of-government approaches to AEH issues with counterparts from other government departments, through the Aboriginal Affairs Coordinating Committee, and other appropriate whole-of-government mechanisms in the context of meeting Priority Reform 2 and the targets in the WA Closing the Gap Jurisdictional Implementation Plan[5].

2.3. Facilitate essential service procurement with community infrastructure providers, including increasing opportunities for ACCOs to deliver co-designed contracted services to their communities by investing in services that support:

- ACCO capacity building in environmental health;
- increased collaboration and partnership between existing ACCOs, supporting opportunities for co-design; and
- increased collaboration and culturally secure partnerships between ACCOs and mainstream community sector organisations, supporting opportunities for co-design.

DATA, EVIDENCE AND RESEARCH

Recommendation 3. As part of the AEH Program, evidence-based models guide all service agreements with appropriate monitoring and evaluation aligned with data sovereignty principles.

3.1 All AEH Program Service Agreements to be based on strategic program logic (see Options Paper), with appropriate monitoring and evaluation of the AEH Program aligned with AHWF outcome measures through a contract reporting framework:

- as per the Sector Support for Sustainable Aboriginal Community Controlled Health Services in WA[6]; and
- aligned with contemporary procurement practices as currently used for the contracting of AHCWA services by WA Health.

[5] WA Closing the Gap Jurisdictional Implementation Plan pp. 11–13 and p. 16.
[6] see Options Paper for detail of recommended AEH Strategic Program Logic Model

COMMUNITY CAPACITY BUILDING

Recommendation 4. Establish mechanisms through co-design to strengthen the capacity and capability of ACCO services and businesses to provide services funded under the AEH Program.

4.1. Approach and endorse AHCWA, under a broadened remit, to provide governance and capability development for ACCOs to increase capacity to provide AEH contracted services. That this be reflected in AEH Program Service Agreements so it can be triggered (based on co-designed measures) as part of the contract management process, as per the Sector Support for Sustainable Aboriginal Community Controlled Health Services in WA.

4.2. Mandate ACCO-restricted procurement where there is an established ACCO with demonstrated capability and capacity in AEH. When these conditions are not met, procurement activity mandates formalised partnerships with local AMSs, ACCHOs and/or ACCOs.

4.3. Continue awarding contracts to Aboriginal businesses and purchasing of goods, services, and community services/works per the WA Government's Buy Local and Aboriginal Procurement Policies.

4.4. Build into AEH Program Service Agreements the requirement of AEH service providers to hold and report on community forums and meetings used to produce CEHAPs, or other suitable community planning tool(s).

Part B: Recommendations Related to AEH Program Management

LEADERSHIP AND GOVERNANCE

Recommendation 5. Develop whole-of-government strategies incorporating Aboriginal leadership across AEH and other relevant sectors.

5.1. The EHD, inclusive of additional dedicated senior Aboriginal personnel (see Recommendation 1.2), in collaboration with the Aboriginal Health Policy Directorate, facilitate cultural leadership and governance of the AEH Program.

5.2. Embed Aboriginal leadership and governance in AEH Program planning, implementation and evaluation through formalised consultation with regional Aboriginal Health Planning Forums, with agenda items including (but not limited to):

- Regional AEH issues and local solutions;
- Consideration of regional PHC data; and
- Co-design of regional AEH policy and programs.

5.3. Through the above mechanisms, the EHD facilitate co-design of the implementation of the proposed model of the AEH Program (as described in the Options Paper, and as mandated through National enHealth planning).

WORKFORCE SUPPORT AND TRAINING

Recommendation 6. Innovate and expand AEH workforce training, including strategic planning and funding for employing community-based workers.

6.1. Continue collaborating with accredited training organisations to co-design AEH content and processes with AHCWA to enable appropriate and accessible training options for AEH and community-based workers.

6.2. WA Health to establish and fund a designated Aboriginal training/supervisory position, aligned with industrial awards and conditions, within an appropriate ACCO to coordinate the ongoing training of AEH workers.

6.3. Service providers include a training focus on data and computer literacy of the AEH workforce—in order to be funded—to improve understanding around the need for quality data collection to improve monitoring and continuous improvement in the delivery of AEH Program outcomes.

6.4. Provide contractual opportunities for AEH service providers to work at a regional level with Community Development Program (CDP) providers to engage CDP participants through local Aboriginal Environmental Health Worker (AEHW) training and employment opportunities.

6.5. In partnership with service-based experts, update the enHealth *Environmental Health Practitioner Manual* (2010) to National Standards, including Healthy Living Practices and aligned with Certificate II curriculum.

DATA, EVIDENCE AND RESEARCH

Recommendation 7. Improve the collection, analysis, dissemination, and use of data to routinely monitor and evaluate AEH Program services, activities and outcomes.

7.1. Implement a routine reporting process beyond solely activity-based data to incorporate outcomes-based reporting, with outcomes in line with those recommended in the Options Paper and determined though co-design. Provide training to service providers on the new reporting requirements to standardise information for improved collation and evaluation.

7.2. Integrate PHC data into the routine monitoring of environment-related disease burden and AEH Program outcomes.

7.3. The EHD, Epidemiology Branch and AHCWA, in collaboration with clinicians, co-design and develop an appropriate methodology to measure environment-attributable disease burden that can be applied across all WA regions.

7.4. The WA Epidemiology Branch produce regular reports (at least annually) to monitor the burden of environment-attributable hospitalisations and deaths among Aboriginal Western Australians aligned with reporting on Closing the Gap progress. Deliver these reports to the EHD and make them publicly available to inform all stakeholders and assist a whole-of-government approach, maintaining principles of data sovereignty.

7.5. Support co-designed, culturally responsive and community directed or endorsed research projects with findings implemented to improve AEH outcomes.

HEALTH PREVENTION AND HEALTH PROMOTION

Recommendation 8. Collaborate with ACCHS and the WA Country Health Service (WACHS) to develop strategies promoting environmental health as key to broader health care responses.

8.1. WA Health strongly advocate for community-led, co-designed, and culturally-responsive health promotion and disease prevention strategies as a core area of collaboration across whole-of-government.

8.2. Expand on existing safe bathroom assessments to include all healthy home hardware and train the AEH workforce to undertake healthy home hardware assessments.

8.3. AEH service providers to promote community engagement in routine 715 health checks to prevent and manage EH-related diseases.

COMMUNITY CAPACITY BUILDING

Recommendation 9. Develop a broad range of strategies to build community skills and capacity to implement and monitor responsive, sustainable environmental health programs.

9.1. Promote environmental health strategies identified by each community to generate sustainable change and improve outcomes.

9.2. Through public notices, or other culturally-responsive mechanisms, keep communities informed on who is responsible for providing environmental services.

9.3. EHD to provide resources (including training) to enhance the capacity of AEH service providers to engage with communities in identifying AEH needs and better understand and develop CEHAPs (or appropriate similar co-designed planning tool).

9.4. Disseminate a summary of Review findings and recommendations to service providers, stakeholders and communities that contributed to the AEH Program Review evaluation.

MAIN REPORT

1. INTRODUCTION

The Aboriginal Environmental Health (AEH) Program has been funded by the Western Australian Department of Health (WA Health) since 1994 to address the gaps in environmental health services provided to remote Aboriginal communities. This Program continues to evolve to allow the provision of services by a hybrid of Community Service Agreements with various local governments and Aboriginal organisations. Withdrawal of the Commonwealth in 2015 from the provision of essential services has significantly impacted service delivery to remote communities[7], including associated services provided by the AEH Program. The Program has not previously undergone a formal Review, which is the intent of the current document.

1.1 Aims

This report presents the process and findings of an independent review of the WA AEH Program and broader areas of need in AEH in WA (see regional profiles in Figure 2). The report findings are intended to provide evidence to underpin WA Health's decision-making and future planning of reforms to improve the effectiveness and sustainability of delivering environmental health services to Aboriginal communities through the AEH Program in WA. The Review was guided by WA Health's Aboriginal Health and Wellbeing Framework 2015–2030 (AHWF) and, in particular, the AHWF's Outcomes Framework for Aboriginal Health 2020–2030[8] throughout the data collection, analysis and reporting phases.

The specific activities of the Review included:

1. Synthesising relevant WA population and health data, including health outcomes impacted by environmental conditions;
2. Conducting a pilot study of Aboriginal Primary Health Care (PHC) data, co-designed with AHCWA (stand-alone activity);
3. Identifying and reviewing relevant national and international Aboriginal environment/health policies and wellbeing models or frameworks;
4. Reviewing environmental health activity data and service provider data for services funded through the current AEH Program;
5. Identifying key WA stakeholders involved in delivering community and household-based environmental health services;
6. Using mixed-methods to gather information on experiences, perceptions and opinions regarding the current AEH Program service delivery model and options for future delivery;
7. Reviewing program costs data, environmental-attributable hospitalisation costs and datasets related to reported services delivery hours; and
8. Providing recommendations for the future procurement and management of AEH programs, with regards to scope, procurement model, outcome measures and output monitoring.

[7] Western Australian Auditor General. (2021). Delivering Essential Services to Remote Aboriginal Communities – Follow up. Perth, Office of the Auditor General Western Australia

[8] Aboriginal Health Policy Directorate, 2019, Outcomes Framework for Aboriginal Health 2020-2030: An outcomes focused approach to funding community-based health care services, Department of Health of WA

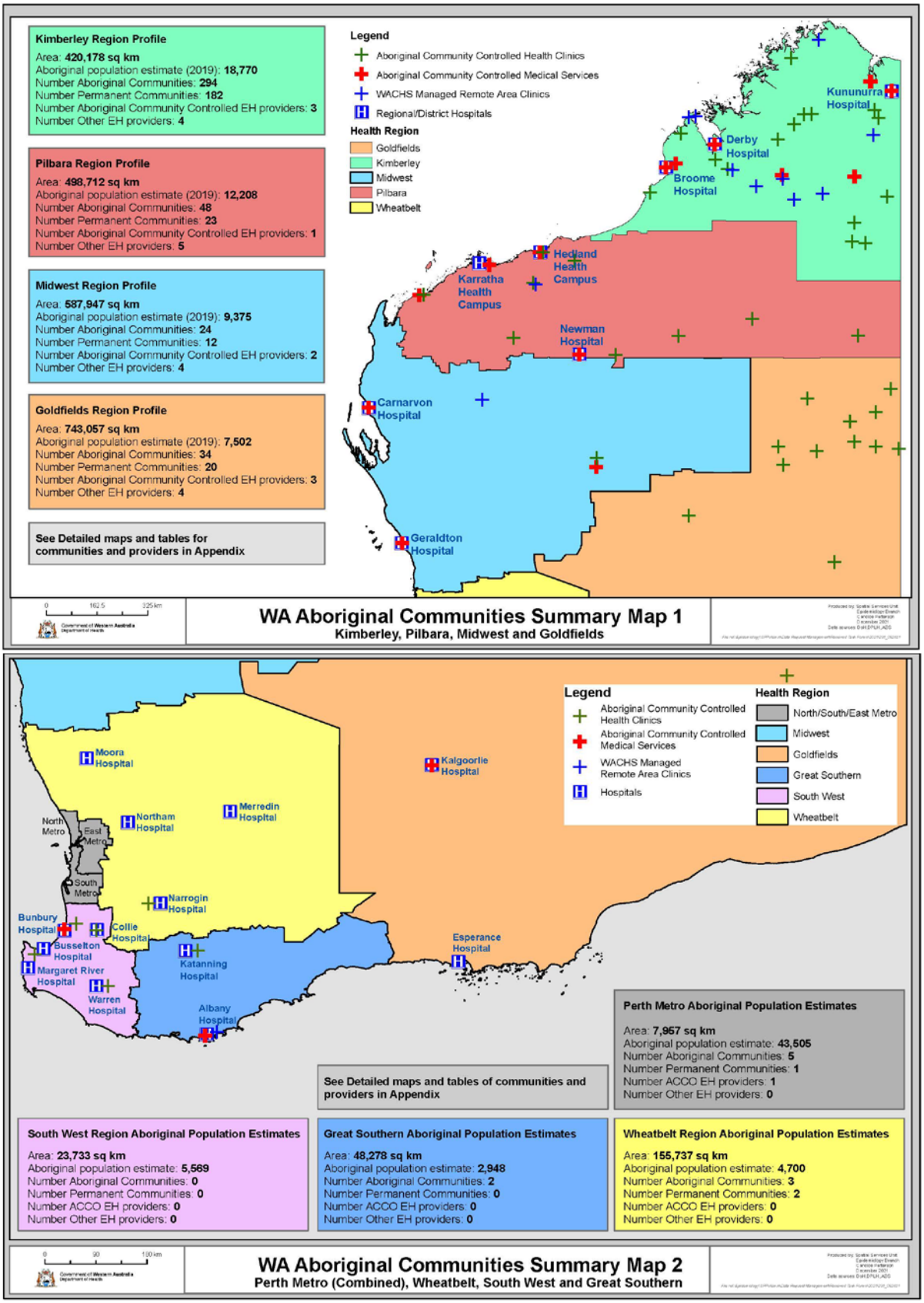

Figure 2: Aboriginal population estimates, numbers of regional and remote Aboriginal communities and health services for the northern (Map 1) and other (Map 2) regions of Western Australia (2019)

Separate to the Main Report, a companion Options Paper has been developed to provide a 'road map' for future AEH Program service delivery in WA. Guided by current Aboriginal health policy frameworks, the Options Paper synthesises the Review findings and recommendations, to address the following broader objectives:

- WA Health has procurement and service models that enable better design, delivery and evaluation of programs and services through an outcomes focused approach
- Contract management is robust and sustainable;
- Procurement processes for AEH services are improved and aligned with WA State and National policy directions;
- Environmental -attributable health outcomes are improved in WA;
- The AEH Program is driven and led by communities and their environmental health needs;
- Strengthened partnerships between external agencies and the AEH Program are enabled; and
- Relevant data and information necessary for ongoing, culturally appropriate program evaluation are identified and made available.

1.2 Structure of the Report

The Review is presented in two sections:

- A Main Report, including case studies, recommendations and appendices; and
- An Options Paper that draws from the recommendations in the Main Report.

The results of a pilot project undertaken in collaboration with the Aboriginal Health Council of WA (AHCWA) (extending previous work by the AEH Program team with certain AMSs) to describe processes for extracting and analysing primary health care (PHC) data to examine environment-attributable health conditions treated in PHC settings are included as Appendix 3. The pilot report will also be available to AHCWA as a stand-alone document. Recommendations arising from the Review findings regarding WA Health's future delivery of the AEH Program, are provided at the end of the Executive Summary. The Options Paper is provided to synthesise the Review findings and recommendations, and to provide an initial starting point for future AEH Program reform.

The Main Report outlines the methods used and findings from the following data sources:

1. Literature review of peer-reviewed research, practice examples and policy in the field of Aboriginal environmental health
2. WA population-level epidemiological data
3. PHC data
4. AEH Program service provider activity data
5. Costs of the AEH Program and environment-related health service provision
6. Stakeholder and community survey data
7. Consultations with AEH Program service providers, stakeholders and community members

Case studies on selected topics are incorporated into the Main Report as examples to synthesise the findings from the array of quantitative and qualitative data sources interrogated for the Review. Selected illustrative topics for the case studies:

- Dust suppression interventions
- Housing
- Murray Valley encephalitis
- Prevention and health promotion
- Trachoma
- Drinking water and cross-sector advocacy
- Managing and preventing skin infections

The Main Report concludes with recommendations that form the basis of the Options Paper.

2. REVIEW BACKGROUND AND CONTEXT

The need to address the social, cultural and environmental determinants of Aboriginal health to improve health and wellbeing is undisputed. The built environment specifically (including housing, roads, water and air quality) significantly impacts the health outcomes of the Aboriginal population in WA. Given the diverse components of the built environment, many government sectors, agencies and funding streams outside of health are responsible for providing services. In remote areas of WA, the status of the built environment for Aboriginal people is suboptimal. Withdrawal of the Commonwealth in 2015 from the provision of essential services significantly impacted state capacity and responsibility for water quality and waste management, with the Department of Communities taking on many municipal and essential services[9].

This section begins with a broad overview of the impact of environmental factors on Aboriginal health, including the complexities of measuring and evaluating the impact of relevant factors. National and WA State policy documents and the research literature related to AEH program strategy, planning, implementation, monitoring and evaluation of service delivery are examined. The section concludes with a brief history of the WA AEH Program and its current service delivery context and model.

2.1 Health of Aboriginal Australians

Australian Aboriginal people experience a markedly greater burden of disease than non-Aboriginal Australians, with the most recently reported difference in premature mortality estimated at 8.6 years for males and 7.8 years for females[10]. In remote and very remote areas, this difference is 14 years. The life expectancy of Aboriginal Western Australians (males 66.2 years; females 71.2 years) ranked third after New South Wales (NSW) and Queensland (Qld) of the four jurisdictions for which reliable mortality data are available[11]. Aboriginal Australians also have shorter life expectancy than First Nation populations in other developed nations such as Canada, the United States of America and New Zealand[12]. The causes of this disparity are complex, but the continuing effects of colonisation and dispossession of lands and resources have contributed to significant health and socioeconomic inequities in Australian Aboriginal people[13].

The gaps in life expectancy, mortality risk and disease burden are driven primarily by preventable conditions, including infectious and chronic diseases[14]. In 2015, the five leading causes of disease burden in Aboriginal Australians were coronary heart disease and four conditions impacted by mental health (suicide/self-inflicted injuries, alcohol, anxiety, depressive disorders)[15], with the all-cause disparity highest between 30 and 50 years of age. In WA in 2018, the diseases with the highest disparity between Aboriginal and non-Aboriginal populations were kidney/urinary disease (rate ratio (RR) 14.1), endocrine disorders (RR 7.1), cardiovascular diseases (RR 4.7), infectious diseases (RR 4.5) and gastrointestinal disorders (RR 4.4). In addition, Aboriginal Australians living in remote and

[9] Western Australian Auditor General. (2021). Delivering Essential Services to Remote Aboriginal Communities – Follow up. Perth, Office of the Auditor General Western Australia
[10] Australian Bureau of Statistics (2018) Life Tables for Aboriginal and Torres Strait Islander Australians, 2010–2012. ABS 3302.0.55.003
[11] ABS. Life Tables for Aboriginal and Torres Strait Islander Australians 2015–2017. ABS, 2018, Canberra
[12] https://apo.org.au/sites/default/files/resource-files/2016-11/apo-nid73107.pdf
[13] Griffiths K, Coleman C, Lee V, Madden R. How colonisation determines social justice and Indigenous health—a review of the literature. Journal of Population Research. 2016 Mar 1;33(1):9–30
[14] Australian Institute of Health and Welfare 2021. Australian Burden of Disease Study 2018: Key findings for Aboriginal and Torres Strait Islander people. Cat. no. Burden of Disease 28. Canberra: AIHW
[15] As above

very remote areas have poorer access to health care and experience a greater burden of disease and higher mortality rates than Aboriginal people living in rural and metropolitan areas[16].

These inequalities are influenced by social determinants of health, including socioeconomic disadvantage related to education, employment and income, levels of social support and social inclusion, early life experiences, environmental and housing conditions, transportation, and access to health services[17]. For Aboriginal people, the social determinants of health and wellbeing sit alongside cultural determinants that include factors such as cultural identity, family, participation in cultural activities and access to traditional lands and waters[18]. Importantly, Aboriginal definitions of 'good health' involve '*more than the absence of disease or illness; it is a holistic concept that includes physical, social, emotional, cultural and spiritual wellbeing, for both the individual and the community*'[19]. Cultural factors such as connection to Country and caring for Country, knowledge and beliefs, language, self-determination, family and kinship, and cultural expression can be protective and positively influence Aboriginal people's health and wellbeing[20,21,22].

2.2 Environmental Determinants of Health

2.2.1 Definition and scope of environmental health

Environmental health is an important aspect of public health, dealing with aspects of natural and built environments that affect people's health and wellbeing. Physical, chemical, biological and environmental factors, combined with social, demographic and cultural factors, are strong determinants of health. Establishing and maintaining healthy environments contributes to the primary prevention of disease and disability by addressing upstream causes of disease burden. However, minimising environmental health risk factors occurs in a complex context necessitating a collaboration of individuals in place and communities, government and non-government agencies in the assessment, provision and maintenance of adequate infrastructure (including housing, water supply, sewage systems[23] and rubbish removal[24,25]) and mitigation of exposure to risks, such as pollutants and/or disease vectors[26].

The World Health Organization (WHO) has linked 133 diseases and injuries to the environment and estimated that, in 2012, 22% of the global burden due to disability and death (26% in children under 5 years) could be prevented by reducing modifiable environmental risks[27]. Their more recent 2019

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[16] Australian Burden of Disease Study: Impact of causes of illness and death in Aboriginal and Torres Strait Islander people 2011.
[17] Wilkinson R, Marmot M. Social determinants of health (2nd edition). The solid facts. Copenhagen; WHO 2003
[18] Marmot, 2011. Social determinants and the health of Indigenous Australians. Medical Journal of Australia 194(10):512–513[19] https://www.aihw.gov.au/reports/australias-health/indigenous-health-and-wellbeing
[19] https://www.aihw.gov.au/reports/australias-health/indigenous-health-and-wellbeing
[20] Aboriginal Health and Wellbeing Framework 2015–2030
[21] Bourke, S , Wright, A Guthrie, J, Russell, l, Dunbar, T, Lovett. R2018. Evidence Review of Indigenous Culture for Health and Wellbeing. *The International Journal of Health, Wellness, and Society* 8 (4):11–27. doi:10.18848/2156-8960/CGP/v08i04/11-2
[22] Gee, G., Dudgeon, P., Schultz, C., Hart, A., Kelly, K.. (2014). Aboriginal and Torres Strait Islander social and emotional wellbeing. In Dudgeon, P. Milroy, H. Walker, R. (Ed.), *Working together: Aboriginal and Torres Strait Islander mental health and wellbeing principles and practice* (2nd ed.,pp. 55–68). Canberra: Department of the Prime Minister and Cabinet
[23] Health Info Net https://healthinfonet.ecu.edu.au/learn/determinants-of-health/environmental-health
[24] Carson, B., & Bailie, R. (2004). Remote Aboriginal and Torres Strait Islander Communities: Issues and Strategies. In N. Cromar, S. Cameron, & H. Fallowfield (Eds.), Environmental Health in Australia and New Zealand (pp. 410–435)
[25] Seemann, K., McLean,S. & Fiocco,P (2017) A gap to close A literature review of waste management, health and wellbeing in rural and remote Aboriginal and Torrres Strait Islander communities
[26] Clifford, H., Pearson, G., Franklin, P., Walker, R., & Zosky, G. (2015). Environmental health challenges in remote Aboriginal Australian communities: clean air, clean water and safe housing. Australian Indigenous HealthBulletin, 15(2):14
[27] Prüss-Üstün, Annette, Wolf, J., Corvalán, Carlos F., Bos, R. & Neira, Maria Purificación. (2016). Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. World Health Organization.

Global Burden of Disease Project highlights the decline in global exposure to harmful environmental risks, including unsafe water, sanitation and handwashing, some types of air pollution, non-optimal temperatures and other exposures[28]. The notable exception is ambient particulate matter pollution. In addition, social and economic development significantly contributed to reducing environmental risk factors, particularly unsafe water, sanitation and handwashing, and thus child mortality.

Improvements in environmental impacts on health have not been commensurate for Aboriginal Australians. While many diseases experienced by Aboriginal people are linked directly to poor environmental health, the general living conditions in many Aboriginal communities fall far short of the standards expected by and largely accessible to the broader Australian population. The *Overview of Aboriginal Health Status 2017*[29] report highlighted that, after age adjustment, Aboriginal people were hospitalised for diseases related to environmental health at 2.3-times the rate in non-Aboriginal people. It also showed that between 2010 and 2014, Aboriginal people living in NSW, Qld, WA, South Australia (SA) and the Northern Territory (NT) died as a result of diseases associated with poor environmental health at 1.7-times the rate of non-Aboriginal people. Further, in 2016, 16% of Aboriginal households were reported to be overcrowded dwellings and over 25% reported structural issues within their dwellings, compared to overcrowding figures of 4% for public housing and 4% for community housing across Australia[30]. In 2014–2015, compared with Aboriginal people from all over Australia, Aboriginal Western Australians had higher rates of renting (76% vs 39%) and overcrowding in non-remote areas (20% vs 15%) and a similar proportion with poor household facilities, such as laundry, sewerage and food preparation[31]. This high burden of environment-related disease impacts life expectancy, education and employability, productivity and quality of life.

As a key contributing factor to the burden of preventable disease for Aboriginal people, environmental health conditions have increased the incidence and severity of diseases such as trachoma, gastroenteritis, respiratory illnesses, scabies and infectious skin diseases that can lead to acute rheumatic fever (ARF) and rheumatic heart disease (RHD)[32,33].

Figure 3, adapted from the Qld Environmental Health Plan, describes several known associations between various environmental health risk factors and specific diseases in Australian Aboriginal populations, although not all diseases associated with environmental exposures are shown and some diseases extend across exposures. While many of these conditions are communicable, environmental factors can substantially impact the rates of non-communicable diseases, with many exacerbated by repeat exposures and chronic effects of environmental risk factors.

The case studies interspersed throughout Section 4: Consultation findings provide more detail of how environmental conditions impact the occurrence and ongoing impact of specific conditions.

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[28] Global Burden of Disease 2019 Risk Factor Collaborators. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet 2020;396:1135–1159

[29] Australian Indigenous HealthInfoNet (2018) Overview of Aboriginal and Torres Strait Islander health status, 2017. Perth, WA: Australian Indigenous HealthInfoNet

[30] Housing Assistance in Australia, 2019. Australian Institute of Health and Welfare. Available from https://www.aihw.gov.au/reports/housing-assistance/housing-assistance-in-australia-2019/

[31] Australian Institute of Health and Welfare 2017. Aboriginal and Torres Strait Islander Health Performance Framework 2017 report: Western Australia. Cat. no. IHW 185. Canberra: AIHW. https://www.aihw.gov.au/getmedia/95635b94-4345-44e9-a57b-3d8414ce5762/aihw-ihw-185-wa.pdf.aspx?inline=true

[32] Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022. State of Queensland (Queensland Health), 2019

[33] Clifford H, Pearson G, Franklin P, Walker R and Zosky G (2015) Environmental health challenges in remote Aboriginal Australian communities: clean air, clean water and safe housing. Australian Indigenous HealthBulletin 15 (2).

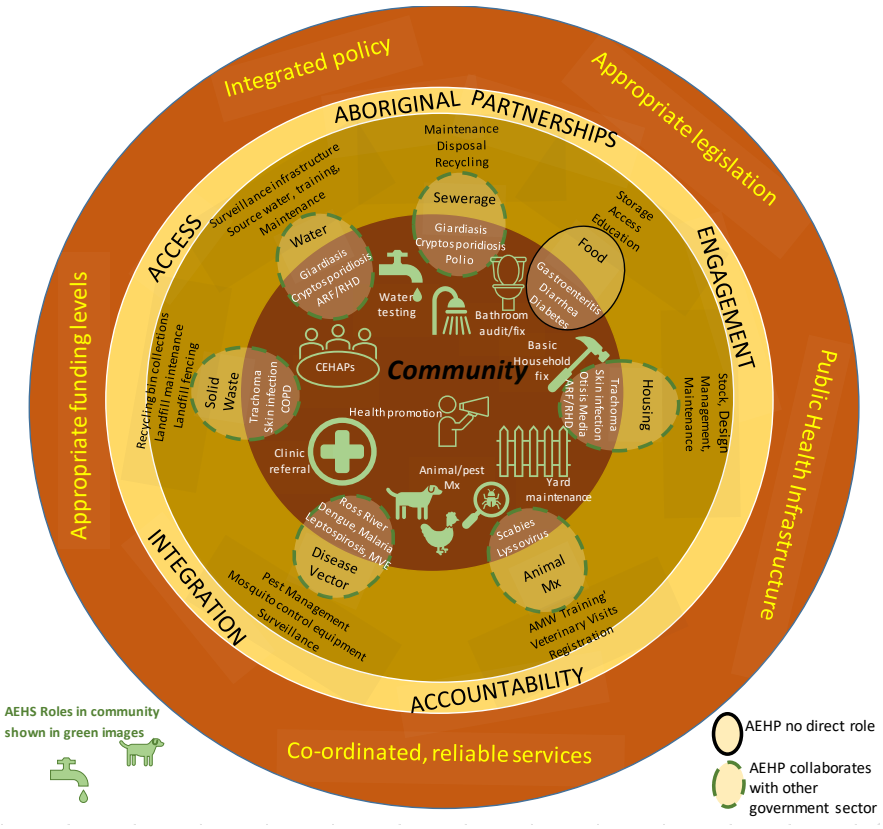

Figure 3: Adverse environmental health exposures and community AEH services

(Adapted by authors from Aboriginal and Torres Strait Environmental Health Plan 2019–2022. State of Queensland, Brisbane 2019; Mx: management; RHD Rheumatic heart disease; ARF acute rheumatic fever)

2.2.2 Measuring the environmental contribution to the burden of disease

It is estimated that 30–50% of health inequalities experienced by Aboriginal people can be attributed to poor environmental health[34]; however, the environment is not the sole cause of all conditions with an environmental component. Indeed, the environment rarely causes 100% of cases of any specific disease. Consequently, counting all cases of specific conditions would overestimate the environmental-attributable burden. Hence, population Environmental Attributable Fractions (EAFs) are used to adjust the counts attributable to the environment[35], multiplying the EAF by the burden of a particular disease to calculate the environment-attributable disease burden in a population. Further details related to the calculation and application of EAFs are included in Appendix 4.

EAFs provide a useful tool that can be applied for different purposes, including:

1. Determining the burden of environment-attributable disease in a region/country.
2. Providing environmental health service providers with an evaluation/monitoring tool and performance measure; and
3. Providing an evidence base to inform funding levels and outcomes-based procurement, and monitor provider performance.

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[34] Department of Health (2013). National Aboriginal and Torres Strait Islander Health Plan 2013–2023, Australian Government, Canberra

[35] McMullen C, Eastwood A, Ward J. Environmental attributable fractions in remote Australia" the potential of a new approach for local public health action. Aust NZ J Public Health;2016; 40:174–180

This Review uses two methods of attributing diseases to environmental health, one developed by the WHO for developed countries in the Western Pacific[36] and the other (Kimberley Environmental Attributable Fraction (KEAF)[37]) developed by the Kimberley Aboriginal Health Planning Forum as more suitable for the Aboriginal and rural context in WA (see Appendix 4 for the methods, conditions and fractions applied when using each method).

2.2.3 Environmental attributable burden in Aboriginal Western Australians

Several WA-specific reports include estimates of the environmental-attributable burden of disease. The 2014 review of performance with recommendations for WA Aboriginal health programs (hereafter 'the Holman report')[38] estimated the attributable burden of premature death in the Aboriginal population to be 13% WA-wide and 20% for the four northern WA regions (i.e. Kimberley, Pilbara, Mid West and Goldfields), based on the WHO's conservative estimate of 17% for all ages in developed countries and 36% in children (0–14 years) in developing countries.

KEAFS were developed and applied to attendances to WA Country Health Services PHC facilities in the Kimberley from July 2012 to June 2014. Significant inequity was identified, with 23.1% of Aboriginal attendances (25.6% in children <5 years) attributed to the environment compared with 14.6% among non-Aboriginal attendances[39]. In 2016, 2,842 hospital admissions in the Kimberley (24.9% in children <15 years) were estimated to be attributable to the environment using KEAFS, translating to $16.9 million from 8,648 bed days[40].

An analysis of the contribution of risk factors to the 2015 burden of disease in Aboriginal Western Australians reported low environmental contribution to disease burden, based on a limited risk factor set (air pollution (1.2%), occupational exposures/hazards (1.1%) and sun exposure (too small to report))[41]. This suggests that current Australian burden of disease studies use methods of limited use to guide AEH-related policy development, given the high rates and disparities in infectious diseases and unintentional accidents (to name a few) with a high environmental attribution.

Most recently, environment-attributable hospitalisation rates (presumably using WHO EAFs, but not directly specified) were reported at statistical local area level for the Kimberley and Pilbara regions (2011–2015) to map service expenditure and outcomes as part of Overcoming Indigenous Disadvantage initiatives across regions[42]. The age-standardised rates of hospitalisations for environmentally related conditions per 100,000 Aboriginal persons in Roebuck (4,445) and Karratha (4,783) at Statistical Area 2 level were much lower than the rate per 100,000 Aboriginal people in WA (5,550). The Derby West Kimberley (10,770), Port Hedland (9,700) and South Hedland (9,570) Statistical Area 2 levels had much higher rates of environmental-related hospitalisations per 100,000 Aboriginal people than the rest of the State.

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[36] Prüss-Üstün, Annette, Wolf, J., Corvalán, Carlos F., Bos, R. & Neira, Maria Purificación. (2016). Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. World Health Organization. https://apps.who.int/iris/handle/10665/204585

[37] McMullen C, Eastwood A, Ward J. Environmental attributable fractions in remote Australia: the potential of a new approach for local public health action. Aust NZ J Public Health;2016; 40:174–180

[38] Holman C, Joyce S. A promising future: WA Aboriginal health programs. Review of performance with recommendations for consolidation and advance. Perth: Department of Health Western Australia. 2014.

[39] McMullen C, Eastwood A, Ward J. Environmental attributable fractions in remote Australia: the potential of a new approach for local public health action. Aust NZ J Public Health;2016; 40:174–180

[40] KAHPF Environmental Health Sub-Committee. Hospitalisations in 2016 of Aboriginal people due to their environment: Demand, costs and Kimberley solutions. KEHF, Broome 2018

[41] WA Burden of Disease Study 2015: Contribution of risk factors to burden in Aboriginal Western Australians. WA Department of Health Perth, 2021

[42] Seivwright, A., Callis, Z., Flatau, P. and Isaachsen, P. (2017) Overcoming Indigenous disadvantage across the regions: Mapping service expenditure and outcomes in the Pilbara and the Kimberley. Regional Services Reform Unit, Department of Communities, Government of Western Australia: Perth. DOI: 10.13140/ RG.2.2.28440.29449

2.3 Research and Policy to Improve Environmental Health

Over the past 20 years, there has been growing recognition within the Australian policy context of the significant impact of the environment on Aboriginal health and wellbeing[43,44,45,46]. These policies increasingly emphasise the need to improve health system deliverables in housing, education and employment, address the social determinants of health, and support and sustain improvements in Aboriginal health outcomes[47]. The refreshed 2021 National Health Plan 2021–2031 has a strong prevention focus, with Priority 7 focusing on healthy environments, sustainability and preparedness. This section includes a summary of relevant government policies, non-government documents and other related peak body submissions and commissioned evaluations that have contributed to setting AEH directions in WA.

2.3.1 National policy environment

The National Aboriginal and Torres Strait Islander Health Strategy 1989 (NAHS) was established as a landmark document in Aboriginal health policy, articulating Aboriginal people's health aspirations and goals within a rights-based framework[20].

The Environmental Health Standing Committee (enHealth) of the Australian Government Department of Health published the first National Environmental Health Strategy (NEHS) in 1999[48]. It was intended as a starting point for ensuring all Australians live in safe and healthy environments going into the 21st century and listed indicators of poor environmental health in Aboriginal communities. The strategy also stated that failure to prevent disease through environmental health solutions generally results in significant financial and cultural costs later in life.

In 2003, the National Strategic Framework for Aboriginal and Torres Strait Islander Health 2003–2013 (NSFATSIH) was developed to complement the NAHS and provide governments with evidence-based approaches for improving health outcomes for Aboriginal people. The Framework outlined a multi-sectoral approach committing governments to work collaboratively to develop joint and cross-portfolio initiatives. Specific strategies were subsequently developed by state and territory governments (Table 1) to support the overall goals and objectives of the NSFATSIH[49].

In 2008, The Council of Australian Governments' (COAG) National Indigenous Reform Agreement, known as 'Closing the Gap', was established, but it made no formal commitment to environmental health at that time. Furthermore, the National Partnership Agreement for Housing, otherwise known as the 'Healthy Homes' initiative, referred to environmental health conditions as important but did not commit to supporting environmental health programs and/or services. It is incongruous that the significant funding associated with this National Partnership Agreement to improve the living conditions of Aboriginal people and, by inference their health, focused on building new homes and refurbishing existing properties with little mention of ongoing maintenance and management to protect health.

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[43] Australian Government/Dept. of Health. National Aboriginal & Torres Strait Islander Health Plan 2021–2031. DoH, 2021.
[44] Environmental Health Standing Committee (enHealth). The National Environmental Health Strategy. Canberra (AUST): Australian Government Department of Health; 1999; /http://carers.health.gov.au/internet/wcms/publishing.nsf/Content/health-pubhlth-publicat-document-metadata-envstrat.htm/$FILE/envstrat.pdf
[45] Australian Government, Implementation Plan for the National Aboriginal and Torres Strait Islander Health Plan 2013–2023, Commonwealth of Australia, Canberra, 2015, https://www.health.gov.au/resources/publications/implementation-plan-for-the-national-aboriginal-and-torres-strait-islander-health-plan-2013-2023
[46] The NACCHO 10-Point Plan to Achieve a Healthy Future for Generational Change 2013–2030, https://www.qaihc.com.au/media/1078/naccho-healthy-futures-10-point-plan-2013-2030.pdf
[47] Expert Reference Panel on Aboriginal Environmental Health (ERPATSIEH) Action Plan 2018–2023, https://www1.health.gov.au/internet/main/publishing.nsf/Content/ohp-environ-enhealth-committee.htm
[48] Environmental Health Standing Committee (enHealth). ibid
[49] https://www.health.gov.au/sites/default/files/documents/2021/02/national-aboriginal-and-torres-strait-islander-health-plan-2013-2023.pdf

Table 1: National policy documents relevant to Aboriginal environmental health

National
Environmental Health Standing Committee (enHealth). The National Environmental Health Strategy. Canberra (AUST): Australian Government Department of Health; 1999
National Indigenous Reform Agreement (Closing the Gap) Council of Australian Governments (2009). Canberra
Department of Health and Aged Care & enHealth Council. The National Environmental Health Strategy: Implementation Plan 2000
National Partnership Agreement for Housing
National Strategic Framework for Aboriginal and Torres Strait Islander Health 2003–2013
National Aboriginal and Torres Strait Islander Health Plan 2021–2031 (refresh of 2013 Plan)
The NACCHO 10-Point Plan to Achieve a Healthy Future for Generational Change 2013–2030
National Strategic Framework for Aboriginal and Torres Strait Islander Health Implementation Plan 2015
National Strategic Framework for Aboriginal Peoples' Mental Health and Social and Emotional Wellbeing 2017–2023
Expert Reference Panel on Aboriginal Environmental Health (ERPATSIEH) Action Plan 2018–2023
The National Agreement on Closing the Gap 2020

Building on the NAHS, The National Aboriginal and Torres Strait Islander Health Plan 2013–2023 provides a long-term, evidence-based policy framework as part of the COAG's approach to Closing the Gap in Aboriginal disadvantage. The Health Plan was produced in partnership with Aboriginal people, community groups and peak bodies, building on the *United Nations' Declaration on the Rights of Indigenous Peoples*.

Drawing on evidence-based research and extensive Aboriginal community consultations, the Health Plan affirmed that improvements in Aboriginal people's health required an integrated approach encompassing '*the strengthening of community functioning, reinforcing positive behaviours, improving education participation, regional economic development, housing and environmental health, and spiritual health*' (p. 13). This integrated approach included but was not limited to housing, essential and municipal services, regional employment services, Aboriginal Community Controlled Health Services (ACCHS), local government authorities (LGAs) and WA Country Health Services (WACHS) Population Health Units—Country Health Service Population Health Units.

In 2015, the Australian Government released the Implementation Plan[50] outlining the actions to be taken by the Government, ACCHS and other key stakeholders to operationalise the vision, principles, priorities and strategies of the Health Plan 2013–2023. Focused on prevention and early intervention, the Implementation Plan set goals for 20 indicators to be achieved by 2023 in accordance with the existing COAG Closing the Gap targets. The Plan included a greater focus on the social and environmental determinants of health that impact Aboriginal health and a more comprehensive approach to PHC and population health to address chronic diseases among Aboriginal people.

The Health Plan recognises that environmental factors can dramatically and negatively impact the social and emotional wellbeing of individuals, families and communities and their ability and capacity to respond proactively to improve health outcomes. Importantly, the Health Plan has recently been refreshed[51] with a greater focus on prevention to align policies and priorities at the national level to better acknowledge the role of the cultural and social determinants of health in health outcomes.

[50] National Strategic Framework for Aboriginal and Torres Strait Islander Health Implementation Plan 2015
[51] Australian Government/Department of Health. National Aboriginal & Torres Strait Islander Health Plan 2021–2031. DoH, Canberra, 2021.

The National Aboriginal Community Controlled Health Organisation (NACCHO) *Investing in Healthy Futures for Generational Change 10-Point Plan 2013–2030* includes the Close the Gap Statement of Intent and the Close the Gap Targets, and strongly supports the WHO's view that comprehensive primary health care is central to achieving real outcomes and health benefits for Aboriginal people, rather than a selective or disease-focused approach that concentrates exclusively on the treatment of illness.

The Australian Health Ministers' Advisory Council enHealth Expert Reference Panel on Aboriginal & Torres Strait Islander Environmental Health Action Plan 2018–2023 outlined the following principles that firmly elevate and embed environmental health as foundational to holistic health:

- ***Policy principle 1*:** Good environmental health conditions are essential for maintaining and improving the health of Aboriginal people.
- ***Policy principle 2*:** Policy and service development and implementation for AEH must involve cross-portfolio consultation and engagement (where appropriate), acknowledging that environmental health outcomes require coordinated input and support from many areas.
- ***Policy principle 3:*** Each Aboriginal community should benefit from the services of an Aboriginal environmental health program.
- ***Policy principle 4:*** The employment of trained Indigenous environmental health practitioners, or access to an equivalent appropriate and skilled environmental health program, is the minimum essential prerequisite for communities to manage their environmental health conditions effectively and comply with their public health responsibilities.
- ***Policy principle 5:*** Indigenous environmental health practitioners should be adequately resourced and supported and recompensed commensurate with their skills and experience.
- ***Policy principle 6:*** Training for Indigenous environmental health practitioners should be provided at a level consistent with the national Population Health Qualifications and competency standards, including Indigenous Environmental Health qualifications and competencies.

Extending significantly on successful elements of COAG's 2008 National Indigenous Reform Agreement, a National Partnership Agreement on Closing the Gap commenced in 2019 reflecting a commitment by all Australian governments *and Aboriginal and Torres Strait Islander representatives* to reform/transform the development and implementation of policies and programs that impact the lives of Aboriginal and Torres Strait Islander peoples. For the first time, representatives of Aboriginal and Torres Strait Islander people and all governments are signatories of the Agreement. Importantly, in 2020, the COAG and the National Coalition of Aboriginal and Torres Strait Islander Peaks made an important shift by recognising and supporting the foundational role of environmental health in Closing the Gap. It sets out a vision that policy making and implementation that impacts the lives of Aboriginal people will be done in full and genuine partnership going forward.

The Expert Reference Panel on Aboriginal and Torres Strait Islander Environmental Health (ERPATSIEH) Action Plan 2019–2023 ('the Plan') gives effect to the National Environmental Health Strategy 2016–2020 that seeks to contribute to closing the gap in the health status of Aboriginal people by improving environmental health conditions. The WA EHD has committed to leading the delivery of two of the Plan's objectives:

- **Objective 2**: Develop a best-practice model for environmental health service delivery in WA Aboriginal communities; and
- **Objective 6:** Include environmental health as part of broader health care responses to managing health conditions (referrals).

2.3.2 Policy context in Western Australia

The WA AHWF acknowledges the importance of the cultural determinants of health and identifies a set of guiding principles, options, and priority areas to improve the health and wellbeing of Aboriginal people in WA through 2030. The Implementation Guide for this Framework provides opportunities for implementing collaborative and flexible action plans aligned to best practice and evidence and provides guidance for decisions and solutions that respond to new and emerging needs at local levels.

In 2020, the WA Government developed its first Closing the Gap Jurisdictional Implementation Plan (WA)[52] ('Implementation Plan') with input from government departments and agencies, statutory bodies, local government, and crucially, the Aboriginal Health Council of WA (WA peak body for the Coalition of Peaks). The Implementation Plan was developed under the National Agreement on Closing the Gap[53], emphasising structural and systemic reform aligned with the WA Aboriginal Empowerment Strategy 2021–2029. The key national and WA policy documents influencing or providing strategic direction to AEH Program policy and service design for WA are outlined in Figure 4.

Table 2 outlines the national and WA policy documents that reference, inform or relate to AEH and provides a high-level policy framework to support the contemporisation and prioritisation of AEH services and support in WA.

There is an interrelationship between the national policies and AEH Program; two specific policies relevant to this review are the ERPATSIEH plan and the National Agreement on Closing the Gap.

Table 2: Policy documents relevant to Aboriginal Environmental Health: Western Australia

Document Title (hyperlinked to source document)
WA Aboriginal Health and Wellbeing Framework 2015–2030
Implementation Guide for the WA Aboriginal Health and Wellbeing Framework 2015–2030 Build the Foundations 2015–2020
Public Health Act 2016 and Health (Miscellaneous Provisions) Act 1911
Environmental Health Directorate Strategic Plan 2020–2023
Outcomes Framework for Aboriginal Health 2020–2030
Closing the Gap Jurisdictional Implementation Plan (WA)
Aboriginal Empowerment Strategy 2021–2029
Delivering Community Services in Partnership Policy
Sustainable Health Review
Climate Health Inquiry

[52] Department of the Premier and Cabinet, (2021) Closing the Gap Jurisdictional Implementation Plan, WA
[53]The National Agreement on Closing the Gap 2020, https://www.closingthegap.gov.au/sites/default/files/files/national-agreement-ctg.pdf

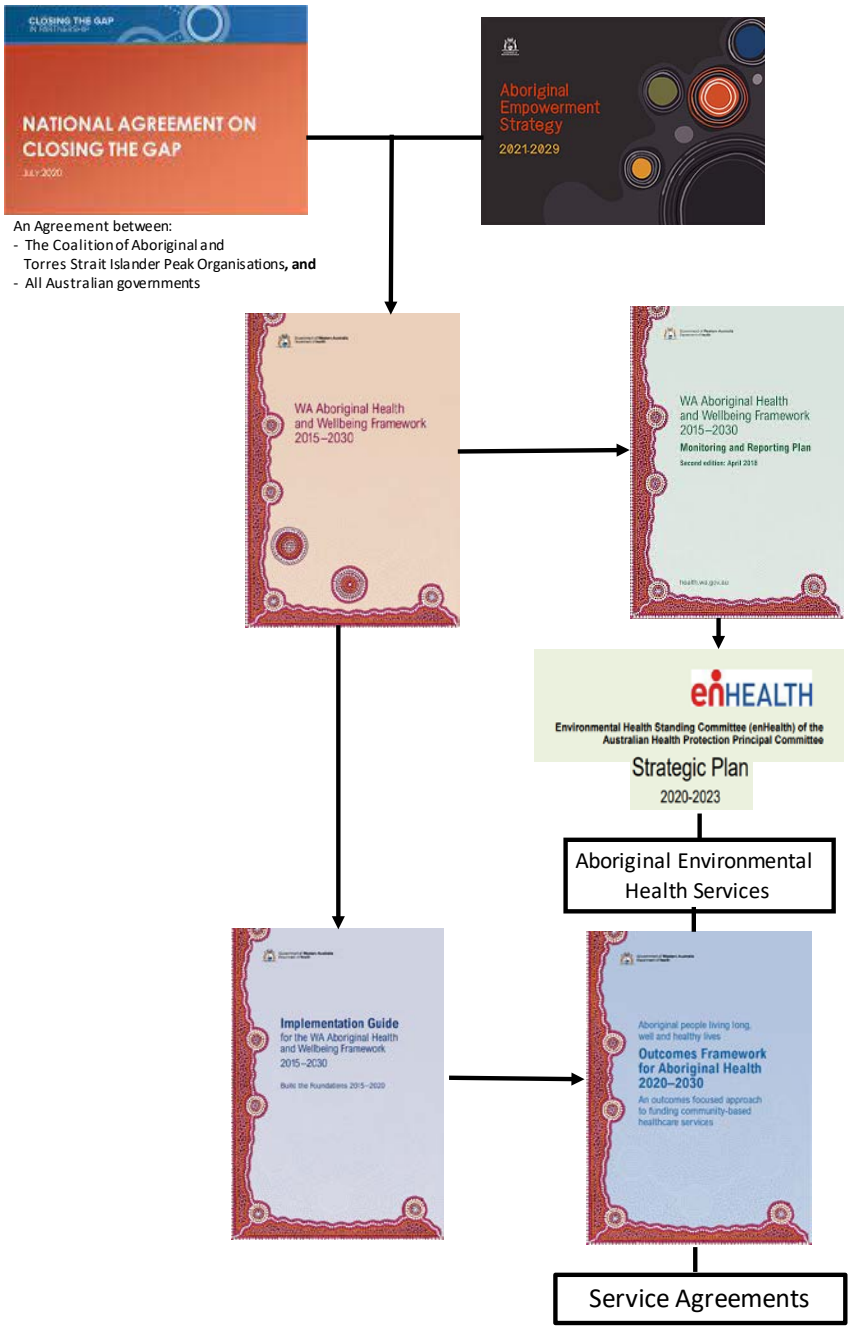

Figure 4: Environmental Health Policy Drivers: the WA Context

2.4 Principles for Effective Program Implementation and Service Delivery at a National Level

The Closing the Gap priorities, combined with the AHWF, provide an overarching conceptual framework to guide the review of the WA AEH Program. Importantly, these priorities are endorsed by Aboriginal representatives, the Coalition of Aboriginal and Torres Strait Islander Peak Organisations ('Coalition of Peaks') and all Australian governments, who for the time are signatories of the National Agreement on Closing the Gap. This represents a shift in the way governments work by encompassing shared decision-making on the design, implementation, monitoring and evaluation impacting the lives of policies and programs to improve life outcomes for Aboriginal people. This provides an important opportunity to enhance the future delivery of AEH services in partnership with the Aboriginal community-controlled sector. The priorities reforms are:

- ***Priority Reform One: Formal partnership and shared decision-making***. Aboriginal people need to have a much greater say in how programs and services are delivered to their people, in their own places and on their own country.
- ***Priority Reform Two: Building the community-controlled sector***. Community-controlled organisations deliver the best services and outcomes for Closing the Gap.
- ***Priority Reform Three: Transforming government organisations***. Government agencies and institutions need to address systemic, daily racism, promote cultural safety and transfer power and resources to communities.
- ***Priority Reform Four: Shared access to data and information at a regional level***. Aboriginal people should have access to the same information and data as governments to drive their development.

Other service-delivery principles of note when reviewing the AEH Program include *engagement, access, integration* and *accountability*. The Closing the Gap Clearinghouse review of mental health and social and emotional wellbeing programs and services confirmed that mainstream and Aboriginal-specific programs and services that adhere to these principles were more effective than those that did not[54]. The review also found that effectiveness depended on the extent to which programs and services were aligned with the nine guiding principles outlined in the social and emotional wellbeing framework.

While each Aboriginal community is unique, and there is no 'one size fits all' approach or solution, there is compelling evidence that reinforces the need for a set of agreed principles to inform the planning, implementation and evaluation of programs, services and strategies designed to address the distinctive health and wellbeing needs, priorities and future aspirations of Aboriginal communities, as per the AHWF and the WA Aboriginal Empowerment Strategy. Aboriginal communities and organisations must have genuine and equal involvement in the planning and implementing of programs, policies and services as well as determination of indicators and measures of success for evaluations. This then needs to be reflected in service agreements, with ongoing monitoring and reporting.

These policy frameworks and implementation plans provide a roadmap to significantly change Aboriginal health and wellbeing. WA Health fulfils its commitments through direct service provision and/or commissioning others to provide services. Effective commissioning involves identifying what services people want and need, how they are provided and by whom.

[54] Dudgeon P, Walker R, Scrine C, Shepherd C, Calma T, Ring I. Effective strategies to strengthen the mental health and wellbeing of Aboriginal and Torres Strait Islander people. Australia: Australian Institute of Health and Welfare, 2014. p.72

The commissioning process involves a partnership between the various Directorates and Systems Contracting Unit (Figure 5).

Figure 5: Commissioning process involving a partnership between the various Directorates and Systems Contracting Unit

Service design is followed by procurement and contract management, with ongoing monitoring and evaluation to achieve the desired outcomes.

Thus, service agreements need to reflect elements of the agreed policies, with ongoing monitoring, review and reporting to ensure that the implemented activities and actions adhere to these principles so that improvements in environmental health outcomes can be measured and evaluated.

This Review draws together information and recommendations on integrating these approaches to transform AEH programs and policies and other systems, as advocated through the National Agreement on Closing the Gap, Priority Reforms. Specific attention is paid to improving Aboriginal Environmental Health, which has recently been embedded into the Closing the Gap reporting requirements for the first time.

2.5 Overview of the Aboriginal Environmental Health Program in WA

This section overviews the current AEH Program used by the WA Health EHD and reflects elements of the policies and literature reviewed above. The AEH Program operates in the context of multiple funding streams involving multiple agencies, dealing with a range of issues.

2.5.1 History and policy context

In 2019, an estimated 104,577 Aboriginal people resided in WA[55]. The maps in Figure 2 show the regional distribution of Aboriginal people in the State during that year, with Metropolitan Perth

[55] Epidemiology Branch, WA Health (data provided August 2021)

(n=43,505), the Kimberley (18,770) and the Pilbara (12,208) having the highest numbers of Aboriginal people. The size of WA, the sparse spread of small populations regionally and the limited provision of services (relative to need) by local and state governments mean that environmental health standards and programs may not always be applied equitably to remote and regional communities. This disparity is exacerbated in remote Aboriginal communities. Maps of the communities in each region are shown in Appendix 5.

The EHD is responsible for maintaining environmental health standards across WA, as auspiced under the Public Health Act 2016[56] and Health (Miscellaneous Provisions) Act 1911 (these Acts replace the former Health Act 1911). The services procured by the AEH Program are cross-referenced in the Sustainable Health Review in recommendations 3a and 3c to '*reduce inequity in health outcomes and access to care with focus on (a) Aboriginal people and families in line with the WA AHWF 2015–2030, and (c) People living in low socioeconomic conditions*'.

In large population areas such as Perth and major regional towns, legislative protection of public health generally performs well. The Health (Miscellaneous Provisions) Act 1911 has been the principal legislation regulating behaviours and factors that deal with risks associated with environmental health in regional and remote Aboriginal communities. However, LGAs historically have not enforced the Health Act 1911 in regional and remote WA Aboriginal communities (including town-based communities), as the vast majority of the approximately 400 regional and remote Aboriginal communities (including 238 permanent communities) are located on Crown Land (see Appendix 6). There is has been a perception that LGAs are not obliged to enforce the Health Act in these communities because the Crown is not bound by the Act. The more recent Public Health Act 2016 does bind the Crown to remove this perceived impediment for regulatory authorities. However, this alone is unlikely to change service provision universally by LGAs, given that this will incur costs. In addition, the provisions made in the Public Health Act 2016 will not cover the vast majority of Aboriginal communities located on Crown lease land until Stage 5 of the Act's implementation strategy, planned to commence in July 2022[57].

To address certain gaps in service provision, the AEH Program has been funded since 1994 to provide a range of services determined by key operational organisations with the capacity and will to deliver. As outlined in the original business case for the AEH Program, the EHD reached out to LGAs in the absence of alternative providers with AEH capacity and experience. Thus, what started as resourcing for local governments to provide additional services to remote Aboriginal communities has evolved (as of January 2021) into a hybrid of Community Service Agreements with four LGAs and 15 Aboriginal Medical Services (AMS) and Aboriginal Community Controlled Organisations (ACCOs) (see Table 3). The AEH Program traditionally focused on communities in remote areas in WA where access to services is compromised. While Aboriginal people residing in towns and cities are generally considered to have access to local government services, public utilities and health care systems[58], several studies suggest this is not always the case, citing lack of affordability, cultural unacceptability and lack of transport as reasons for this[59]. Moreover, several town-based communities in major towns live in substandard conditions. Consequently, the AEH Program now offers a limited level of services to Aboriginal people living in most regional centres within the four regions.

[56] https://www.healthywa.wa.gov.au/Articles/N_R/Public-Health-Act-2016
[57] https://ww2.health.wa.gov.au/Articles/S_T/Timeline-to-implement-the-Public-Health-Act-2016
[58] EHD business case, correspondence from Matthew Lester AEH Program Manager
[59] Ware, VA Improving the accessibility of health services in urban and regional settings for Indigenous people, Resource sheet no. 27 produced for the Closing the Gap Clearinghouse December 2013

The AEH Program delivers services to remote WA communities and town-based communities based on community needs, identified gaps in service delivery and processes informed by evidence on the management of environmental health-related issues. In line with the WA Environmental Health Directorate Strategic Plan 2020–2023 Priority 2.1, the EHD is responsible for:

- Coordinating the delivery of the AEH Program across WA to offer and provide environmental health-related services to remote Aboriginal communities;
- Conducting workforce development and regional training for environmental health practitioners working with regional and remote Aboriginal communities;
- Promoting and supporting the establishment and use of Community Environmental Health Action Plans (CEHAPs); and
- Implementing improvements in trachoma at-risk communities[60] including emergency plumbing repairs and safe bathroom assessments.

While the AEH Program targets several key environmental health areas, it does not deliver utilities (i.e. water, power), municipal services (i.e. waste management and roads) or housing to remote communities. However, it does provide a community presence that reviews the performance of services that directly impact community environmental health and living conditions.

The AEH Program currently contracts 19 service providers, including LGAs, AMS and ACCOs (see Table 3), focusing on the built environment. Importantly, the AEH Program directly employs Aboriginal people who live in or have a connection with the communities in which they work. The program currently employs 55–60 FTE environmental health practitioners, 75–80% of whom are Aboriginal[61].

The AEH Program encompasses an 'in-home' environmental health improvement program including the following components:

- Safe bathroom assessments
- Plumbing Emergencies
- Dog health
- Pest control
- Health promotion and education
- Referrals and follow up
- CEHAPs
- Training

The EHD states that:

> *"central to the program is the use of CEHAPs, which are developed for service delivery based on the priority needs of the remote community, by consultation, and the capacity of the service provider. They effectively comprise an agreement between the service provider and the community about what will be provided and the process through which services provision will be operationalised and recorded."*[62]

The EHD has recently developed a three-level approach to implementing 'in-home' environmental health improvement, promoting it as a 'best-practice model'. The model includes:

Level 1: Clinic referral system. A referral process from community clinics for people who have presented with preventable illnesses and could benefit from an environmental health assessment of their home. With patient consent, a referral from the clinic to the local environmental health service provider effects an assessment to determine that the health hardware in the home is functional and

[60] In 2019 WA identified 38 communities in four regions (Australian Trachoma Surveillance Report 2019. Kirby Institute, UNSW Sydney, Sydney NSW 2052)
[61] Robert Mullane, Principal Advisor Aboriginal Environmental Health, Science & Policy Unit, Environmental Health Directorate l email correspondence 07/12/21

supports the Healthy Living Practices[62]. Any deficiencies are identified and either repaired during the assessment or referred to the housing maintenance provider. It is now in place in many remote communities.

Level 2: Safe bathrooms. A priority initiative focused on ensuring, as far as possible, that households have access to safe and functional bathrooms for practising HLP1 (the ability of people to wash themselves). It identifies the health hardware in the bathroom to ensure people can shower safely using hot water, soap and individual towels. The follow-up process, in addition to remediating any deficiencies in bathroom hardware, involves the installation of mirrors and soap holders and the provision of soap to households. The EHD works with WA Country Health Services to adopt this as part of the Squeaky Clean Kids project recently developed for targeted trachoma in at-risk remote communities. Communities prioritised for Safe Bathrooms can be identified by community clinic evidence of the prevalence of other preventable diseases.

Level 3: Routine health hardware assessments. Involves performing rolling health hardware assessments, with community support, in all homes in remote communities, expanding this assessment to all areas of the home that support safe bathing, food preparation and storage, clothes washing and safe sleeping areas. All repairs are done during the assessment or referred to the housing maintenance provider. The health hardware assessments should be repeated in targeted communities every three months. This process is not in place, but the concept is strongly supported, and some pilot programs have recently commenced.

2.5.2 Aboriginal Environmental Health Program — Current Model

There are currently 19 service providers funded under the AEH Program. Details of the types of services invested in by region, drawn from Service Provider reports from July to December 2019 (pre-COVID), are included in Table 3,

Table 4 and Table 7. Further detail on program activities is provided in Section 4.3.

Table 3: Service providers, contract value, region and service delivery communities

Service delivery organisation	Contract amount	Region	Service delivery communities (as reported in July-Dec 2019 reports)
Bega Garnbirringu Health Service	$385,421	Goldfields	Mt Margaret, Wongatha Wonganara, Ninga Mia, Mulga Queen, Nambi Village, Cosmo Newberry, Tjuntjuntjarra, Kurrawang
Bundiyarra Aboriginal Community Aboriginal Corporation	$349,424	Mid West	Kardaloo, Barrell Well, Pia Wajari; this program also provides basic environmental health services to identified households in Geraldton
City of Kalgoorlie-Boulder	$238,771	Goldfields	Boulder Camp, Laverton, Ninga Mia, Cosmo Newberry, Leonora, Tjuntjuntjara, Irragul, Menzies, Wongatha Wonganarra Village, Kalgoorlie, Morapoi Station, Kurrawang, Mt Margaret, Mulga Queen, Nambi Village
Derbarl Yerrigan Health Service	$122,074	Perth	Perth Metropolitan area
Geraldton Regional Aboriginal Medical Service (Gascoyne) [1]	$260,000	Mid West	Carnarvon
Looma Community Inc	$103,158	Kimberley	Looma

[62] Healthabitat. The Healthy Living Practices. 2019. Mona Vale: Healthabitat Pty Ltd. http://www.healthabitat.com/the-healthy-living-practices. The Healthy Living Practices are a collection of nine guidelines that define the essential requirements to ensure people are able to live healthy lives. See Glossary for full list.

Service delivery organisation	Contract amount	Region	Service delivery communities (as reported in July-Dec 2019 reports)
Mawarnkarra Health Service	$217,298	Pilbara	Roebourne, Wickham, Karratha, Cheeditha, Mingalatharndu, Weymul Ngurrawana, Bindi Bindi (Onslow)
Menzies Aboriginal Corporation	$145,351	Goldfields	Indigenous population of Menzies townsite and MAC housing tenants
Ngaanyatjarra Health Service	$699,236	Goldfields	Irrunytju – Wingellina, Mantamaru – Jameson, Papulankutja – Blackstone, Warakurna, Wanarn
Ngangganawili Aboriginal Health Service	$196,942	Goldfields	Wiluna Town, Bondini Community, Windidda Community
Nindilingarri Cultural Health Service	$862,983	Kimberley	**Fitzroy Valley Communities:** Yiyili, Ganinyi, Pull Out Springs, Moongardi, Kupartiya, Mingingkala, Bawoorrooga, Galeru, Mimbi, Ngumpan, Wangkatjungka, Ngalingkadji, Djugerari, Yakanarra, Koorabye, Kadjina, Yungngora, Jimbalakudunj, Ngurtawarta, Mindi Rardi, Kurnangki, Bungardi, Junjuwa, Galamunda, Darlngunaya, Buruwa, Loanbun, Muludja, Gillarong, Bayulu, Karnparrmi, Joy Springs, Biridi, Fitzroy Crossing **Fitzroy Valley Schools:** Wulungarra CS Kulkarriya CS, Wangkatjungka Community School, Kulkarriya CommunityNgalapitaCS, Yakanarra CS, Bayulu CS, Djugerari CS, Muludja CS, Yiyili CS.
Nirrumbuk Aboriginal Corporation	$1,604,803	Kimberley	Kullari Region: One Arm Point, Djarindjin, Lombadina, Beagle Bay, Bidyadanga and surrounding outstations Kununurra region, including Nulleywah & Mirima town reserves and outlying communities of Molly Springs, Emu Creek, Guda Guda, Warrayu & Doon Doon (Kununurra area); joint visit with KPHU environmental health staff to Kalumbaru when organised Kutjungka communities of Balgo, Mulan and Billiluna; Halls Creek town-based communities and reserves and Halls Creek town itself when requested by the Shire Nirrumbuk provides service to communities when requested, if practical and feasible, e.g. Warmun
Paupiyala Tjarutja Aboriginal Corporation	$196,625	Goldfields	Tjuntjuntjarra
Pilbara Meta Maya Regional Aboriginal Corporation	$722,380	Pilbara	Tjaka Borda, Koombana, Jinparinya, Punja namml, Marta Marta, Warralong, Yandeyarra, Goodabinya, Irrungadji, Parnpajinya, Jigalong, Parngurr, Punmu, Kunawarritji
Puntukurnu Aboriginal Medical Service (Newman)[1]	$260,000	Pilbara	Punmu, Parngurr, Kunawarratji, Jigalong
Shire of Ashburton	$135,674	Pilbara	Wakuthuni, Bellary, Bindi Bindi, Peedamulla, townships of Paraburdoo, Onslow, Tom Price
Shire of Derby West Kimberley (taken over *Mowanjum Aboriginal Corporation)*	$500,866	Kimberley	Balginjirr, Biridu, Burawa, Burrinunga, Darlngunaya, Derby, Djimung Nguda, Djimbalakudunj, Djugerari, Dodnun, Galamanda, Gillarong, Imintji, Jarlmadangah, Joy Springs, Junjuwa, Karmulinunga, Karnparrmi, Kupungarri, Kurnangki, Loanbun, Looma, Pandanus Park, Mindi Rardi, Mowanjum, Muludja, Munmural, Ngalingkadji, Ngallagunda,

Service delivery organisation	Contract amount	Region	Service delivery communities (as reported in July-Dec 2019 reports)
			Ngumpan, Ngurtawarta, Wangkatjungka, Windjingayre, Yakanarra, Yungngora, Kadjina, Koorabye, Tirralintji and Yulumbu
Shire of Halls Creek	$254,522	Kimberley	Yiyili, Ganinyi, Pullout Springs, Mimbi, Moongardie, Bawaworraworra, Koonjie Park, Halls Creek town camps, Ringer Soak, Warmun, Frog Hollow, Violet Valley, Red Hill, Balgo, Mulan, Billiluna, Nicholson Block, Mardiwah Loop & Yardgee
Yulella Aboriginal Corporation	$250,265	Mid West	Meekatharra, Yulga Jinna, Cue, Mt Magnet and Buttah Winde, Burringarrah

CS: Community School; [1] Annual grant for delivery of AEH services to Aboriginal communities in the Gascoyne region only

Table 4: Resource allocation by region

Region	Contracts and grants value 2020/21 ($)	% of program	Est. State Aboriginal population	$ value/head 2020/21
Goldfields	$1,924,190	24.9%	5,631	$ 341.71
Kimberley	$3,483,475	45.1%	14,291	$243.75
Mid West	$859,689	11.1%	6,169	$139.36
Pilbara	$1,335,351	17.3%	8,365	$159.64
Perth Metropolitan Area	$122,074	1.6%	29,118	$4.19

There is considerable complexity in the Aboriginal community context in which the AEH Program is delivered, including coordination and communication with other service providers. Figure 3 outlines how the program fits into the various components of essential environmental/municipal services and the diseases associated with poor environmental infrastructure.

Table 5 below summarises the important environmental exposures that impact Aboriginal health, particularly in remote regions of Australia, and shows the corresponding requirements to ensure a healthy environment. Gaps and key partners are shown for each factor, reflecting areas of shared responsibility. Different communities have different agencies involved with multiple accountabilities. The complex nature of overlapping responsibilities, communication with agencies and gaps in services are explored further in the activity data, survey and consultation reporting sections. Specific activities offered by different providers are detailed in Section 4.3 (Service Provider Activity Analysis), and Excel spreadsheet available on request. Community and stakeholder perceptions are presented in Sections 4.5 and 4.6.

Table 5: Environmental risk factors (including their components) impacting Aboriginal health and cross-sectoral agencies responsible[1]

Risk factor group and agencies	Component risk factors	
1. Water quality, sanitation and hygiene ***Multiple agencies responsible, including WaterCorp, Departments of Communities and Health[2], community-based non-government organisations, governing Community councils***	Water treatment and fluoridation Rubbish removal Household food prep Monitoring Hand hygiene	Bathroom facilities Laundry facilities Soap stock Functioning toilet Functioning bathroom
2. Home condition ***Multiple agencies responsible, including Departments of Communities and Health[2], governing Community councils***	Maintenance Home hazards Crowding	Pests and vermin Pets (dog vectors) Temperature control
3. Indoor air pollution ***Communities, Households, Health****	Tobacco smoke Combustible fuels	Dust
4. Built environment & land ***Main Roads WA, LGAs, governing Community councils, REMS, contracted Store Management***	Road design Road maintenance Vehicle availability/safety Lighting Transport	Infrastructure Community shops Community hazards Injury risks
5. Non-occupational, non-domestic chemical exposure ***Industry, Landowners, Health[2], Departments of Environment/Water***	Environmental chemical levels Pesticides Exposure from industry	
6. Recreational environment ***LGAs, Departments of Communities and Health[2], REMS***	Pools Gardens Playgrounds	Bushland Oceans and rivers
7. Climate ***Multiple across all sectors; emergency services, Health[2]***	Air temperature Extreme weather (floods, cyclones)	Humidity
8. Public water resources ***LGAs, REMS, Communities, Health[2]***	Drainage Irrigation Wastewater removal	Water storage Insect vectors
9. Outdoor air pollution ***Industry, Transport, main roads, LGAs/REMS and governing Community councils***	Smog Transport pollution	Industry pollution Dust
10. Radiation ***Health[2], Industry***	UV radiation Ionising radiation	
11. Environmental noise	Non-occupational ambient noise	
12. Occupational exposures ***Industry, Health[2], LGAs***	Occupational noise Occupational chemical poisonings	Industry, health

Abbreviations: LGA, Local Government Authority, REMS Remote Essential and Municipal Services
[1] Adapted from McMullen et al.[63]; [2] Environmental health is part of Health contribution

[63] McMullen C, Eastwood A, Ward J. Environmental attributable fractions in remote Australia" the potential of a new approach for local public health action. Aust NZ J Public Health;2016; 40:174–180

3. METHODS

3.1 Methods: Literature Review

Given the significant contribution of the environment to Aboriginal health and wellbeing, there is a growing body of evidence and research in environmental health. However, while recognising the contributions of the literature in this area, we note that the methodologies used often involve narrow conceptions of health, as well as nature, land, or environments as inanimate, secular spaces. These publications have limited applicability in certain instances as they frequently fail to consider Aboriginal people's connection to land, sea, culture, spirituality, family and community. Given the variety of methods and approaches in this area of research, we conducted a meta-narrative literature review of AEH and wellbeing research.

3.1.1 Search strategy

Peer-reviewed research articles: Keywords were developed iteratively using relevant subject headings terms, indexed keywords and MeSH terms to search databases PubMed and CIHNAL PLUS. Boolean operators 'AND' and 'OR' were used to combine search terms across concepts to identify relevant and recent articles published from January 2010 onwards. The search terms were: ("Environmental health" OR "Environmental health determinant") AND ("Aboriginal" OR "Indigenous" OR "First Nation" OR "Torres Strait Island") AND ("close the gap").

Government reports, policies and non-indexed articles: Targeted searches were conducted using Google, Google Scholar, Australian National Library (i.e. TROVE) and the Aboriginal and Torres Strait Islander Health Bibliography. Steering Committee members, environmental health service providers from other jurisdictions and the Review Team were invited to submit documents from their collections.

The findings from the literature review are integrated into various parts of the report, including the Introduction, Case Studies and Options Paper.

3.2 Methods: Epidemiological and Primary Health Care Data Analyses

3.2.1 Routinely-collected health data related to Aboriginal Environmental Health in WA

The Review Team obtained information on the burden of environmental health-related disease among Aboriginal people in WA. The data were obtained from various data collections and government departments (Table 6). Hospital, death, RHD register and notifiable diseases are statutory data collections and thus have complete capture across WA.

Table 6: Type and source of population-level and primary health care data

Type of data	Data provided by	Years covered
Hospital separations	Epidemiology Branch	2015-2019
Notifiable diseases	Communicable Disease Control Directorate	2019, 2020
RHD notifications (RHD register)	WA RHD Control Program	2020
Emergency department	Unavailable in sufficiently robust form[1]	NA
PHC data (indicative data only)	AMS participating in a pilot	July 2020–June 2021

Abbreviations: PHC – Primary Health Care; RHD – Rheumatic Heart Disease

[1] Emergency Department data were excluded due to ED data in rural hospitals not being coded robustly for analysis

Two methods of attributing diseases to the environment were used: the WHO EAF for developed countries in the Western Pacific[64] and the KEAF[65]. The WA Epidemiology Branch only applied the KEAFs to the Kimberley, Pilbara, Mid West and Goldfields regions of WA, as these regions were considered the most comparable to the Kimberley, in terms of the remoteness level of Aboriginal communities, life circumstances, environment and health burden. Both estimates are provided here to provide results from comparative measures to aid decision-making as to the best methods of monitoring these health conditions in the future.

The complete set of aggregated data tables provided to the Review Team by the different data custodians is in Appendix 4. These data have been synthesised in the tables and figures presented in Section 4.2.

3.2.1.1. *Environment-attributable hospitalisations*

EAFs, using both methods outlined above, were applied to routinely-collected administrative WA hospitalisation data. These data provide demographic (including age, sex, Aboriginal status and region of residence) and clinical information (recorded using the International Classification of Diseases) relating to each hospitalisation. All admissions with a principal diagnosis code for any of the conditions in the WHO and KEAF list were counted and grouped by health region, broad age-group (0–14 years, 15–24 years, 25 years and over) and disease type. The percentage of each of the selected diseases that can be attributable to the environment, according to the WHO and KEAF methods, was then applied to the corresponding number of disease-specific counts to estimate the number of hospitalisations attributable to the environment by Aboriginal status, broad age group and region.

Obtained counts were then used to calculate health-region-specific age-standardised rates per 100,000 population. The precision of these rates is reflected in the 95% confidence intervals provided. Age-standardised RRs were calculated as the ratio of Aboriginal to non-Aboriginal rates, reflecting differences in rates between these populations.

Length of stay and costs associated with environmental attributable hospital admissions were also determined, overall and by health region. The contribution of specific diseases to the Aboriginal environment-attributable burden were ranked for each region and age group.

As mentioned in Section 2.2.2 the WHO EAFS and KEAFs differ with respect to the list of diseases and the percentage assumed to be attributable to the environment. Thus, the results from the WHO EAFs and KEAFs are presented separately. Where possible, the results from the two are compared directly to show the extent to which they provide different estimates of the environmental burden in the WA regional context.

3.2.1.2. *Communicable diseases notification data*

WA Health collects and collates counts of statutory disease notifications across WA. Numbers of notifications of a subset of diseases deemed to be environment-related (based on KEAF and WHO lists) were provided to the Review Team by region, age group and disease name. The KEAF and WHO fractions were then applied to the counts to provide count estimates of environment-attributable notifications.

3.2.1.3. *Additional information on acute rheumatic fever and rheumatic heart disease*

The WA RHD Control Program collates a register of patients with ARF and RHD in WA as part of a Commonwealth initiative. Notifications of ARF and RHD are required by law but are known to be

[64] Prüss-Üstün, Annette, Wolf, J., Corvalán, Carlos F., Bos, R. & Neira, Maria Purificación. (2017). Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. World Health Organization. https://apps.who.int/iris/handle/10665/204585

[65] McMullen C, Eastwood A, Ward J. Environmental attributable fractions in remote Australia: the potential of a new approach for local public health action. Aust NZ J Public Health;2016; 40:174–180

underestimated by about 23%[66]. The WA RHD Control Program provided the summary data for this Review.

3.2.2 PHC data from six Aboriginal community-controlled Aboriginal medical services

Extraction and analysis of PHC data covering July 2020 to June 2021 were undertaken jointly between the Review Team and AHCWA to examine the feasibility and potential of routine data extraction from existing electronic clinical record systems in PHC to provide evidence to support outcomes-based funding for diseases due to environmental conditions among Aboriginal people in WA that are not identified in hospital or other secondary health care records. This was an additional component to the AEH Program Review, outside the original scope, and is reported in detail in Appendix 3. However, preliminary findings and commentary on the barriers and enablers for obtaining these data are included in the Main Report to provide additional insights on the viability of access and potential utility of such data. Specifically, the focus of the pilot was primarily on the process for accessing, extracting, and analysing the data, including its governance, rather than the health care contact findings themselves. As such, 15 conditions deemed highly sensitive to the environment were included. This work extends previous work undertaken by the AEH Program team in partnership with various AMS in WA.

3.3 Methods: AEH Program Service Provider Activity Analysis

Tables were constructed for communities in each WA region that had data for at least one of the following:

- a CEHAP; or
- environmental health program activity data.

The number of CEHAPs for each community was determined from reporting documents provided by the EHD. In cases where service providers (e.g. Nindilingarri) provided a single CEHAP to cover multiple communities, this was recorded as a separate CEHAP for each listed community.

Environmental health activity data and service provider data for services funded through the AEH Program were obtained from program activity data provided by the EHD. Activity type was determined by the 'Environmental Health Category' variable. Frequency counts for each type of activity were determined by community. Service providers were categorised as either AMS, LGA or ACCO (Table 7). Cross-tabulations were performed to determine the type of service providers that delivered environmental health activities for each community for the following time periods:

- January 2017 – December 2019 (pre-COVID-19)
- January 2020 – December 2020 (COVID-19)
- January 2021 – June 2021 ('post'-COVID-19)
- All periods combined.

It is recognised that analyses of the hours of service for different activity types for each community, overall and by service provider, would have informed a comparison of investment of resources. However, the data were not deemed reliable enough to include these results. This was likely due to difficulties with the data input process used by service providers/workers resulting in inaccurate units of time being attributed to activities.

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[66] Agenson T, Katzenellenbogen JM, Seth R, Dempsey K, Anderson M, Wade V, et al. Case ascertainment on Australian registers for acute rheumatic fever and rheumatic heart disease. Int J Environ Res Public Health. 2020:17,5505: doi:10.3390/ijerph17155505

Table 7: Categorisation of service providers funded through the AEH Program

Type of Provider	Service Providers
ACCO[1]	Aboriginal Movement for Outback Survival Aboriginal Corporation[2] Bundiyarra Aboriginal Community Looma Community Inc Aboriginal Corporation Menzies Aboriginal Corporation Mowanjum Aboriginal Corporation[3] Nirrumbuk Environmental Health and Services Pty Ltd Paupiyala Tjarutja Aboriginal Corporation Pilbara Meta Maya Regional Aboriginal Corporation Yulella Aboriginal Corporation
AMS	Bega Garnbirringu Health Services Incorporated Carnarvon Medical Service Aboriginal Corporation (now a part of the Geraldton Regional Aboriginal Medical Service (GRAMS) Derbarl Yerrigan Health Service Mawarnkarra Health Service Aboriginal Corporation Ngangganawili Aboriginal Community Controlled Health and Medical Aboriginal Corporation Nindilingarri Health Services Inc Nyaanyatjarra Health Service Aboriginal Corporation Puntukurnu Aboriginal Medical Service
LGA	City of Kalgoorlie-Boulder Shire of Ashburton Shire of Derby West Kimberley Shire of Halls Creek Shire of Ngaanyatjarraku

Abbreviations: ACCO, Aboriginal Community Controlled Organisations; AMS, Aboriginal Medical Services; LGA, Local Government Authority

[1] ACCOs have been identified as such; however the EHD categorises these agencies as NFPs

[2] These service providers are not currently funded by the AEH Program but were during part of the reporting period for this review (January 2017 – June 2021)

[3] Provider has now merged with Shire of Derby West Kimberley but were a separate entity (with separate activity data) during part of the reporting period for this review (January 2017 – June 2021)

While not under the remit of the AEH Program, the EHD provided data on Remote Essential and Municipal Services (REMS) provision to communities. The time period for these data was not specified, so it was included in the summary table for all time periods. The number of REMS activity types was summed for each community. As outlined above, it is acknowledged that REMS is not under AEH Program management. However, the information related to REMS provision has been included in the report to provide additional context and reflect the extent of the system and the number of service providers involved in addressing environmental health conditions in WA communities.

Each community was classified as a 'Remote Aboriginal Community' or 'Town-Based Community or Reserve' as per data received from WA Health's EHD on the estimated Aboriginal population in remote communities. Communities not listed in these data were classified as 'Town', where this could be determined from external sources, or recorded as missing data (see below). Estimated population size (by category/range) and occupancy (permanent or seasonal) for each community were also obtained from this dataset. Communities not included in these data have missing data fields for these variables. Land tenure data for each community were obtained from the WA Department of Planning, Lands and Heritage's Land Use Management division. Communities were classed into one of five tenure types for this report: (i) ALT Estate; (ii) ALT Lease, (iii) Management Order; (iv) National Park; and (v) Reserve.

The dataset received by the Review Team specifically indicated communities that were 'ALT Estates' or 'ALT Leases' (communities with both tenure types noted were classed as 'ALT Lease'), with other classifications determined from information in the dataset under the 'Reserve Purpose' and 'Reserve

Vesting' fields. Communities were classified as: (i) 'Management Order', if this term was noted in the vesting information, except when the management order was made to ALTs and then this classification took precedence; (ii) 'National Parks', if this term or similar was noted in the purpose or vesting information; (iii) 'Reserves', if there were data in the purpose and vesting fields but no other category indicators present. Communities with management orders to ALTs were classified as ALT Estates or Leases.

It is noted that a more robust and complete list of land tenure types for all Aboriginal communities, and one that is easily accessible, would provide more accurate information for informing and basing government policy decisions (see Appendix 6 for further descriptions of land tenure). Activity data were also analysed to identify overlaps in service provision by funded service providers.

3.3.1 Additional data

As part of the AEH Program reporting requirements, service providers submit a narrative report every six months. While predominantly qualitative, the numbers of bathroom assessments and clinic referrals are included as quantitative measures in these reports (see Activity data findings in Section 4.3).

3.3.2 Missing data

Some service providers listed specific community names in their initial contract response documents (e.g. they were mentioned as communities that would receive an AEH service during the contract period). However, no AEH service provision activity data were recorded for these communities (Goldfields: Coolgardie, Kanpa, Marmion Village. Kimberly: Djilimbardi, Jillyung, Larinyuwar, Manawan, Pantijan, Purlawala, Udialla, Yarri Yarri, Yurmulun/Yirralalem). In addition, several Aboriginal communities in WA did not have any AEH service provision data recorded and are therefore not included in the tables.

There were 447 program activity data entries with 'Unknown' listed as the community and region. Where it was possible to determine the community with a high degree of certainty from the description provided in other parts of the report, these data were inserted (n=60, 13.4% of missing data). The remainder were not included in the summary tables, and this may have contributed to nil or low activity data frequencies for some communities for which data were incomplete or not available. Notably, one service provider (Kimberley region) accounted for most (74.5%) of the missing/'Unknown' data entries, but it was not possible to determine the community to which these entries should be attributed. This may have caused some bias in results for communities serviced by this provider.

Follow-up discussions with the EHD highlighted potential explanations for the lack of activity data or minimal reporting of some activity types for some communities, which should be considered when reviewing the activity data in this report. Potential reasons include:

- Temporary communities or camps that are not occupied year-round (seasonal camps), single-family dwellings or unoccupied communities. Seasonal camps generally represent homelands that are returned to during the year to carry out on-country responsibilities, thus requiring some basic infrastructure like bores and drop toilets. Many single-family communities do not seek assistance from program service providers.
- Some communities are satellites of major communities (notably, communities in the Dampier Peninsula). The service provision for these may have been attributed to the major communities during activity reporting, and thus extra activity may not be evident. Service providers may visit these communities during the year to check for inhabitants, and whether assistance is required. Some communities are only visited on request.
- Some communities (notably East Kimberley communities) are visited by service providers not contracted by WA Health, and therefore no activity data were available.

- The ‘Planning and Liaison’ health activity category was designed to record only COVID-19 related planning and liaison activities. It is therefore expected that data would only be recorded in 2020 and 2021. As per contract requirements, all other regular planning activities are meant to be reported in the six-monthly written report.

3.3.3 Data cleaning and assumptions

Some community names varied across data sources or included incorrect spelling or alternate names. The names shown in the table represent the combined and corrected community names as far as could be ascertained from other WA Health data and/or external sources.

Program activity data were analysed as received, using the environmental health classifications service providers allocated at the time of data input. Based on additional information in the comments section of the reporting template, some variation was noted between providers as to which classification was used when allocating tasks. It was beyond the scope of this Review to analyse all entries in detail, but the interpretation of results should take this potential source of error into account.

Wiluna was included in the Mid West region for reporting on activity data, as this is the region it was assigned to in the activity data and CEHAPs. However, it is acknowledged that operationally, and for regional Aboriginal Health Forums and planning, Wiluna relates to the Goldfields region.

It is also noted that the City of Kalgoorlie-Boulder is not technically a ‘local’ government authority and provides services to numerous communities in its capacity as a ‘regional’ provider. However, for simplicity of reporting, it has been included in the LGA category of service provider.

3.4 Methods: Costing

WA Health’s EHD and Purchasing and System Performance Division provided most of the data and summary calculations for AEH Program costs. Some additional total costs were also calculated to inform the Review. WA Health’s Epidemiology Branch provided data on environmental attributable hospitalisations costs, using Diagnostic Related Group data from the WA Hospital Morbidity Data Collection.

Two additional datasets were provided relating to the number of reported hours spent delivering services by service providers funded through the AEH Program. One was an unadjusted dataset, with the number of reported hours as entered directly by the service providers for all reported activities and in line with the program activity data presented in this report. The other was an adjusted dataset, with the number of reported hours adjusted by the EHD to reflect hours attributable to contracted activities more accurately. Summary figures for both datasets are presented with all costs in Australian dollars. The data included in the report reflect the most recent, complete version of the data received. The Review Team received a subsequent version of the adjusted data (including additional reported hours by service providers), but the complementary unadjusted data were unavailable, so the earlier versions were used for this report to enable comparison.

3.5 Methods: Surveys

Service provider, community and other stakeholder surveys were conducted to garner perceptions of AEH services and programs provided in townsites and communities (town-based, regional, and remote) across WA. Survey respondents were assured that all responses would be confidential, with data de-identified for reporting purposes. While a survey of this nature was not part of the original Review methodology, given the vast geographical area of WA, it was undertaken to add to the diversity of feedback sources. Survey questions were developed iteratively by the Review Team and completed by participants online. Surveys comprised a mixture of categorical response, close-ended and open-ended questions (see Appendix 7 and 8 for questionnaires).

The service provider survey was sent to all current AEH Program service providers. A total of 26 survey responses with responses were received, covering 100% of the 19 funded service providers.

The community and stakeholder surveys targeted individual community members and agencies in towns and Aboriginal communities who received AEH services. While the survey was sent directly to a range of stakeholders providing AEH-related services, it was also shared with anyone who may have been able to provide additional insight into the delivery of AEH services. There were 45 responses to this survey.

3.6 Methods: Qualitative Data

Extensive in-depth qualitative interviews (n=179) were conducted separately with service providers, stakeholders (including relevant agencies that interact with or are potentially impacted by AEH issues) and community members from the Kimberley, Pilbara, Goldfields and Mid West regions between July and October 2021. The total number of participants, their roles and Aboriginal representation are detailed in Table 8 and Table 9. There was a high degree of representation of Aboriginal participants in all groups interviewed. Additionally, interview data were augmented by relevant Aboriginal media reports, AHCWA AEH Conference findings and qualitative comments included in the survey to provide more contextual information.

Table 8: Number of participating service providers, by role and Aboriginality

Service providers	Aboriginal	Non-Aboriginal	Total
Chief Executive	3	5	8
Division Head/Manager	1	9	10
Program Manager/Coordinator	7	4	11
Aboriginal Environmental Health Worker	16	2	16
Clinic Manager/General Practitioner	0	3	3
Total	**29 (60.4%)**	**19 (39.5%)**	**48 (100%)**

Table 9: Number of community members and stakeholders by position and Aboriginality

	Aboriginal	Non-Aboriginal	Total
Community members	30	0	30
Director/Chairperson	7	0	7
Health Worker	17	31	48
LGA Worker	0	5	5
Education workers	6	6	8
Other Stakeholders	21	12	33
Total	**81 (61.7%)**	**50 (38.2%)**	**131 (100%)**

The value of using a qualitative research approach in the Review consultation resides in its context specificity and ability to include different stakeholder perspectives and experiences. A thematic analysis was conducted to identify common themes.

Qualitative data from interviews were thematically analysed and only incorporated into findings when they represented recurrent themes. Key themes are illustrated with participant quotes that are representative of the overall perspectives and themes of participants. Multiple and, at times, opposing/contradictory perspectives are included for completeness.

To ensure the quality and rigour of the qualitative findings and allow for rich insights, the results are described in a thematic narrative and not quantified or collapsed into frequencies.

However, drawing on both the survey findings and the consultations enabled the quantitative and qualitative components to be integrated to produce more meaningful conclusions. It is important to note that the qualitative analyses reported here do not attempt to mimic the quantitative data (surveys). Rather, it provides alternative standards to ensure that the quality and rigour of the analysis of the perspectives of multiple stakeholders are captured in ways that quantitative research is unable to do.

The research questions for the community and stakeholder consultations were endorsed by the Review Steering Committee as appropriate and specific to the data collection. The consultation processes involved individual and small group interviews that lasted between 35 and 90 minutes (see Appendix 9 for discussion prompts). Wherever practical, two team members conducted the interviews, either recorded or notes taken and then transcribed. While qualitative data analysis strives to be rigorous and robust, the focus here is on confirmability and transferability rather than generalisability of the data.

The reliability of the data and analysis is enhanced through extensive engagement with stakeholders and community members. The strengths of qualitative research findings involve in-depth detail about beliefs and perceptions of the participants with respect to their understanding of the AEH Program and their actual experiences within their built environments. These descriptions contribute greatly to the context-specific thematic reasoning outlined in the report.

Actual excerpts of representative data (participant comments) are presented and contextualised so that conclusions can be made on the basis that the analysis of these results is rigorous or reliable. Additional comments are included in Appendix 10.

3.7 Limitations

The reported findings need to be considered in light of known limitations in the data sources and data collection methods used. Concerning disease burden, our methods relied heavily on inpatient hospitalisations data known to underestimate the actual health and cost burden of environment-related health conditions. In addition, given the exploratory nature of the PHC pilot, this work did not have comprehensive coverage and the methods used could be more fully developed.

The service activity data, while large in volume, varied in quality and completeness such that service provision and resource utilisation could not be accurately ascertained or compared. It was not possible to discern the reason for observed overlaps in some services. Importantly, these activity data do not provide clear insight into AEH Program outcomes as they are almost solely activity-based in their focus.

While all service provider organisations participated in the survey for this Review, the responses were dependant on the knowledge and perspectives of participants. The survey methodology was limited in that most questions were closed, with limited response types allowing a full exploration of issues. Some of these limitations were addressed in the detailed qualitative interviews with stakeholders and community members. Qualitative data collection methods focus on the perspectives and opinions of participants, providing in-depth insights. The purposive sampling attempted to obtain diverse participants representing a range of views.

The synthesis of all the findings from multiple sources allows conclusions to be drawn. Below we provide the results of each method separately, including conclusions that consider the method used. Our recommendations and Options Paper are based on informed interpretation of a summation of these findings.

4. FINDINGS

Drawing together all the findings from the data sources below, the Review found that there is a strong need for the continuation of the AEH Program with assured ongoing funding. In addition, extensive evidence highlights the need for additional new funding to address needs outside the remit of the current AEH Program. Despite the many examples of good practice in the current AEH Program, the findings also indicate a strong need for system changes to meet the environmental health needs of communities served. In particular, given the diverse government sectors, agencies and funding streams responsible for providing environmental health services, there needs to be a greater focus on more formal inter-sectoral communication, greater transparency, greater executive level engagement with the Aboriginal controlled sector and greater high-level advocacy. The system strengthening policy drivers inherent in the AHWF and the National Agreement on Closing the Gap confirm the mandate for implementing recommendations from the AEH Program Review (see Options Paper).

As outlined above, the findings must be considered in light of the identified data and methodological limitations (see Section 3.7).

4.1 Environmental Health Research Literature

This section overviews the main findings from the meta-narrative review that focused on best-practice models to address the impacts of environmental factors on Aboriginal health, both in Australia and internationally. In particular, the literature review considered specific issues experienced by Aboriginal people living in remote and very remote contexts and the enduring and transgenerational impacts of colonisation on Aboriginal health and wellbeing. Literature that provides evidence of the links between environmental factors and health has been integrated throughout the Main Report, the Background section, the Case Studies and the Options Paper.

The reviewed First Nations and AEH studies from the USA, Australia, Canada and New Zealand described various environmental inequalities based on differences in exposure to environmental risks, access to amenities and the associated health burden. They largely focused on:

- Reviewing policy and research practice[67,68,69,70,71]
- Specific factors such as housing access[72,73], clean water[74,75] and wastewater disposal[76]

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[67] Chakraborty A, Daniel M, Howard NJ, Chong A, Slavin N, Brown A, et al. Identifying Environmental Determinants Relevant to Health and Wellbeing in Remote Australian Indigenous Communities: A Scoping Review. Int J Environ Res Public Health. 2021;18(8).

[68] Dudgeon P Walker, RWR, Scrine C, Shepherd C, Calma T, Ring I. Effective strategies to strengthen the mental health and wellbeing of Aboriginal and Torres Strait Islander people. Australia: Australian Institute of Health and Welfare; 2014.

[69] Gupta H, Tari-Keresztes N, Stephens D, Smith JA, Sultan E, Lloyd S. A scoping review about social and emotional wellbeing programs and services targeting Aboriginal and Torres Strait Islander young people in Australia: understanding the principles guiding promising practice. BMC Public Health. 2020;20(1):1625.

[70] Johnston L, Doyle J, Morgan B, Atkinson-Briggs S, Firebrace B, Marika M, et al. A review of programs that targeted environmental determinants of Aboriginal and Torres Strait Islander health. Int J Environ Res Public Health. 2013;10(8):3518–3542.

[71] Luke JN, Ferdinand AS, Paradies Y, Chamravi D, Kelaher M. Walking the talk: evaluating the alignment between Australian governments' stated principles for working in Aboriginal and Torres Strait Islander health contexts and health evaluation practice. BMC Public Health. 2020;20(1):1856.

[72] Pholeros P, Lea T, Rainow S, Sowerbutts T, Torzillo PJ. Improving the state of health hardware in Australian Indigenous housing: building more houses is not the only answer. Int J Circumpolar Health. 2013;72.

[73] Standen JC, Morgan GG, Sowerbutts T, Blazek K, Gugusheff J, Puntsag O, et al. Prioritising Housing Maintenance to Improve Health in Indigenous Communities in NSW over 20 years. International Journal of Environmental Research and Public Health. 2020;17(16):5946.

[74] Bradford LEA, Bharadwaj LA, Okpalauwaekwe U, Waldner CL. Drinking water quality in Indigenous communities in Canada and health outcomes: a scoping review. International Journal of Circumpolar Health. 2016;75(1):32336.

- Exposure to particular pollutants such as lead, dust and asbestos[77,78,79]
- Specific health conditions such as trachoma[80], skin infections[81], ARF/RHD[82] and lung disease[83].

These studies provide valuable background information on AEH challenges and successes. However, they only explain part of the burden of environmental inequalities for these populations. The benefits and harms for AEH are highly dependent on individual policy characteristics and a range of contextual factors. However, as some studies suggest, co-benefits influencing the built environment '*are rarely considered in decision-making leading to biased policies and goal failures*'.[84] As a result, the reviewed studies offer limited insight, suggestions or models for addressing the environmental health challenges at a systemic level; instead, they provide useful information on best-practice components that could be incorporated into a more comprehensive model.

In general, the literature shows that health and environmental policies, programs and services increasingly recognise the crucial role of Aboriginal cultures, land ownership, diverse geographic and socioeconomic circumstances and equitable access to services. Innovative Australian interventions resulting from local community–service–researcher collaborations focusing on RHD, trachoma and skin studies are making some inroads but have not been implemented at the broad government systems level, highlighting the need for greater dissemination and policy and practice and the translation of data, information and research findings addressing health prevention and health promotion of infectious diseases at the community level.

4.1.1 Lessons to develop best-practice models for environmental health programs

This literature review identified historical and current work relevant to the current AEH Program Review, including key reports and examples of AEH programs, policy and planning that used best-practice principles. Evidence from the literature (described below) is also reflected in the Case Studies below) and Options Paper.

AEH has a long history. The language has changed over the past 30 years, but the concepts, intentions and shortcomings essentially remain. A 1998 consultation with communities in the NT identified similar themes to those echoed today—program effectiveness is enhanced by developing partnerships between AEHWs and environmental officers, creating formal training within communities, and

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[75] Rajapakse J, Rainer-Smith S, Millar GJ, Grace P, Hutton A, Hoy W, et al. Unsafe drinking water quality in remote Western Australian Aboriginal communities. Geographical research. 2019;57(2):178–188.
[76] Islam M, Yuan Q. First Nations wastewater treatment systems in Canada: Challenges and opportunities. Cogent Environmental Science. 2018;4(1):1458526.
[77] Clifford H, Pearson G, Franklin P, Walker R, Zosky G. Environmental health challenges in remote Aboriginal Australian communities: clean air, clean water and safe housing,. Australian Indigenous Health Bulletin 15, (2) pp. 1–13; 2015.
[78] Knibbs LD, Sly PD. Indigenous health and environmental risk factors: an Australian problem with global analogues? Glob Health Action. 2014;7:23766
[79] Meltzer GY, Watkins BX, Vieira D, Zelikoff JT, Boden-Albala B. A Systematic Review of Environmental Health Outcomes in Selected American Indian and Alaska Native Populations. J Racial Ethn Health Disparities. 2020;7(4):698–739.[11–13];
[80] Shattock AJ, Gambhir M, Taylor HR, Cowling CS, Kaldor JM, Wilson DP. Control of trachoma in Australia: a model based evaluation of current interventions. PLoS Negl Trop Dis. 2015;9(4):e0003474.
[81] Hendrickx D, Amgarth-Duff I, Bowen AC, Carapetis JR, Chibawe R, Samson M, Walker, R. 2020 Barriers and enablers of health service utilisation for childhood skin infections in remote aboriginal communities of Western Australia. Int J Environ Res Public Health. 2020; 17(3)
[82] Haynes E, Mitchell A, Enkel S, Wyber R, Bessarab D. Voices behind the Statistics: A Systematic Literature Review of the Lived Experience of Rheumatic Heart Disease. Int J Environ Res Public Health. 2020 Feb 19;17(4):1347. doi: 10.3390/ijerph17041347. PMID: 32093099; PMCID: PMC7068492.
[83] Laird, P, Walker R, Lane M, Totterdell J, Chang AB, Schultz A. 2020. Recognition and management of protracted bacterial bronchitis in Australian Aboriginal children" a knowledge translation approach. *Chest.* https://doi.org/10.1016/j.chest.2020.06.073
[84] Mikael Karlsson, M., Eva Alfredsson, A. & Westling, N. (2020) Climate policy co-benefits: a review, Climate Policy, 20:3, 292–316, DOI: 10.1080/14693062.2020.1724070.

creating additional employment opportunities[85]. Significant barriers to program effectiveness include the inability of funding arrangements to deliver community control and ownership of the program, unclear roles/expectations, inadequate support and training, and community dynamics. A clear framework (including ongoing and meaningful consultation process), improved program management and greater Aboriginal participation are needed. Lessons of the past confirm the following essential elements in designing and implementing an environmental health program in an Aboriginal context:

- ***A clear project logic framework*** informed by high level, co-designed Aboriginal health policies and improved management, accountability, community governance and partnerships[86].
- ***Inter-agency cooperation*** addressing the needs and priorities of communities to promote effective inter-agency collaboration on issues relating to AEH[87].
- ***A single state-wide coordinating process or committee*** focusing solely on AEH. A whole-of-government approach is required to ensure multi-sectoral problem solving and accountability. Prevention should remain the main focus for this entity[88].
- ***Appropriate design and construction*** regulated through codes of practice, as exemplified by Housing and Environmental Infrastructure Development in Aboriginal Communities[89] and the Housing for Health Guide[90] (previously called the National Indigenous Housing Guide).
- ***A strong integrated, accountable structure*** involving the Aboriginal community-controlled sector and coordinated by an appropriate government department is needed to manage the interface between health, environmental health and other sectors[91].
- ***Community development and human-centred design principles***[92] recognising inter-sectoral linkages within Aboriginal communities are crucial for supporting sustainability and processes where communities identify challenges/prioritiess[93].
- ***The capacity of WA Health's AEH Program*** needs to be appropriately resourced with sufficient FTE to undertake the required evaluation, needs analysis and advocacy at appropriate levels of government, and in-house expertise across a range of areas strengthened. The capacity of EHD staff should also be enhanced in terms of skills relating to evaluation, needs analysis and advocacy at appropriate levels of government. In-house expertise across a range of areas should be maintained and preferably expanded in the EHD[94].
- ***Culturally appropriate/validated tools*** for evaluating AEH are needed to allow comprehensive and comparable data collection across communities. Models of well-tested tools exist that allow place-based co-design processes. The Healthy Community Assessment Tool (HCAT) has been

[85] Standen G. A study of an Aboriginal environmental health worker program in the top end of the NT. Masters of Public Health dissertation. University of Sydney 1998.
[86] Standen G. A study of an Aboriginal environmental health worker program in the top end of the NT. Masters of Public Health dissertation. University of Sydney 1998
[87] Urbis Keys Young,. "Accountability in Indigenous Environmental Health Services–Australia 2002." (2002).
[88] Stoneham M, Daube M. Future directions for Indigenous environmental health in Western Australia. Public Health Advocacy Institute of WA. 2009
[89] Environmental Health Needs Coordinating Committee (2000) Code of Practice for Housing and Environmental Infrastructure Development in Aboriginal Communities in Western Australia Environmental Health Needs Coordinating Committee Inter-Governmental Working Group, Western Australia
[90] https://www.healthabitat.com/resources/housing-for-health-the-guide/
[91] Standen et al ibid
[92] Human-centred design principles: 1. Understand and identify the core problem; 2. Observe and take a people focus; 3. Test and retest; 4. Take a whole of system approach (e.g. Loudon, G. 2021. "Indigenous research methodologies: The role of human-centred design in indigenous research" In: Heritage, Paul, (ed.) Indigenous Research Methods: Partnerships, Engagement and Knowledge Mobilisation. People's Palace Projects, London, UK, pp. 54-70. ISBN 978-1-3999-0787-3
[93] Stoneham M, Daube M. ibid
[94] Stoneham M, Daube M. ibid

shown to benefit community leaders, government officers and stakeholders[95,96]. The HCAT process strategically facilitates inter-agency communication by providing a common language resulting in close collaboration between all agencies and multi-pronged approaches. However, local stakeholders have less power to direct the course of action where resource allocation and distribution are impacted by regional, state or federal level policies or programs. Versions of the HCAT have been trialled/used extensively around Australia, with positives outcomes, including by the WA EHD.

4.1.2 Lessons from other Australian jurisdictions

This section provides a brief review of key features in AEH plans and programs from Qld, SA and NSW to provide additional relevant background and context of what other Australian jurisdictions have undertaken in relation to AEH.

4.1.2.1. *Queensland Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022*[97]

In its third iteration, the environmental health planning for Queensland's remote and discrete communities focuses on developing partnerships between environmental health and clinical care, providing environmental health advocacy across government and supporting workforce development. Implementation of the Plan is through 16 discrete Aboriginal local governments funded by the Queensland Health Aboriginal and Torres Strait Islander Public Health Program to employ local workers to oversee and manage environmental health in their communities.

The plan also seeks to provide an evidence base by consolidating information from various sources to provide an overview of environmental health in Aboriginal communities. A baseline of infectious diseases and hospitalisation rates for LGAs will be compiled and used to set health performance indicators for environmental health actions and engage government stakeholders with clear evidence of the interactions between built environments and disease.

4.1.2.2. *South Australian (SA) Aboriginal Environmental Health Plan 2021–2025*[98]

The SA AEH Plan guides state-wide environmental public health planning processes, programs and service delivery. It provides a framework for ongoing inter-sectoral partnerships and coordinated actions based on a shared understanding to encourage other relevant sectors (e.g. housing, local government council) to address environmental factors that influence community living conditions. The Plan outlines six key priority areas and their corresponding actions, focusing on nine Healthy Living Practices originally defined in the landmark 1986 Uwankara Palyanku Kanintjaku Report[99]. The SA AEH Model is described in Figure 6.

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[95] McDonald EL, Bailie R, Michel T. (2013) Development and trialling of a tool to support a systems approach to improve social determinants of health in rural and remote Australian communities: the healthy community assessment tool. *Int J Equity Health.* Feb 26; 12:15.

[96] Tsou, C., Green, C., Gray, G., & Thompson, S. C. (2018). Using the Healthy Community Assessment Tool: Applicability and Adaptation in the Midwest of Western Australia. *International Journal of Environmental Research and Public Health, 15*(6), 1159. https://doi.org/10.3390/ijerph15061159

[97] Aboriginal and Torres Strait Islander Environmental Health Plan 2019–2022. State of Queensland (Queensland Health), Brisbane 2019

[98] Graham P, Howard N, Chakraborty A, 2020, South Australian Aboriginal Environmental Health Plan 2021–2025, Department for Health and Wellbeing, South Australia Government, Adelaide, South Australia

[99] Uwankara Palyanku Kanyinjtaku (UPK), Strategy for Well Being. A review of public and environmental health on the Anangu Pitjantjatjaraku Lands. 1986, Nganampa Health Council: Alice Springs

4.1.2.3. *NSW Aboriginal Environmental Health*

NSW AEH activities focus on their Healthy Housing for Health Program. Improving living environments guided by the nine Healthy Living Practices[100] and using a 'Survey and Fix' process to identify and repair items around the home that will give the best health outcome, particularly for children under five years old.

NSW AEH is also a partner in the Aboriginal Communities Water and Sewerage Program that aims to improve water supply and sewerage services in 62 eligible Aboriginal communities. The program is a joint initiative of the NSW Government and the NSW Aboriginal Land Council and involves an investment of more than $200 million over 25 years for the maintenance, operation and repair of water supply and sewerage systems. Aboriginal Affairs is the lead government agency, while NSW Health plays an important role by monitoring health standards for water and sewerage systems in the communities involved. Since the ACWSP commenced in 2008, there have been verified improvements in water quality and infrastructure including water disinfection.

NSW AEH also has a strong commitment to Aboriginal Environmental Health Officer traineeships, comprising a six-year 'earn and learn' opportunity. NSW Health partners with local councils, local health districts and other agencies who have knowledge and skills in environmental health to employ trainees. High-level technical advice is often disregarded in the administrative overseeing, managing, and implementing of public housing programs.

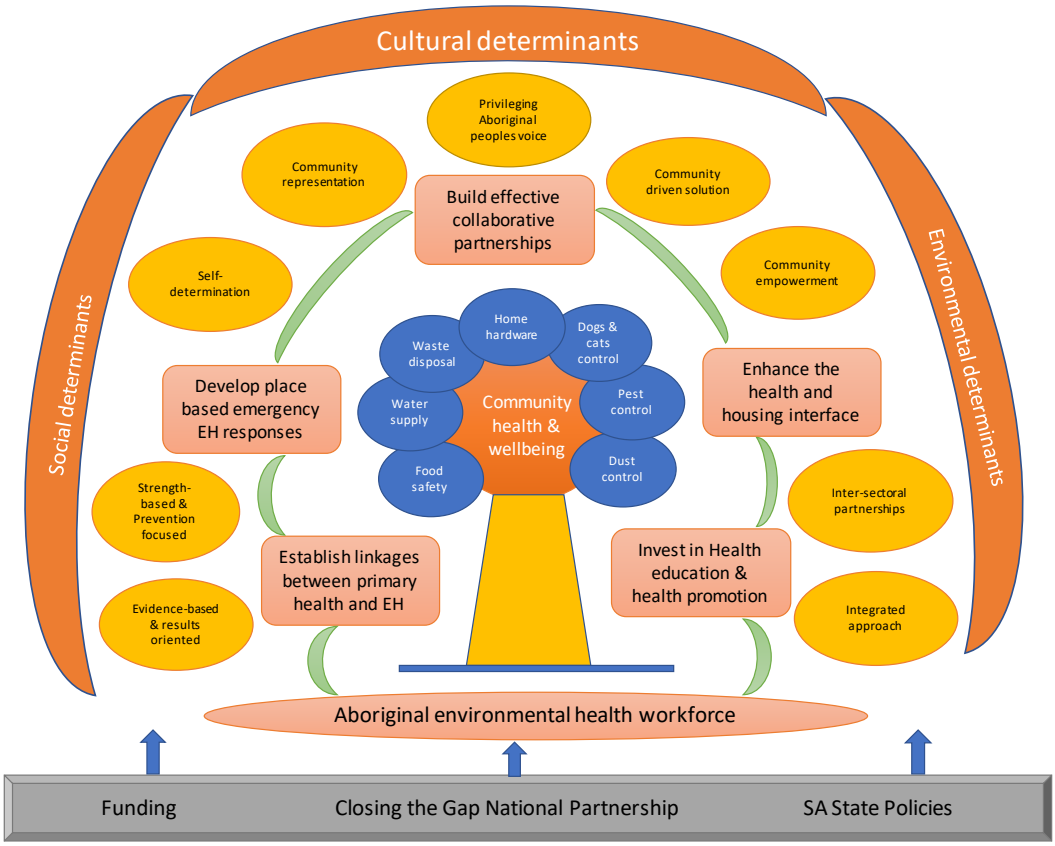

Figure 6: South Australian Aboriginal Environmental Health Model

[100] Uwankara Palyanku Kanyinjtaku (UPK), Strategy for Well Being. A review of public and environmental health on the Anangu Pitjantjatjaraku Lands. 1986, Nganampa Health Council: Alice Springs

4.2 Epidemiological and Health Service Findings

This section provides results from routinely-available health data on the burden of environmental-attributable conditions at the population level across all regions of WA. Such data are important for monitoring progress to reduce the burden of disease contributed by the environment, yet the data sources and measurement tools have limitations.

4.2.1 Routinely-collected health data related to Aboriginal Environmental Health in WA

4.2.1.1. *Hospitalisation data*

The WHO method

The WHO method for determining EAFs for health conditions (see Appendix 4) identified 19,996 hospital admissions in 2019 among Aboriginal people living in the 10 WA health regions, translating into 3,215 environmental-attributable admissions, 12,488 bed days and $22.82 million in hospital costs (Table 10).

Age-standardised rates of all environment-attributable admissions were consistently and substantially higher in Aboriginal than non-Aboriginal people across all WA health regions (Figure 7, Table 10 and Table 11), with RRs between the two populations ranging from 1.7 (South West) to 4.0 (Pilbara). For example, Aboriginal people in the Pilbara were four-times more likely to be hospitalised due to an environment-related health condition than non-Aboriginal people, with the difference statistically significant as indicated by the non-overlapping 95% confidence intervals. Of note are the relatively high rates of environmental-attributable Aboriginal admissions in the metropolitan regions.

Using the WHO method, mental health was the leading cause of environment-related hospitalisations among Aboriginal people in the southern regions of WA, including the Perth metropolitan area. At the same time, unintentional injuries ranked highest in the northern regions and ranked highly in other regions. Lower respiratory infections and falls ranked highly in the northern regions (Appendix 4).

Table 10: Number of environment-related hospital admissions, length of stay and costs, by health region, for Aboriginal people, 2019 (using WHO EAFs)

Health region	Total admissions	No. EnvR admissions	Age-standardised hospitalisation rate			EnvR bed days	EnvR cost ($M)
			EnvR rate per 100,000	95% CI: lower	95% CI: upper		
Kimberley	5,370	838	5,395.28	4,975.57	5,814.99	2,753	5.31
Pilbara	2,315	368	4,051.74	3,439.85	4,663.64	1,240	2.54
Mid West	1,805	281	3,828.01	3,314.33	4,341.68	1,058	2.03
Goldfields	1,364	222	3,519.13	2,984.02	4,054.24	946	1.75
Wheatbelt	845	141	4,120.17	3,335.76	4,904.58	511	0.93
South West	709	115	2,737.18	2,103.19	3,371.17	418	0.76
Great Southern	530	86	3,965.51	2,714.16	5,216.87	366	0.62
North Metro	1,506	248	4,360.08	3,504.90	5,215.26	1,255	1.89
East Metro	3,580	581	4,027.37	3,556.85	4,497.89	2,524	4.4
South Metro	1,972	335	3,643.85	3,083.92	4,203.78	1,417	2.59
WA	**19,996**	**3,215**				**12,488**	**22.82**

Abbreviations: CI, Confidence Interval; EAF, Environmental Attributable Fraction; EnvR, Environment-related; $M, Australian dollars in millions; Metro, metropolitan; WHO, World Health Organization

Table 11: Number of environment-related hospital admissions, length of stay and costs, by health region, for non-Aboriginal people, 2019 (using WHO EAFs)

Health region	Total admissions	No. EnvR admissions	Age-standardised hospitalisation rate			EnvR bed days	EnvR cost ($M)
			EnvR rate per 100,000	95% CI: lower	95% CI: upper		
Kimberley	1,630	256	1,682.32	1,440.33	1,924.30	820	1.85
Pilbara	2,491	338	1,016.07	873.49	1,158.65	1,226	2.56
Mid West	7,039	1,094	1,791.25	1,679.99	1,902.51	4,844	8.66
Goldfields	4,562	706	1,538.02	1,422.05	1,653.98	3,101	5.63
Wheatbelt	9,791	1,508	1,708.02	1,614.23	1,801.80	7,950	11.87
South West	21,348	3,302	1,655.50	1,596.58	1,714.42	14,410	25.18
Great Southern	7,599	1,234	1,753.18	1,647.59	1,858.76	6,529	9.4
North Metro	77,957	11,560	1,489.43	1,461.99	1,516.87	60,981	91.87
East Metro	70,024	10,943	1,543.03	1,513.84	1,572.23	52,118	88.2
South Metro	70,419	10,742	1,497.00	1,468.22	1,525.78	49,236	83.55
WA	**272,860**	**41,683**				**201,215**	**328.77**

Abbreviations: CI, Confidence Interval; EAF, Environmental Attributable Fraction; EnvR, Environment-related; $M, Australian dollars in millions; Metro, metropolitan; WHO, World Health Organization

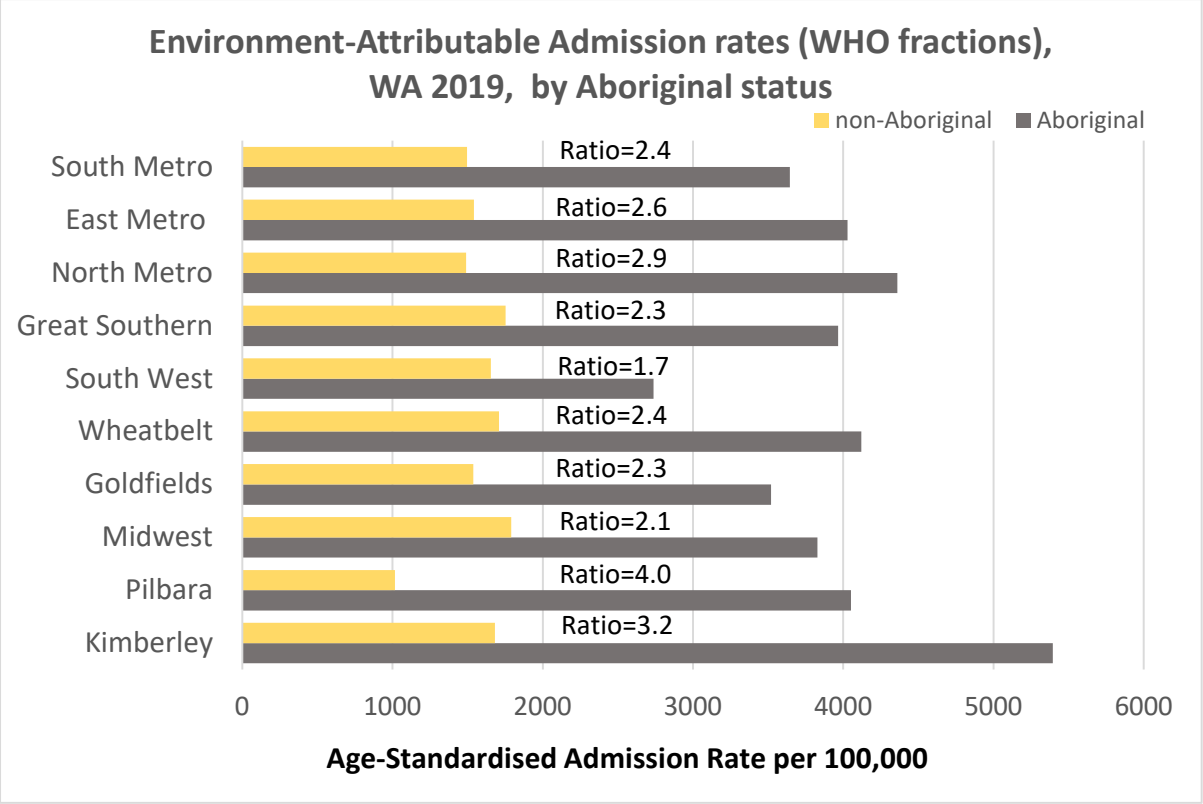

Figure 7: Environment-attributable admission rates and ratios (WHO EAFS), WA 2019

Table 12: Ranking of Aboriginal environmental-related number of admissions and costs (2015–2019), by cause and health region (WHO method)

	Kimb	Pilb	Mid W	Gold	Wheat	S West	Gr South	N Metro	E Metro	S Metro
Unintentional injuries	1	1	1	1	2	2	3	2	2	2
Lower respiratory tract infections	2	2	3	2	4	5	4	7	5	7
Falls	3	3	2	5	1	3	6	4	4	4
CVD (not RHD)	6	4	4	4	3	4	2	6	3	5
Mental health / psychosocial	5	5	5	3		1	1	1	1	1
Violence	4	6	7	6		8			8	
Cancer	7	7	6	9	6	6	5	5	6	6
Diarrhoeal disease	8	8	8	8	8	10	9	10	10	8
Chronic lung disease (incl. COPD)	9	9	9	10	7			8	9	9
Asthma	10	10			9	9	8	9		
Poisonings			10	7	5	7	7	32	7	3
Cataracts										10

Abbreviations: COPD, Chronic Obstructive Pulmonary Disease; CVD, Cardiovascular Disease; E Metro, East Metropolitan; Gold, Goldfields; Kimb, Kimberley; Mid W, Mid West; N Metro, North Metropolitan; Pilb, Pilbara; RHD, Rheumatic Heart Disease; S Metro, Metropolitan; S West, South West; Wheat, Wheatbelt

Leading cause 2nd leading cause 3rd leading cause

Among Aboriginal Western Australians, environmental-attributable hospital admission rates were substantially higher among adults 25+ years than children (0–14 years) and adolescents (15–24 years) across all health regions. Apart from the Goldfields and Pilbara, adolescents had higher rates than children in all regions (Figure 8 and Appendix 4).

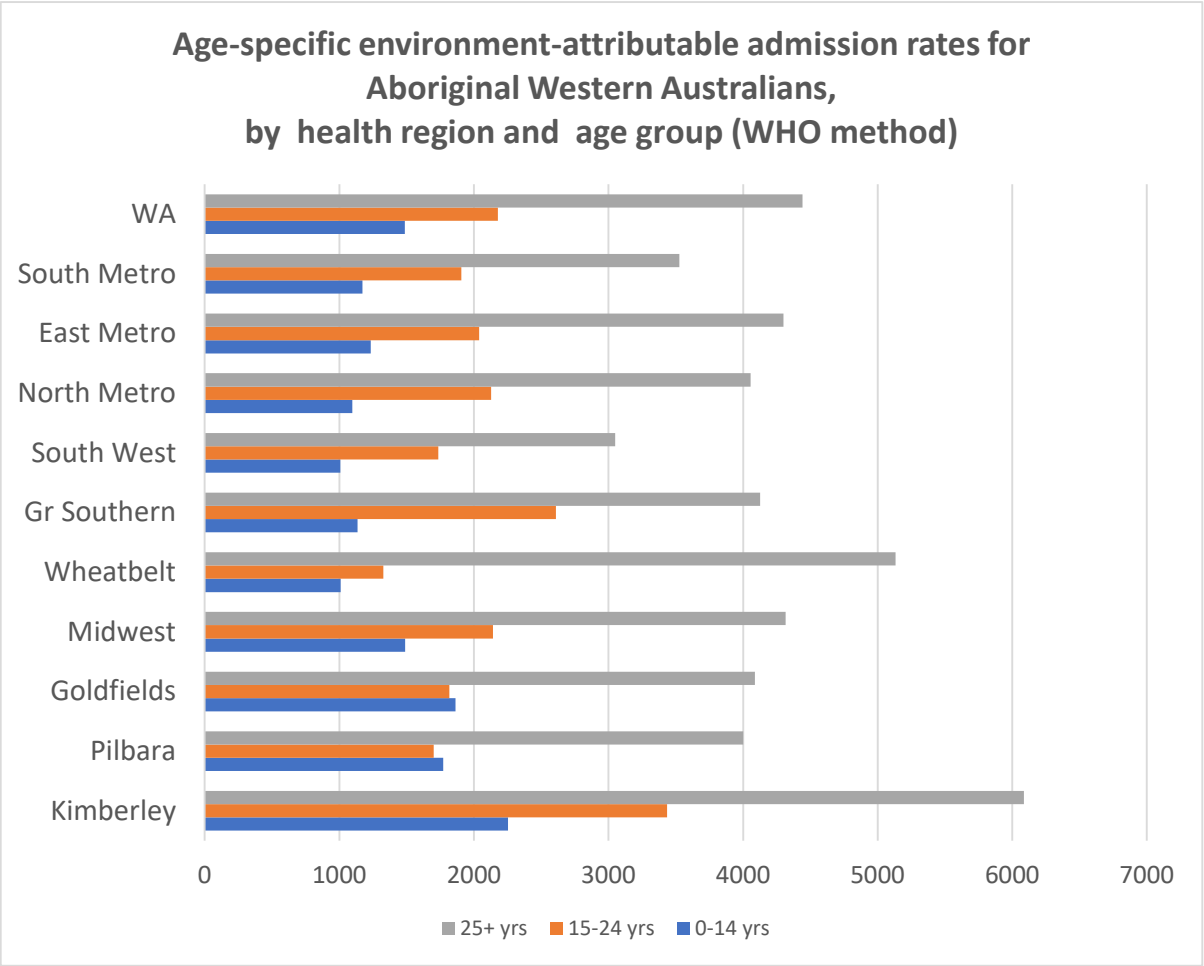

Figure 8: Age-specific environmental attributable hospitalisation rates for Aboriginal Western Australians, by health region and broad age group using the WHO method

KEAF method

The KEAF method identified 10,791 hospital admissions among Aboriginal people living in the four northern WA health regions (Kimberley, Pilbara, Goldfields, Mid West), translating into 5,613 environmental-attributable admissions, 18,504 bed days and $38.04 million in costs to the WA health system in 2019 (Table 13 and Appendix 4). Thus, the KEAF method estimated substantially higher rates of environment-attributable hospitalisations among Aboriginal people than the WHO method, with RRs between 2.0 (Goldfields) and 3.4 (Pilbara) (Figure 9, Table 13 and Table 14).

Figure 9 compares the rates from the two methods for determining EAFs, showing that the WHO method yields much lower estimates than the KEAF method for Aboriginal and non-Aboriginal populations in WA. Similarly, when examining the four northern regions for which the KEAFs were applied, the WHO method yields much lower hospital costs ($11.63 million) attributable to the environment than the KEAF method ($38.04 million)—a difference of $26.41 million—suggesting that current costings undertaken by WA Health are considerably underestimated. This has implications for how environmental-attributable burden is measured, costed, funded and monitored over time in WA settings.

Table 13: Number of environment-related (EnvR) hospital admissions, length of stay and costs, by health region, for Aboriginal people, 2019 (using KEAF)

Health region	Total admissions	No. EnvR admissions	Age-standardised hospitalisation rate			EnvR bed days	EnvR cost ($M)
			EnvR rate per 100,000	95% CI: lower	95% CI: upper		
Kimberley	5,307	2,776	17,134.02	16,402.25	17,865.79	8,970	18.00
Pilbara	2,315	1,210	12,248.73	11,236.95	13,260.50	3,700	7.89
Mid West	1,805	947	12,586.84	11,664.27	13,509.40	3,178	6.80
Goldfields	1,364	680	10,590.15	9,654.85	11,525.44	2,656	5.35
Total	**10,791**	**5,613**				**18,504**	**38.04**

Abbreviations: CI, Confidence Interval; EnvR, Environment-related; KEAF, Kimberly Environmental Attributable Fraction; $M, Australian dollars in millions

Table 14: Number of environment-related (EnvR) hospital admissions, length of stay and costs, by health region, for non-Aboriginal people, 2019 (using KEAF)

Health region	Total admissions	No. EnvR admissions	Age-standardised hospitalisation rate			EnvR bed days	EnvR cost ($M)
			EnvR rate per 100,000	95% CI: lower	95% CI: upper		
Kimberley	1,630	927	6,234.65	5,760.33	6,708.97	2,377	5.85
Pilbara	2,491	1,394	3,641.73	3,366.97	3,916.48	3,336	7.94
Mid West	7,039	3,798	6,213.12	6,006.00	6,420.23	12,866	25.23
Goldfields	4,562	2,422	5,261.39	5,047.26	5,475.53	8,198	16.72
Total	**15,722**	**8,541**				**26,777**	**55.74**

Abbreviations: CI, Confidence Interval; EnvR, Environment-related; KEAF, Kimberly Environmental Attributable Fraction; $M, Australian dollars in millions

The RRs between Aboriginal and non-Aboriginal populations using the WHO and KEAF methods also differed according to age group (Table 15, derived from Appendix 4). The 0 to 14-year age group had higher RRs using the KEAF method (RR range: 1.8-3.3) than the WHO method (1.2–2.3), likely driven by the exclusion of skin infections by the WHO EAFs; the 25+-year age group mostly had higher RRs using the WHO method. The WHO method yielded somewhat higher differentials for environmental-related hospitalisations between Aboriginal and non-Aboriginal populations than the KEAF method.

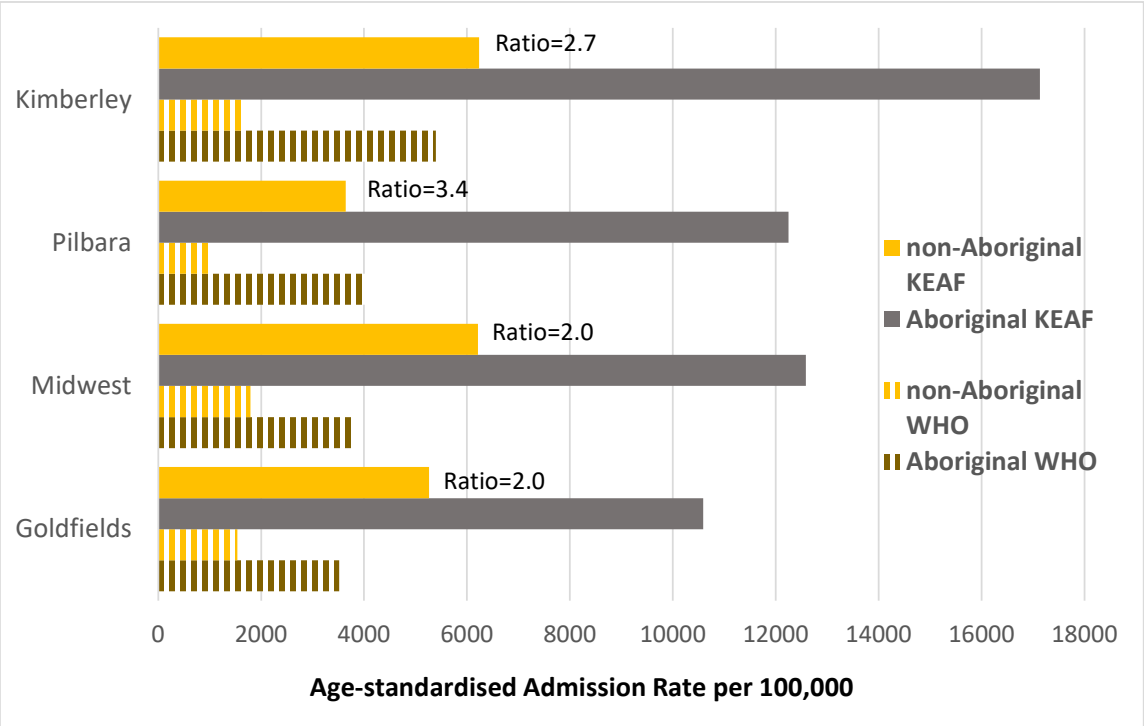

Figure 9: Environment-attributable hospital admission rates (KEAF fractions), northern WA 2019, by Aboriginal status

Table 15: Aboriginal to non-Aboriginal environment-attributable hospitalisation age-standardised rate ratios by attributable fraction method (WHO or KEAF), health region and broad age-group, WA 2019

	WHO method Age-specific ASRR (Aboriginal/non-Aboriginal)			KEAF method Age-specific ASRR (Aboriginal/non-Aboriginal)		
	0–14	15–24	25+	0–14	15–24	25+
WA	2.1	2.1	2.2	–	–	–
South Metro	1.8	2.0	1.7	–	–	–
East Metro	1.7	2.0	2.2	–	–	–
North Metro	1.6	2.0	2.0	–	–	–
Goldfields	2.0	1.6	2.4	2.5	1.4	1.9
Kimberley	2.3	2.1	3.8	3.3	1.8	3.1
Mid West	1.6	1.5	1.8	1.8	1.2	1.7
Pilbara	2.1	1.5	5.5	2.5	1.6	4.6
South West	1.3	1.4	1.3	–	–	–
Wheatbelt	1.2	1.0	2.0	–	–	–
Great Southern	1.2	1.6	1.6	–	–	–

Abbreviations: ASRR, Age-Standardised Rate Ratio; KEAF, Kimberly Environmental Attributable Fraction; WA, Western Australia; WHO, World Health Organization

Skin infections and unintentional injuries were the leading cause of environment-attributable hospitalisations (by a large margin) using the KEAF method for the four northern regions, with estimated costs of $39.12 million and $35.31 million, respectively, over five years. Various types of

trauma contributed substantially to the disease and cost burden. Lower respiratory infections and non-RHD cardiovascular disease mostly ranked third and fourth (Table 16 and Appendix 4). Skin infections are excluded from the WHO conditions considered attributable to the environment, and thus the two methods could not be compared.

Table 16: Ranking of Aboriginal environmental-related number of admissions and costs (2015-2019), by cause and health region (KEAF method)

	Kimberley	Pilbara	Mid West	Goldfields
Skin infections	1	1	1	1
Unintentional injury incl dog bite	2	2	2	2
Cardiovascular disease (not RHD)	4	3	3	3
Lower respiratory infections	3	4	5	4
Falls	5	5	4	5
Violence	6	7	9	8
Mental health / psychosocial	7	8	6	6
Diarrhoeal diseases	8	9	8	7
Otitis media	9			9
Cataracts	10	10	10	10
Traffic accidents		6	7	

Leading cause; 2nd leading cause; 3rd leading cause

Limitations: Although providing State-wide coverage, hospital data only identify people with diseases serious enough to be admitted for inpatient care. Emergency and outpatient data are not included; thus, disease burden will be substantially underestimated. Additionally, the data presented here only identify cases that considered the principal diagnosis (rather than secondary diagnoses). For these reasons, PHC data can provide additional important indications of ambulatory service use in a community setting (see results of pilot study below).

4.2.1.2. *Communicable diseases notification data*

Previous analyses of WA notification data reported that age-adjusted notification rates of various communicable diseases in 2017 were consistently and substantially higher among Aboriginal compared with non-Aboriginal WA populations, reflected by age-adjusted rate ratios of 8.5 for hepatitis C (40% of WA cases), 2.5 for hepatitis B (45% of cases), 3.0 for chlamydia (24% of cases), 10.4 for gonorrhoea (29% of cases) and 6.6 (9.2% of cases)[101]. After age adjustment, tuberculosis was 4.0 times more likely among Aboriginal Western Australians from 2010–2014.

Notification counts without applying fractions

A total of 3,231 and 3,547 environmental health-related communicable disease notifications among Aboriginal people (no attributable fractions applied) were made to WA Health in 2019 and 2020, respectively (Appendix 4). Of the 3,547 notifications in 2020 (Appendix 4), the Kimberley region contributed 36%, Metropolitan 26%, Pilbara 15%, Goldfields 10% and Mid West 8% (Appendix 4) of

[101] Australian Indigenous HealthInfonet. Overview of Aboriginal and Torres Strait Islander health status in Western Australia. Retrieved 10 February 2022 from https://healthinfonet.ecu.edu.au/learn/health-facts/overview-aboriginal-torres-strait-islander-health-status/

all notifications for environmental health-related communicable disease. The remaining regions contributed 1–2% each.

Notification counts after applying fractions

In 2020, after applying the Kimberley and WHO EAFs, 393 and 323 communicable disease notifications, respectively, were estimated to be attributable to the environment. The KEAF estimates identified 59% from non-sexually transmitted infection conditions, while the WHO approach identified only 11% from such conditions (Figure 10 and Appendix 4). This is likely due to the additional conditions included in the KEAFs (notably ARF and RHD), and a higher fraction of sexually transmitted infections applied by the WHO method (see Appendix 4).

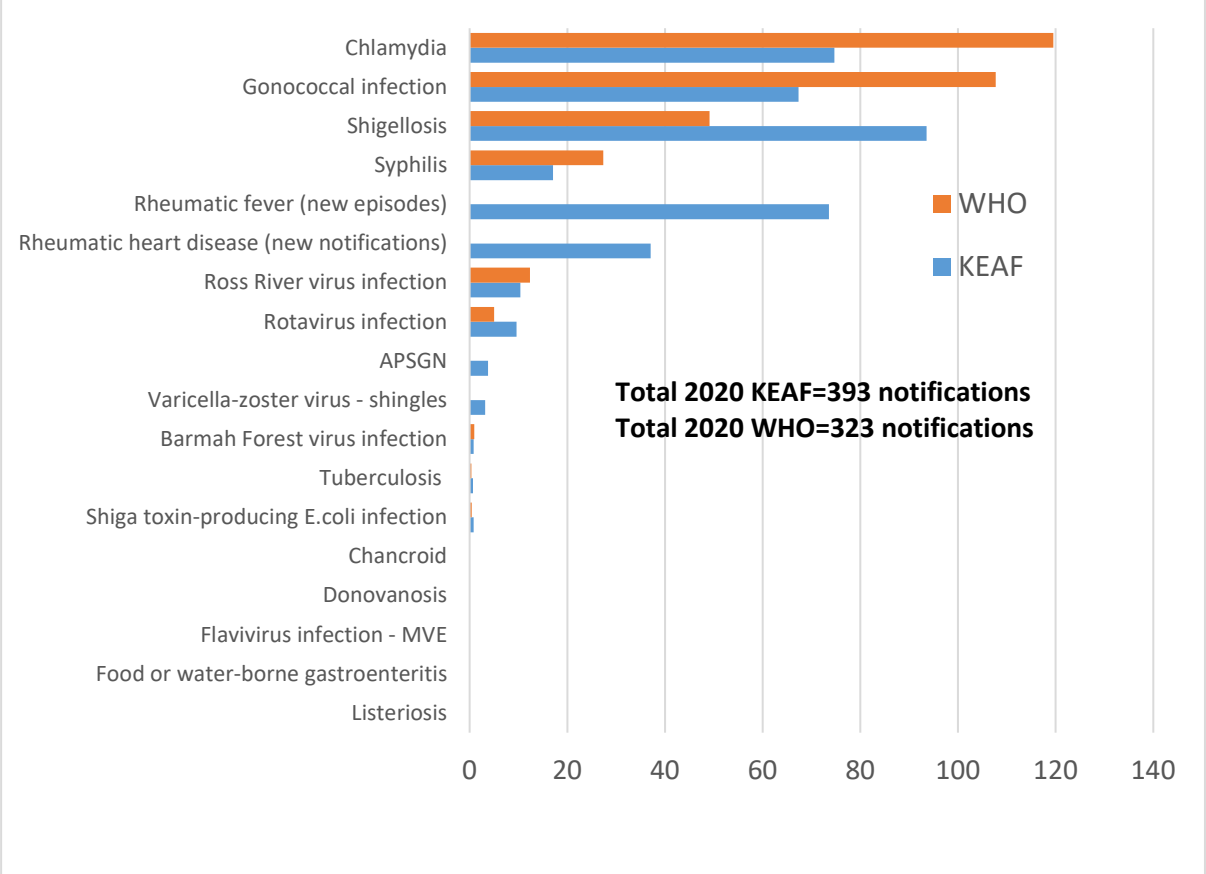

Figure 10: Counts of environment-attributable disease notifications, by disease, WA 2020

In 2020, the Kimberley, Perth Metropolitan and Goldfields regions had the most environment-attributable notifications for communicable diseases (Figure 11). The KEAF method estimated higher environment-attributable attributable notifications than the WHO method for all northern regions, particularly in the Kimberley where RHD/ARF imparted the highest environmental health-attributable burden among the notifiable diseases selected (40% of total).

The KEAF method also yielded a higher proportion of environment-attributable notifications for communicable disease among children 0–14 years (28%) than the WHO method (12%). The opposite was true for the 15 to 24-year age group (30% and 44%, respectively). The two methods yielded similar counts in the 25+-year group (Figure 12). The specific contributions of separate diseases to age groups are included in Appendix 4.

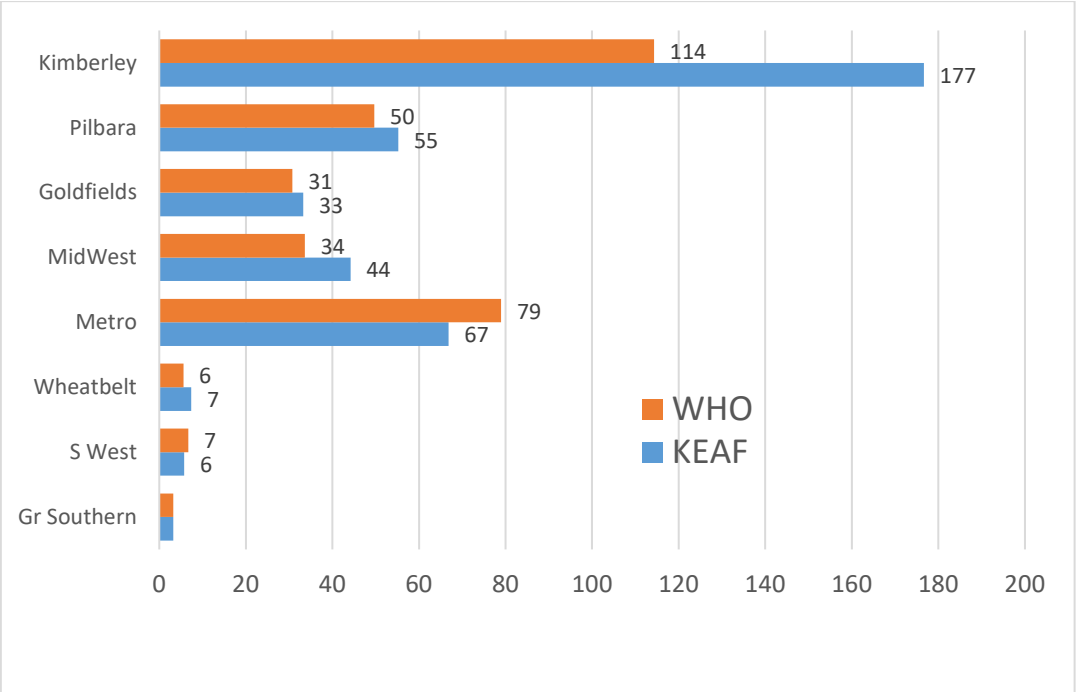

Figure 11: Counts of environment-attributable disease notifications, by region and method (KEAF vs WHO), Western Australia 2019

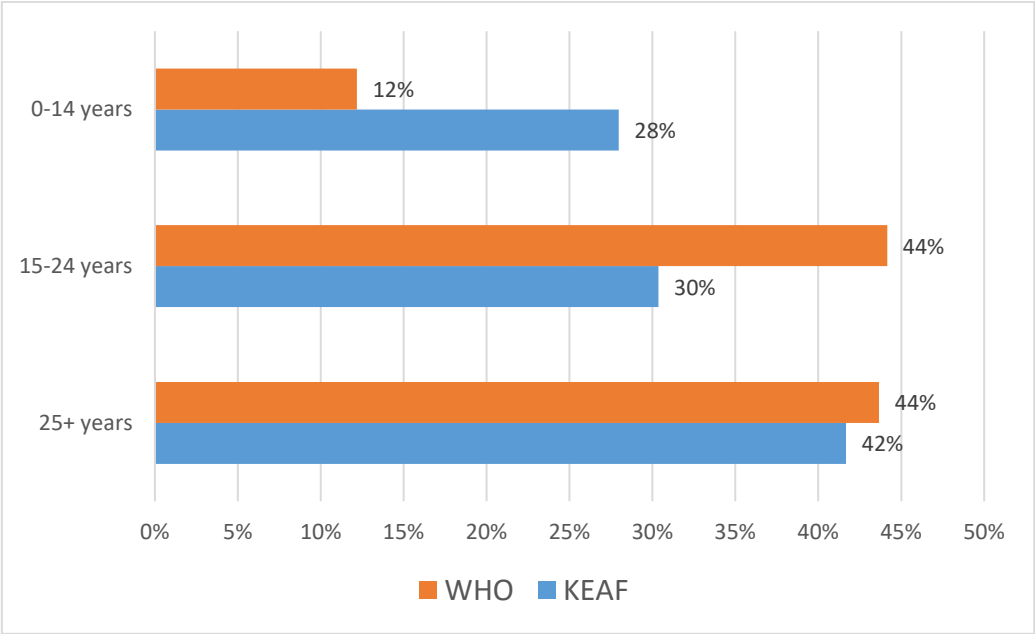

Figure 12: Age-distribution of environment-attributable disease notification proportions, by EAF method, WA 2020

4.2.1.3. *Additional information on acute rheumatic fever and rheumatic heart disease*

As of 31 December 2020, the WA RHD control program had registered 1,044 Aboriginal people of all ages (80% <45 years) who live in WA with a history of ARF and/or RHD (Appendix 4).

The 'End RHD in Australia: Study of Epidemiology' estimated an annual average of 867 Aboriginal people living in WA with a history of ARF and/or RHD <55 years from 2015–2017, identifying people from both the register and hospital admission data[102]. Aboriginal people accounted for 80% of all WA ARF/RHD cases identified. On average, Aboriginal people living in WA with ARF or RHD died at 42 years of age. Half of those deaths were directly attributable to RHD or complications.

Additional information from the RHD register, including age-specific counts, is available in Appendix 4. Further research data from The University of Western Australia (UWA) End RHD: Study of Epidemiology project are available on request.

Limitations: Although notifications are required by law for specific conditions, these are often under-reported due to missed diagnosis or clinician omission. Consequently, notifications might be underestimated, as is true for ARF and RHD[103].

4.2.2 Primary Health Care 'pilot'

As outlined above, the PHC data analysis presented in the Main Report represents an exploratory 'pilot' study initiated through the Steering Committee after the original Review scope was determined to investigate the process for obtaining PHC data for future evaluation. Consequently, we report mainly on the process with a few indicative results to illustrate the type of data available through co-design from AMS electronic records (see also Appendix 3).

4.2.2.1. Sources of attribution of disease burden to environment

Given time restraints and scope limitations, this pilot only used KEAFS as a source of environmental attribution for health conditions and further limited clinical items to those with EAFs ≥ 80% (n=15 conditions; see full report).

4.2.2.2. Workforce to undertake data extraction

The ACCHS sector in WA has a skilled workforce to extract useful aggregated data from PHC systems, particularly when the design of what is needed must be Aboriginal-led in alignment with the National Agreement on Closing the Gap. Central data extraction by Telstra is not required for successful and standardised record extraction from CommuniCare systems used in most WA ACCHS.

4.2.2.3. Denominators

Counts of items are insufficient. Suitable denominators are also required; hence, we also extracted the number of people attending the service and the number of clinical items used.

4.2.2.4. Selected indicative data

- Approximately 27,000 clinical items were recorded for 'highly sensitive' environment-attributable conditions (i.e. conditions defined as ≥80% attributable to the environment). Once the fractions were applied, approximately 25,000 clinical items were estimated to be directly attributable to the environment using KEAFs.

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[102] Katzenellenbogen JM, Bond-Smith D, Cunneen R, Dempsey K, Cannon J, Stacey I, Wade V, De Klerk N, Greenland M, Sanfilippo FM, Brown A, Carapetis JR, Wyber R, Nedkoff L, Hung J, Bessarab D. Ralph AP. Contemporary incidence and prevalence of rheumatic fever and rheumatic heart disease in Australia using linked data: the case for policy change. J Am Heart Assoc 2020;9:e016851. DOI: 10.1161/JAHA.120.016851

[103] Agenson T, Katzenellenbogen JM, Seth R, Dempsey K, Anderson M, Wade V, et al. Case ascertainment on Australian registers for acute rheumatic fever and rheumatic heart disease. Int J Environ Res Public Health. 2020:17,5505: doi:10.3390/ijerph17155505

- The three Kimberley AMS (covering the largest population) contributed over 85% of clinical items for highly sensitive environment-attributable conditions from all six participating AMS (Figure 13).
- The 25+ year age-group (covering the largest age range) accounted for approximately 60% of the clinical item load from highly sensitive environment-attributable conditions in all six participating AMS (Figure 13; pie chart). More than one-quarter of these clinical items were in the 0 to14-year age group.

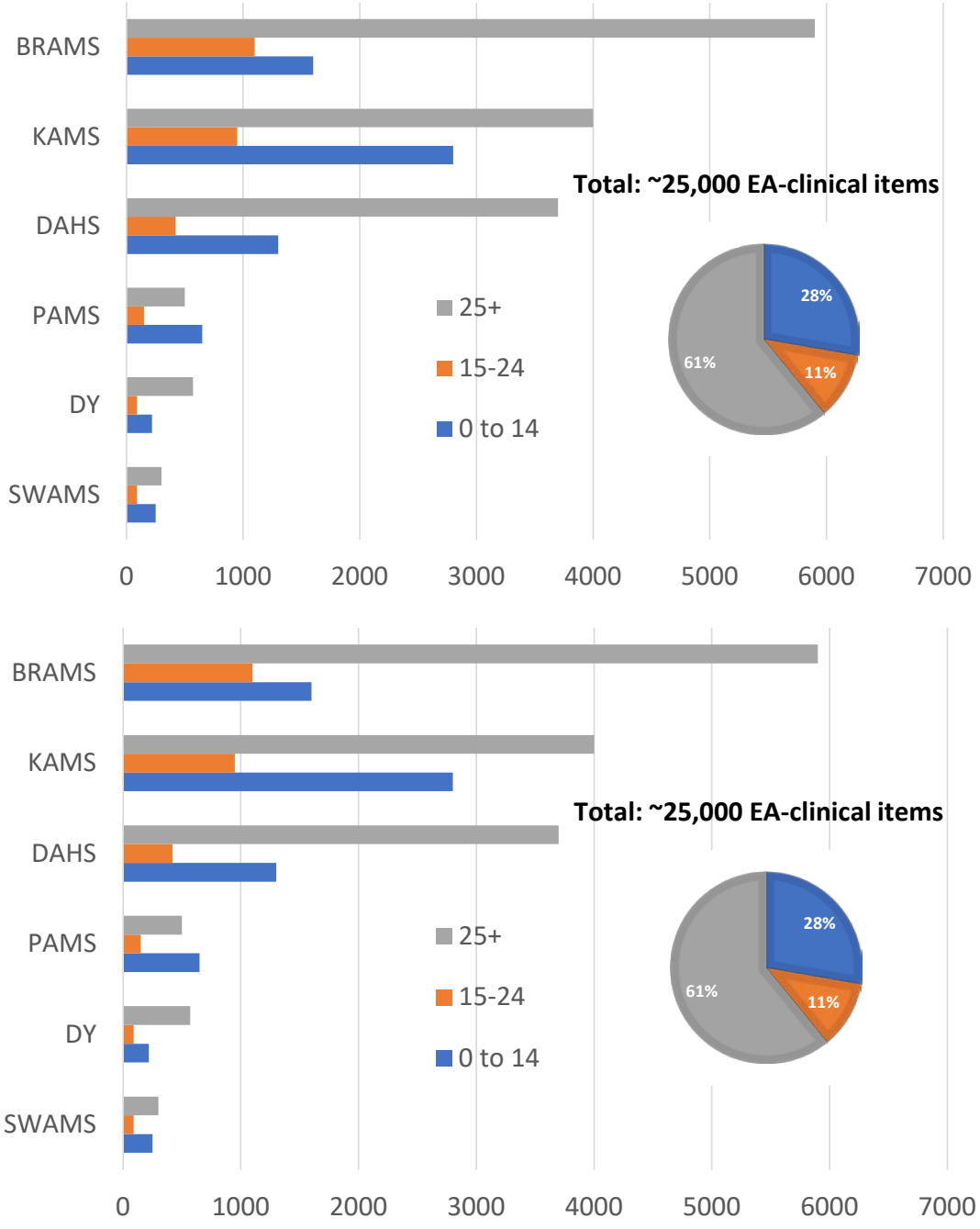

Figure 13: Total of highly-sensitive* environment-attributable clinical items in primary care by Aboriginal Medical Service and age group: July 2020–June 2021 (indicative data)

*conditions ≥80% attributable to the environment

Across all AMS, unintentional injury and skin infections contributed the highest number of highly sensitive environment-attributable conditions recorded (Figure 14). Skin infection was the highest contributor to highly sensitive environmental clinical items in children 0–14 years seen in primary care. AMS-specific data will be made available to the services separately.

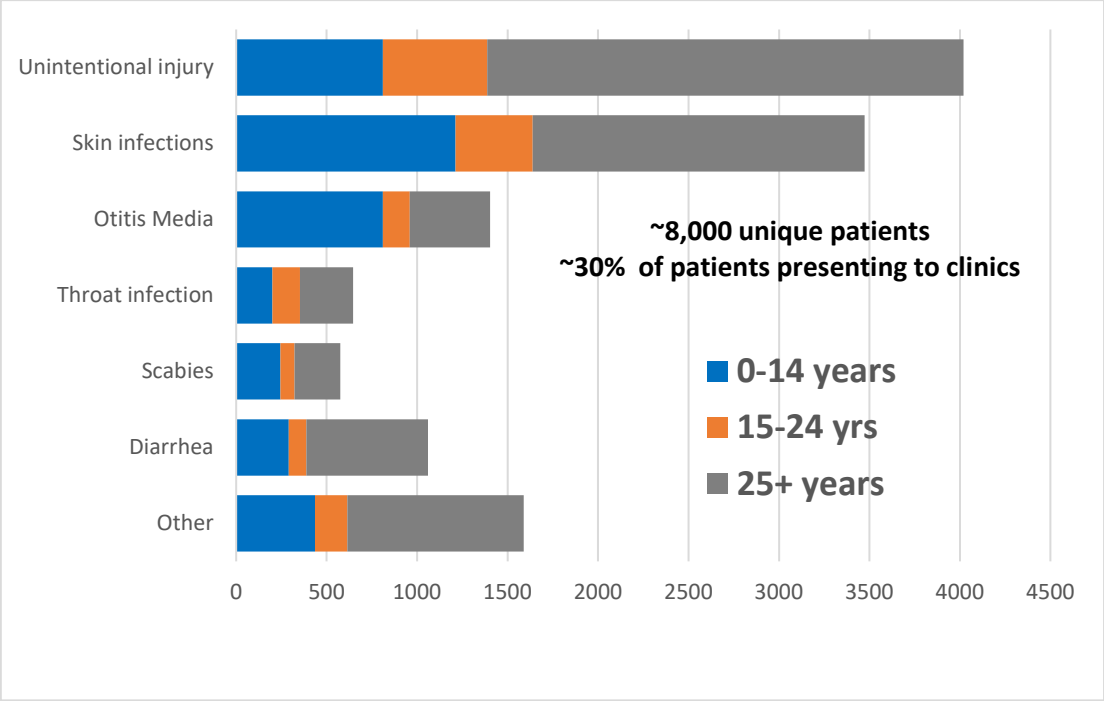

Figure 14: Approximate number of persons receiving primary care clinical items at all participating Aboriginal Medical Services for environment-sensitive conditions, by age and conditions

4.2.2.5. Barriers

Time was a major constraint, particularly given the short turnaround needed and multiple demands on health information staff in the clinic, including the time-sensitive COVID-19 vaccination rollout. Verification of which condition codes map to the environment-attributable disease categories was not fully achieved, particularly for unintended injury.

Aligning the data from MMeX and Communicare was a challenge. The comparability of the data from the two systems had not been verified in terms of the actual clinical items selected and the denominator information. Unlike hospital data, the method for estimating costs of environment-attributable demand in PHC from this data source is not well-established. Estimating costs of environment-related disease in PHC will need a broader capture of variables. Social costs to affected individuals and their families are not captured by health service costing exercises.

4.2.2.6. Facilitators

The pilot had strong support from the ACCHS sector, which, through its peak body (AHCWA), had convened an internal environmental health conference for member AMS prior to initiating the pilot. Trust and Aboriginal leadership of the process accelerated most of the time-intensive phases of project development, allowing completion of the pilot in a relatively short period. The process was supported by a Data Agreement between the Review Team and each participating service. The health information staff contributed significantly, and code written by a senior programmer could be shared with others. The strong collaboration between the Review Team and participating ACCHS enriched the process and facilitated adherence to data sovereignty principles. This experience outlines the importance of co-design, transparency and two-way consultation to obtain PHC data for future program evaluation and reflects a process for undertaking commitments from AMS and government to share data on a regional basis, as required by national and WA Closing the Gap Strategies.

4.3 Service Provider Activity Analyses

There were 218 communities included in these analyses, each with a CEHAP or activity data from an AEH Program service provider. Of these, 174 (79.8%) were permanent communities, eight (3.7%) were seasonal communities, one was recorded as unoccupied, and the remaining 35 (16.0%) had unknown occupancy status. Of the 218 communities, 154 (70.6%) were classified as remote Aboriginal communities, 29 (13.3%) were town-based communities or reserves, 24 (11.0%) were towns (e.g. Broome, Halls Creek), and 11 (5.0%) had unknown status as no data were available. There were 73 communities with ALT Leases, and 33 were ALT Estates. Five were classed as other Management Orders, two as National Parks and 11 as Reserves. No land tenure data was available for the remaining communities (n=94). Understanding the legislative and policy implications of land tenure must be considered in planning AEH Program design and delivery. Maps showing AEH provider types by region and ALT status are in Appendices 5 and 6.

The reason for the observed overlap in service provision to communities was not clear from the activity data available. While some instances may indicate unnecessary duplication of services, others may reflect purposeful inter-agency collaborations and regional planning and partnerships to provide services, which is encouraged by the AEH Program. When triangulated with qualitative data (Section 4.6), some of the reasons for overlapping service provision activities were to fill existing perceived gaps. Table 17 summarises environmental health activities in each region with detailed analysis of these data in the subsequent text.

Table 17: Environmental health activity as the proportion (%) of total activities for each time period, for each Western Australian region

	Goldfields			Kimberley			Mid West			Pilbara		
	2017–19	2020	2021[1]	2017–19	2020	2021[1]	2017–19	2020	2021[1]	2017–19	2020	2021[1]
Animal management	7.2	9.0	8.6	12.4	7.9	7.3	2.0	2.1	1.4	10.8	11.1	17.1
Climate control	0.5	1.0	0.1	0.1	0.1	0.0	0.9	0.0	0.4	0.3	0.1	0.0
Community housing	21.2	25.8	37.7	19.5	12.7	21.8	46.9	49.8	43.0	24.9	31.9	30.6
Distribution of resources	0.0	0.7	1.9	0.0	0.7	0.9	0.0	2.7	8.2	0.0	0.1	2.1
Drinking water	3.3	3.5	4.1	7.9	4.8	3.4	2.0	0.2	0.0	3.0	0.5	0.0
Dust	0.4	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.9	0.0	0.0
Emergency management	4.4	3.0	2.8	2.6	5.0	5.9	1.7	2.3	1.1	1.8	2.0	1.4
Health promotion	1.5	4.7	4.7	8.5	18.8	12.5	3.7	1.8	1.1	4.3	13.8	6.0
Pest control	3.6	4.6	8.2	1.3	2.6	3.7	16.0	15.5	13.6	9.8	14.0	10.7
Planning & liaison	0.0	0.3	3.6	0.0	0.6	5.3	0.0	0.3	6.8	0.0	0.0	8.9
Solid waste	24.5	13.2	10.0	14.0	12.1	9.3	10.6	14.4	12.5	11.7	5.1	7.5
Travel	21.5	19.6	9.5	24.6	25.3	22.8	13.5	6.3	8.6	22.7	12.6	10.0
Waste water	4.9	6.0	5.0	5.1	4.2	3.4	1.4	1.3	1.1	3.3	2.1	5.3
Other	7.0	8.4	3.7	3.9	5.2	3.8	1.2	3.4	2.2	6.5	6.7	0.4

[1]2020 time period only includes January to June

4.3.1 Goldfields region

Seventeen of the 27 communities had at least one CEHAP, and all 27 had received at least one type of environmental health service across all time periods: 2017–2019 (Jan–Dec), 2020 (Jan–Dec) and 2021 (Jan–June). In 20 of the communities, these services were administered by multiple service providers, including:

- Aboriginal Movement for Outback Survival Aboriginal Corporation (ACCO)
- Bega Garnbirringu Health Services Incorporated (AMS)
- City of Kalgoorlie-Boulder (LGA)
- Menzies Aboriginal Corporation (ACCO)
- Nyaanyatjarra Health Service Aboriginal Corporation (AMS)
- Paupiyala Tjarutja Aboriginal Corporation (ACCO)
- Shire of Ngaanyatjarraku (LGA)

Most of these 20 communities received services from their local shire (City of Kalgoorlie-Boulder or Shire of Ngaanyatjarraku) and one other environmental health service provider (in 17 communities the provider was an AMS). Two communities (Mt Margaret and Tjuntjuntjara) received services from all three provider types (LGA, AMS and ACCO). There was a high level of service overlap in reported activity data, especially regarding animal management, community housing, drinking water, dust, emergency management, health promotion, solid waste, travel and wastewater.

Across all time periods, the most common activity types were those categorised as Community Housing (1,966 instances, 23.6%), Solid Waste (1,759, 21.1%) and Travel (1,675, 20.1%). The least common activities addressed Climate Control (49, 0.6%) and Dust (28, 0.3%). The number of activities related to Planning and Liaison (32, 0.4%) and Distribution of Resources (25, 0.3%) were also low; however, no activities related to these categories were recorded for any community between 2017 and 2019.

When comparing the different time periods, the proportion of total activities delivered to the Goldfields region was relatively consistent for most environmental health activity types. The exceptions were an increase in Community Housing activities in 2021 compared to earlier periods, a decrease in Solid Waste activities in 2020 and 2021 from 2017–2019, and a decrease in Travel related activities in 2020 from 2017–2019. Slight increases were observed in Health Promotion in 2020 and 2021 (possibly COVID-related messages) from 2017–2019, and Pest Control in 2021 compared to the earlier periods.

4.3.2 Kimberley region

Of the 137 communities in the Kimberley, 29 communities had one provider CEHAP, and 12 had two CEHAPs, the second of which was a CEHAP provided by Nindilingarri that covered multiple sites.

Across all time periods, 99 communities (72.3%) in the Kimberly had at least one environmental health activity by an LGA or ACCO service provider, with 43 communities receiving services by both provider types. These providers were:

- Looma Community Inc (ACCO)
- Mowanjum Aboriginal Corporation (ACCO)
- Nindilingarri Cultural Health Service Inc (ACCO-AMS)
- Nirrumbuk Environmental Health and Services Pty Ltd (ACCO)
- Shire of Halls Creek (LGA)
- Shire of Derby West Kimberley (LGA)

Most of these communities received services from either Nindilingarri Cultural Health Service Inc or Nirrumbuk Environmental Health and Services, plus their LGA (Shire of Halls Creek or Shire of Derby West Kimberley, both of which receive AEH Program funding). There was a high level of overlap in services in activity data of animal management, community housing, drinking water, health promotion, solid waste, travel and wastewater. Only Broome, Halls Creek, Nicholson Block and Yiyili received services from two different health services (i.e. Nindilingarri Health Services Inc and Nirrumbuk Environmental Health and Services).

Three communities had no reported data for any service provision (Kurlku, Ngarantjadu and Worrimbah). Considering all time periods, the most common activity type in the region was Travel (4,357 instances, 24.6%), followed by Community Housing (3,204, 18.1%) and Solid Waste (2,355, 13.3%). The least common activities were Climate Control (16, 0.1%), Dust (12, 0.1%) and Planning and Liaison (750.4%).

When considering the proportion of the total activities delivered to the region, there were notably fewer Community Housing activities in 2020 than in the other time periods. There was also a slight decrease in Animal Management in 2020 and 2021, and Solid Waste in 2021, and a gradual decrease in Drinking Water activities since 2017–2019. Conversely, Health Promotion activities increased from 2017–2019, especially in 2020.

4.3.3 Mid West region

Of the 18 communities in the Mid West region, two had a CEHAP recorded. Nine were remote Aboriginal communities, and two were town-based communities or reserves, all classed as permanent occupancy. Seven communities were classified as towns. Three communities had ALT Leases (16.7%) and two were classified as ALT Estates (11.1%).

Most Mid West region communities received services from one provider, with only four communities receiving multiple services from different provider types:

- Bega Garnbirringu Health Services Incorporated (AMS)
- Bundiyarra Aboriginal Community Aboriginal Corporation (ACCO)
- Geraldton Region Aboriginal Medical Service (for operations at former Carnarvon Medical Service Aboriginal Corporation) (AMS)
- City of Kalgoorlie-Boulder (LGA)
- Ngangganawili Aboriginal Community Controlled Health and Medical Aboriginal Corporation (AMS)
- Yulella Aboriginal Corporation (ACCO)

Three service providers serviced the communities of Bondini (two AMS and the LGA) and Burringurrah (two ACCO and an AMS), while two service providers serviced each of the communities of Mount Magnet (ACCO and AMS) and Wiluna (two AMS). Duplicate and/or overlap/joint activities provided in the same community by two or more AEH service providers were reported for animal management, community housing, and pest control. Considering all time periods, Community Housing was the most common activity type (1961 instances, 47.0%) and Dust the least common (3, 0.1%). No activities related to Distribution of Resources or Planning and Liaison were recorded for any community from 2017–2019, so the activity data for these categories was also low (40, 1.0%, and 21, 0.5%, respectively).

The proportion of total activities in each time period was relatively consistent for most environmental health activity types in this region. There was a slight increase in the provision of Distribution of Resources and Planning and Liaison and a decrease in Travel in 2020 and 2021 compared to 2017–2019. The number of communities to receive no service provision in 2021 doubled from previous periods to eight communities.

4.3.4 Pilbara region

Seven (19.4%) of the 36 Pilbara communities had a CEHAP recorded. Across all time periods, all communities received service provision by one service provider type, with five receiving services by an AMS and an ACCO and one by an AMS and an LGA. The service providers were:

- Mawarnkarra Health Service (AMS)
- Pilbara Meta Maya Regional Aboriginal Corporation (ACCO)
- Puntukurnu Aboriginal Medical Service (AMS)
- Shire of Ashburton (LGA)

Ngurawaana received services from Mawarnkarra Health Service and the local Shire of Ashburton (contracted AEH Program service provider). Parngurr (Cotton Creek), Jigalong, Kunawarritji, Parnpajinya and Punmu each had two AEH Program service providers (Pilbara Meta Maya Regional Aboriginal Corporation and Puntukurnu Aboriginal Medical Service) with a high level of overlap in services reported in activity data in terms of animal management, community housing, drinking water, dust, emergency management, health promotion, solid waste, wastewater and travel.

Considering all time periods, the most common activities in the region were Community Housing (1,298 instances, 26.5%) and Travel (985, 20.1%). The least common were Climate Control (11, 0.2%) and Dust (32, 0.7%). The number of activities related to Planning and Liaison (25, 0.5%) and Distribution of Resources (7, 0.1%) were also low; however, no activities related to these categories were recorded for any communities from 2017–2019.

When considering the proportion of total activities delivered to the region, many remained consistent across the different time periods. A notable increase was observed in Health Promotion activities in 2020 (likely due to COVID-related messaging and the Trachoma project), and Community Housing since 2017–2019, which may be explained by the EHD initiative to move the focus on activities from the exterior to the interior of the home. An increase in Animal Management activities was also observed in 2021, likely due to a veterinary visit by the Animal Management in Rural and Remote Indigenous Communities organisation rescheduled from 2020 (as advised by the EHD). Pest Control activities varied across the periods, peaking in 2020, and Solid Waste activities decreased from 2017–2019.

4.3.5 Remote Essential and Municipal Services

As outlined above, REMS do not sit within the AEH Program management remit. However, information related to REMS provision is included below to provide additional context and reflect the extent of the system in which the AEH Program operates and the number of service providers involved in addressing environmental health conditions in the WA communities.

Fourteen communities (51.9%) in the Goldfields received services by REMS, all of which received services from at least one other AEH Program service provider. Two communities received services from REMS plus all other types of providers (AMS, ACCO and LGA), while two other communities received REMS and additional services from an LGA. The remaining 10 communities received services from REMS, plus an AMS and an LGA.

In the Kimberley, 100 communities (73.0%) received a service by REMS, of which 35 received no other service provision. Of the other 65 communities to receive REMS, 33 received services from an LGA and an ACCO, 22 received additional services from an ACCO only, and 10 received services from an LGA only.

Eight communities (44.4%) in the Mid West received services from REMS, two of which received no other service provision. Of the other six communities, additional services were provided by an AMS and an ACCO for one community, an AMS for one community, and an ACCO for four communities.

Eighteen communities (50.0%) in the Pilbara region received services from REMS, all of which received services from at least one other provider type. Five communities received additional services from two provider types: four from an AMS and an ACCO, and one from an AMS and an LGA. Five communities also received services from an ACCO, four from an AMS and four from an LGA.

4.3.6 Six-monthly service provider reports

While the six-monthly service provider reports provide additional data and insight into how the AEH Program currently reports activity against the requirements outlined in service agreements, they do not routinely provide data on AEH Program outcomes as they are largely activity-based in their focus. However, it is evident from an analysis of service report activity narratives that many of the themes raised confirm those identified in the qualitative service provider interviews (see Section 4.6). For example, recurrent themes relating to service delivery, such as workforce, lack of training and inadequate financial resourcing, were reported. However, the proportion of funded time that service provider staff dedicate to environmental health activities is not easily ascertained from the current reported activity or six-monthly report data, making definitive assessments difficult, and further underlining the need for reform in routine reporting for the Program.

Table 18 provides a count of bathroom assessments and clinical referrals provided in two sets of six-monthly reports from 2019. It reveals that of the 19 service providers who completed the six-monthly reports, just 20 bathroom assessments were conducted in the June 2019 reporting period (by a single service provider), and 489 bathroom assessments were completed across six service providers in the December period. Similarly, 34 clinic referrals were made (by two providers) in the first six months of 2019, increasing to 83 by seven service providers in the second half of that year.

Table 18: Number of bathroom assessments and clinic referrals in 2019[1]

Service provider	Bathroom assessments June 2019	Bathroom assessments Dec 2019	Clinic referrals June 2019	Clinic referrals Dec 2019
Bega Garnbirringu Health Services Incorporated	–	–	–	–
Bundiyarra Aboriginal Community Aboriginal Corporation	–	–	–	–
City of Kalgoorlie-Boulder	20	–	3	–
Derbarl Yerrigan Health Service	–	150	–	39
Looma Community Inc	–	150	–	25
Mawarnkarra Health Service Aboriginal Corporation	0	–	31	–
Menzies Aboriginal Corporation	–	15	–	0
Ngangganawili Aboriginal Community Controlled Health and Medical Aboriginal Corporation	–	–	–	-
Nindilingarri Health Services Inc	0	0	0	0
Nirrumbuk Environmental Health and Services Pty Ltd[2]	–	–	–	–
Nyaanyatjarra Health Service Aboriginal Corporation	–	–	–	–
Paupiyala Tjarutja Aboriginal Corporation	–	0	–	0
Pilbara Meta Maya Regional Aboriginal Corporation	–	56	–	4
Puntukurnu Aboriginal Medical Service	–	–	–	-
Shire of Ashburton	–	0	–	2
Shire of Derby West Kimberley	–	0	–	2
Shire of Halls Creek	–	38	–	1
Shire of Ngaanyatjarraku[3]	–	–	–	–
Yulella Aboriginal Corporation	–	75	–	10

[1] Not all service providers submitted six-monthly reports in this time period; four providers used reporting templates that did not ask for data regarding bathroom assessments or clinic referrals
[2] NEH&S have consistently withheld from EHD all data relating to the number of environmental health referrals
[3] Ceased being a SP on June 30, 2019

4.4 Costing Analyses

4.4.1 Contract AEH Program costs

4.4.1.1. *Costs overall and by region*

Overall, costs for service provider contracts and grants funded through the AEH Program totalled $7,697,409 and accounted for approximately 95% of all EHD departmental costs for the Program ($8108,254) for the 2020/2021 financial year (Table 19). The remaining 5% of costs comprised staffing costs for 2.5 FTE. The total number of hours contracted for the AEH Program was 78,510 hours.

Table 19: Summary of WA Health Environmental Health Directorate total departmental costs for 2020/20211

Item[1]	Cost ($)	Percentage of total cost (%)
Contracts/Grants paid in 2020/2021	7,697,409	94.93
Environmental Health Directorate staff costs (salaries and on-costs/travel etc.)	410,815	5.07
Total	**8,108,254**	**100.00**

[1] Data provided by WA Health's Environmental Health Directorate and Purchasing and System Performance Division via email. All costs are exclusive of GST. Figures are State funds only and do not include 2020/2021 Commonwealth Trachoma funds passed on to Curtin University (approximately $345,000, excl. GST)

The Kimberley region had the highest number of contracted hours (approximately 28,000 hours) and Program-related costs ($3.5 million) across six service providers at an average cost of $580,579 per provider in this region (Table 20). The Goldfields had approximately the same number of contracted hours but lower total costs ($2.0 million) across eight different service providers (average of $254,465 per provider). The Mid West had the lowest regional costs ($0.8 million), and the Perth Metropolitan area had the lowest costs overall ($0.1 million).

Table 20: Number of contracted hours and total cost by region[1]

Region	Number of service providers	Contracted hours[1]	Total price ($)
Goldfields	8	27,965	2,035,718
Kimberley	6	27,993	3,483,476
Perth Metropolitan	1	1,950	122,074
Mid West	2	9,400	859,688
Pilbara	3	11,202	1,335,351
Total	**20**	**78,510**	**7,836,307**

[1] Data from Financial and Service Provision Hours and Expenditure Review data ($s x Contracted & Reported Hrs tab) provided by WA Health's Environmental Health Directorate

4.4.1.2. *Costs by service provider type*

In the unadjusted dataset (see Section 3.4), the total number of reported hours across all service providers in 2019/2020 was 61% of the total number of contracted hours (Table 21). The percentage of contracted hours provided during this period was approximately equal for ACCO (73%) and LGA (79%) providers but substantially less for ACCHS providers (37%). A similar difference between provider types was observed in 2020/2021. The overall percentage of contracted hours provided by all providers decreased to 57% in 2020/2021, with the largest decrease between time periods noted for LGA providers (79% to 65%). Differences in the number of contracted hours and reported hours across service provider types often reflect factors related to local need, historical funding/contracting arrangements and service provider capacity.

Table 21: Service provision costings by contracted hours per annum and hours provided for 2019/2020 and 2020/2021, summarised by service provider type and overall (unadjusted data[1])

Provider type	No. providers	Total contracted hrs/annum	2019/2020[2]				
			Contract price ($)	Total reported hrs	Cost per contract hrs ($)	Difference between contracted & reported hrs	Contracted hrs provided (%)
ACCHS	8	25,801	2,963,154	9,405.0	315.06	16,396.0	36.5
ACCO	7	41,019	3,316,645	29,849.2	111.11	11,169.8	72.8
LGA	4	6,905	1,111,274	5,452.1	203.82	1,452.9	79.0
Total	**19**	**73,725**	**7,391,073**	**44,706.4**	**165.32**	**29,018.7**	**60.6**
			2020/2021[2]				
ACCHS	8	25,801	3,003,954	10,073.6	298.20	15,727.4	39.0
ACCO	7	41,019	3,372,033	27,272.9	123.64	13,746.2	66.5
LGA	4	6,905	1,129,833	4,511.2	250.45	2,393.9	65.3
Total	**19**	**73,725**	**7,505,820**	**41,857.6**	**179.32**	**31,867.4**	**56.8**

Abbreviations: ACCHS, Aboriginal Community Controlled Health Service; ACCO, Aboriginal Community Controlled Organisation; Hrs, Hours; LGA, Local Government Authority; No., Number

[1] Data not adjusted by WA Health's Environmental Health Directorate to reduce reported hours for non-contracted activities (in line with reported activity data throughout the report)

[2] Data from Financial and Service Provision Hours and Expenditure Review data (Service Provision Analysis_All tab) provided by Department of Health's Environmental Health Directorate

When the EHD adjusted these data to include only activities considered contracted through the AEH Program, the number of reported hours by all service providers decreased, especially for ACCOs. Therefore, the percentage of contracted hours provided also decreased for all provider types for a total of 45% in 2019/2020 and 49% in 2020/2021 (Table 22). In 2019/2020, the percentage of contracted hours provided differed between provider types: LGAs (71%), ACCOs (50%) and ACCHS (32%). The observed differences between provider types were similar in the 2020/2021 period, although slightly less marked: LGAs (63%), ACCOs (54%) and ACCHS (36%).

It is unclear from the data available why the number of reported hours differ markedly between service provider types; further examination of this issue is warranted to determine whether particular service providers are providing fewer than the contracted hours for contracted activities or there is a lack of understanding or different interpretations of which activities should be reported. The results could also reflect differences in the ability or capacity to use the reporting program/software and the need for additional training for some providers, as indicated in the consultation interviews. The EHD also noted that some service providers potentially inflate hours in their reporting to meet contractual obligations.

Table 22: Service provision costings by contracted hours per annum and hours provided for 2019/2020 and 2020/2021, summarised by service provider type and overall (adjusted data[1])

Provider type	No. providers	Total contracted hrs/annum	2019/2020[2]				
			Contract price ($)	Total reported hrs	Cost per contract hrs ($)	Difference between contracted & reported hrs	Contracted hrs provided (%)
ACCHS	8	25,801	2,963,154	8,148.2	363.66	17,652.8	31.6
ACCO	7	41,019	3,316,645	20,414.5	162.47	20,604.5	49.8
LGA	4	6,905	1,111,274	4,890.3	227.24	2,014.8	70.8
Total	**19**	**73,725**	**7,391,073**	**33,452.9**	**220.94**	**40,272.08**	**45.4**
			2020/2021[2]				
ACCHS	8	25,801	3,003,954	9,288.5	323.41	16,512.5	36.0
ACCO	7	41,019	3,372,033	22,286.3	151.31	18,732.7	54.3
LGA	4	6,905	1,129,833	4,378.0	258.07	2,527.0	63.4
Total	**19**	**73,725**	**7,505,820**	**35,952.75**	**208.77**	**37,772.3**	**48.77**

Abbreviations: ACCHS, Aboriginal Community Controlled Health Service; ACCO, Aboriginal Community Controlled Organisation; Hrs, Hours; LGA, Local Government Authority; No., Number

[1] Data adjusted by Department of Health's Environmental Health Directorate to reduce reported hours for non-contracted activities

[2] Data from Financial and Service Provision Hours and Expenditure Review data (Service Provision Analysis_All tab) provided by Department of Health's Environmental Health Directorate

4.4.1.3. *Employment figures and service delivery hours*

The EHD provided the number of available service delivery hours, calculated by assuming 936 hours per 1.0 FTE per annum, based on 50% of employable hours from a possible 36 hours/week.

When considering the number of FTE service providers employed in 2019/2020 and the number of available service delivery hours per annum, providers spent 74% of their available hours delivering services (Table 23). In 2020/2021, this increased to 80% of available hours. However, the percentages differed between service provider types, with ACCHS spending 48% of available hours delivering services, compared to ACCOs (98%) and LGAs (65%) in 2019/2020.

The distributions across service provider types were similar, although ACCOs provided excess hours, resulting in 107% of available hours spent on delivering services. Calculations were also provided regarding the 'optimum' number of FTE positions that could be employed by each service provider, which was slightly higher for all provider types, with the largest increase noted for ACCHS providers.

The optimum number of hours available for service delivery, and the percentage of available service hours in which this would have resulted, were also calculated. For both time periods, the total percentage of available hours that would have been spent delivering services with the optimal employment decreased. In 2019/2020, the percentage of hours decreased from 74% using the actual employment figures to 67% using the optimum employment figures. Similarly, in 2020/2021, the percentage of hours decreased from 80% (actual figures) to 72% (optimal figures).

Table 23: Actual and optimum employment figures for 2019/2020 and 2020/2021, summarised by service provider type (adjusted data[1])

Provider type	Actual employment				Optimum employment		
	No. FTE staff employed as at 1/7/2021	Annual no. hrs available for service delivery[3]	Total reported hours	Available hrs spent delivering services (%)	No. staff that could be employed	Optimum annual no. hrs available for service delivery[3]	Optimum available hrs spent delivering services (%)[4]
2019/2020[2]							
ACCHS	18	16,848	8,148.2	48.4	21	19,656	41.5
ACCO	22.3	20,873	20,414.5	97.8	23.5	21,996	92.8
LGA	8	7,488	4,890.3	65.3	9	8,424	58.1
Total	**48.3**	**45,209**	**33,452.9**	**74.0**	**53.5**	**50,076**	**66.8**
2020/2021[2]							
ACCHS	18	16,848	9,288.5	55.1	21	19,656	47.3
ACCO	22.3	20,873	22,286.3	106.8	23.5	21,996	101.3
LGA	8	7,488	4,378.0	58.5	9	8,424	52.0
Total	**48.3**	**45,209**	**35,952.75**	**79.5**	**53.5**	**50,076**	**71.8**

Abbreviations: ACCHS, Aboriginal Community Controlled Health Service; ACCO, Aboriginal Community Controlled Organisation; FTE, Full Time Employment; Hrs, Hours; LGA, Local Government Authority; No., Number

[1] Data adjusted by Department of Health's Environmental Health Directorate to reduce reported hours for non-direct service delivery activities

[2] Data from Financial and Service Provision Hours and Expenditure Review data (Service Provision Analysis_All tab) provided by Department of Health's Environmental Health Directorate

[3] At 50% of employable hours, resulting in a possible 36hrs/week per FTE

[4] Total number of reported hours / Annual number of hours available for service delivery

4.4.2 Health service costs

Environmental-attributable hospitalisations costs were determined using KEAFs and WHO attributable fractions (Tables 10, 11, 13, 14 in a previous section, plus Table 24 and Table 25 below).

The total cost for Aboriginal and non-Aboriginal populations in the Kimberley, Pilbara, Mid West and Goldfields regions was approximately triple using KEAFs ($94 million) compared to the WHO method ($30 million). This is likely due to the WHO method not including major health conditions related to environmental health in the WA setting. The actual fractions are inconsistent between methods, such as skin infections. Considering the KEAF method, costs for Aboriginal and non-Aboriginal populations combined were highest in the Mid West region ($32 million) and lowest in the Pilbara region ($16 million). In total, non-Aboriginal populations had greater environment-attributable crude costs (no adjustment for population size; $56 million) than Aboriginal populations ($38 million), although the distribution differed by region. In the Kimberley, Aboriginal populations had approximately triple the costs of non-Aboriginal populations, yet the opposite was observed in the Goldfields and Mid West, and they were similar between the two groups in the Pilbara. Aboriginal admissions, and therefore costs, were over-represented in all regions when considering their percentage in the population.

For all regions combined, the costs in the 25+-year group accounted for most of the total costs (79.2%), followed by children aged 0–14 years (13.3%) and those aged between 15 and 24 years (7.5%). This was consistent for all regions in both the Aboriginal and non-Aboriginal populations.

Table 24: Environmental attributable hospitalisations cost in 2019, by the four northern WA health regions, Aboriginality and age groups (KEAF method)[1]

		Cost sum ($M)			
Health region	Race	Ages 0–14	Ages 15–24	Ages 25+	Total
Kimberley	Indigenous	3.43	1.71	12.85	18.00
	Non-Indigenous	0.52	0.51	4.82	5.85
	All	3.96	2.22	17.68	23.85
Pilbara	Indigenous	1.56	0.53	5.80	7.89
	Non-Indigenous	1.56	0.51	5.86	7.94
	All	3.13	1.04	11.66	15.83
Goldfields	Indigenous	1.02	0.65	3.69	5.35
	Non-Indigenous	1.29	1.07	14.35	16.72
	All	2.31	1.72	18.03	22.07
Mid West	Indigenous	1.29	0.70	4.82	6.80
	Non-Indigenous	1.80	1.35	22.08	25.23
	All	3.09	2.05	26.90	32.04
Total	**All, four regions**	12.48	7.03	74.27	93.78

Abbreviations: KEAF, Kimberley Attributable Environmental Fractions method for determining environmental attributable fractions

[1] Data provided by Department of Health Epidemiology Branch using data from the Western Australian Hospital Morbidity Data Collection

Table 25: Environmental attributable hospitalisations cost in 2019, by health region, Aboriginality and age groups (WHO method)[1]

		Cost sum ($M)			
Health region	Race	Ages 0–14	Ages 15–24	Ages 25+	Total
Kimberley	Indigenous	0.59	0.61	4.12	5.31
	Non-Indigenous	0.15	0.17	1.53	1.85
	All	0.74	0.78	5.65	7.16
Pilbara	Indigenous	0.31	0.18	2.05	2.54
	Non-Indigenous	0.43	0.18	1.95	2.56
	All	0.74	0.35	4.01	5.10
Goldfields	Indigenous	0.24	0.19	1.33	1.76
	Non-Indigenous	0.340	0.34	4.89	5.64
	All	0.64	0.53	6.22	7.39
Mid West	Indigenous	0.25	0.24	1.54	2.03
	Non-Indigenous	0.50	0.40	7.76	8.66
	All, four regions	0.74	0.64	9.30	10.68
Total		2.86	2.30	25.17	30.33

Abbreviations: WHO, World Health Organization method for determining environmental attributable fractions.

[1] Data provided by the Department of Health Epidemiology Branch using data from the Western Australian Hospital Morbidity Data Collection. Age-specific data extracted for this table excluded trauma like unintentional injuries

4.5 Service Provider and Community Survey Results

In addition to the quantitative survey findings, we have integrated open-text survey findings on specific issues such as the use of CEHAPs into relevant sections in the consultation reporting and Case Studies below. However, while the findings offer important insights into the perceptions of the service providers and community stakeholders surveyed, they reflect self-reported information that can be subjective. In addition, some of those surveyed likely differ in their understanding of the combined responsibilities, duties and/or accountability for AEH Program service provision across providers or the wider AEH sector (see Section 4.6.1.1). The findings reported in this section must be considered within this context.

4.5.1 Service Providers

Twenty-six service provider surveys (representing the 19 AEH Program funded services) were completed between 5 June 2021 and 30 August 2021, with seven from the Goldfields region, eight from the Kimberley region, five from the Mid West, four from the Pilbara and one from the Perth Metropolitan area. In several cases, 3–5 staff members ranging from CEOs, program coordinators and AEHWs completed the survey together for their organisation with one person reporting on their behalf. The demographic information and place of current work of respondents are listed in Table 26.

Most respondents (n=25, 96%) said they were aware of CEHAP, with 19 (73%) indicating they had developed a CEHAP. Eighteen respondents (69%) reported that CEHAPs were somewhat to very effective (n=9 'effective or very effective', n=9 'somewhat effective'), underlying the importance of such processes.

Table 26: Demographic information from service providers (n=26 respondents)

	Male (n=18)	Female (n=8)	Total (n=26)
Age group (years)			
25–34	2	2	4
35–44	1	1	2
45–54	4	3	7
55–64	9	1	10
65+	2	1	3
Identifies as:			
Aboriginal	9	3	12
Non-Aboriginal	9	5	14

Some 61% of service providers reported that they currently provide environmental health services not funded through the AEH Program. The most commonly reported unfunded activities related to rubbish removal, yard and house clean-ups, advocacy and working with other agencies to address specific issues. Other reported unfunded activities included: delivering food boxes, yarning, counselling, advocacy, medication delivery, transport, liaison and general assistance around public health matters, ensuring airstrips are safe for Royal Flying Doctor Service (RFDS) planes to land in the community, flu/COVID-19 vaccination drives, clean up of water holes, house moving when a house becomes inhabitable, mattress transport, towel and soap procurement, firewood supply to camps, statutory inspections, and follow up and control of notifiable diseases. However, as noted in the qualitative findings (Section 4.6.1.1), some of the survey responses reflect that staff do not necessarily see or completely understand the combined duties and accountabilities to their AEH Program contract.

Respondents also reported other services viewed as necessary but perceived as under- or unfunded, including:

- Involvement with other health service staff members in environmental health safety and education campaigns (including mental health)
- Landfill site maintenance, dust control and mitigation
- Cleaning, repairing and constructing homes, cleaning yards, waste management, basic routine plumbing and electrical maintenance.

However, many of these needs exceed the remit of the AEH Program (e.g. electrical), while others are primarily REMS procured/funded responsibilities with an AEH Program role to ensure that their provision to an agreed standard. Other services are currently in-scope and actively encouraged within service provider contracts (e.g. routine/basic plumbing).

All 26 respondents reported regularly working with various other services when delivering their environmental health services and/or programs (Table 27). While these results indicate that most service providers recognise the value of partnering with other health and non-health agencies in addressing environmental health concerns, only 21% and 17% of respondents reported working with AMS and local clinics, respectively. These findings reveal that service providers perceive a lack of collaboration with other service types; however, more objective data are needed to determine the actual level of collaboration with different service types.

Table 27: Reported collaboration with other services

Collaborating services [1]	Percentage (%)
Housing	21
AMS	21
Local community nurse	17
Essential services	14
Water Corp	7
Visiting clinician	7
Other	13
[1] Multiple responses allowed	

Respondents highlighted several internal and external barriers and opportunities that providers face when delivering environmental health services as part of the AEH Program (Table 28). Internal barriers such as workforce issues, lack of training and inadequate financial resourcing were reported by 21 of 26 service providers. One-third of the service providers indicated they received their training from an external provider, and 65% identified at least one training program not currently offered that they see as valuable in training community members in environmental health. In particular, respondents indicated that the AEH Cert 2 and Cert 3 training should be offered more frequently and locally. More detailed information regarding training is included in Section 4.6.3.

Table 28: Perceived barriers to AEH service provision reported in the survey

Barriers	N (%)
Sorry business	21 (80.8%)
Lack of community understanding/capacity	20 (76.9%)
Workforce challenges	19 (73.1%)
Lack of resources	19 (73.1%)
Lack of training	17 (65.4%)
Lack of financial resources/funding	17 (65.4%)

4.5.2 Stakeholder and community

Forty-five stakeholders completed the survey, with 13 identifying as Aboriginal and four as Culturally and Linguistically Diverse. There was reasonable coverage by region, type of organisation (Table 29) and mix of senior and frontline staff. Six respondents reported that they were a Chief Executive/Director, 16 were managers, nine were clinicians, five were environmental health officers/workers, three were project officers or case managers, and six worked in other sectors. Most were from the Kimberley (n=20) and Pilbara (n=9), predominately stakeholders from the community-controlled and government sectors.

Of the 45 stakeholders, 10 (22%) reported knowing their community had a CEHAP (six said they helped develop the CEHAP). Six stakeholders indicated they did not have a CEHAP, and 29 reported they were unsure about the CEHAP in their community. The ten that knew about the CEHAP indicated they had a good relationship with their environmental health service providers and communities. When asked more generally about the perceived effectiveness of AEH services in their region, 83% of respondents rated overall services as effective (17%) to somewhat effective (51%), with 32% as not effective.

Table 29: Respondent and organisational characteristics for the stakeholder survey

Region	Aboriginal community or stakeholder	AMS / ACCOs	Government	Non-government	Total
Goldfields	1	3	2	0	6
Kimberley	2	6	10	2	20
Metropolitan	0	1	0	0	1
Mid West	0	2	1	0	3
Multiple regions	0	0	2	0	2
Pilbara	1	4	2	2	9
South West	0	2	0	0	2
Total	**5**	**19**	**17**	**4**	**43**

Abbreviations: AMS, Aboriginal Medical Service; ACCOS, Aboriginal Community Controlled Organisation;
Total does not sum to n=45 due to two respondents having missing region data (1 AMS/ACCO, 1 Non-government)

Consistent with service provider survey responses, stakeholders also highlighted a range of internal and external factors that they perceived to impact the effectiveness of environmental health service delivery in their regions (Figure 15), including a lack of resources, lack of training, inadequate funding and workforce issues.

When asked if there were any barriers to employing local people, 11 stakeholders (25%) did not believe there were any barriers, while 16 did not know. Of the 11 who identified barriers, the main reasons provided were lack of funding/financial resources (n=4), lack of training/qualified workers (n=4), administrative barriers, including the need for a police check or driver's licence, and the lack of motivation to work/unreliable attendance/lack of transport.

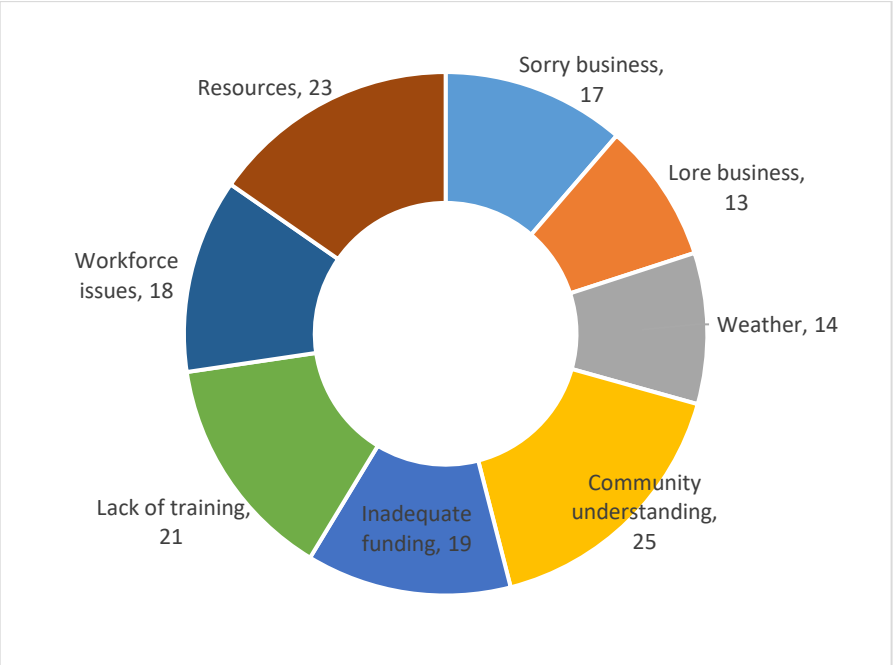

Figure 15: Stakeholder survey responses regarding perceived factors impacting the effectiveness of environmental health service delivery

4.6 Community, Stakeholder and Service Provider Consultation Findings

This section discusses key findings from interviews and consultations with service providers funded through the AEH Program, stakeholders and communities[104] regarding their perceptions and experiences with the AEH Program delivery in WA. Qualitative data from all interviews were thematically analysed, with responses only incorporated into the presented findings when they were recurrent. Key themes are illustrated with participant quotes representing the overall perspectives/themes emerging from the collated data. Multiple and, at times, opposing/contradictory perspectives are included to illustrate the range of responses received.

The findings are presented in three parts:

i. Issues impacting AEH outcomes outside of the EHD jurisdiction

ii. Specific areas of AEH Program responsibility—what is and is not perceived to be working

iii. Systems perspectives—across services, sectors, and regions.

Consultation findings are presented in the above order to firstly cover the macro-environmental health context within which the AEH Program is required to operate. As outlined previously, many factors related to environmental health and the built environment are outside the remit (or control) of the AEH Program but impact the Program's operation and ultimate success. This provides an important context of the broader issues perceived by communities, stakeholders, and service providers in terms of environmental health for rural and remote WA Aboriginal populations. It also demonstrates the extent of AEH issues impacting Aboriginal people in the State for which funding and contracted services are insufficient or not available currently to underline the need for further resourcing in this area.

[104] Where a finding was mentioned in all interview types (service providers, stakeholders and community members), the group is referred to generically as participants.

The consultation findings related to the AEH Program itself are subsequently presented, such that the broader context can be considered with the community, stakeholder and service provider responses provided with respect to the AEH Program itself.

4.6.1 Issues impacting AEH outcomes outside of the AEH Program jurisdiction

As discussed in Section 2.5.2, the AEH Program's responsibilities and sphere of influence intersect with multiple government agencies responsible for providing and maintaining community infrastructure, essential and municipal services, housing and health (

Table 4). The complexities of negotiating and working with multiple agencies are reflected in the consultation findings, with several service providers talking about a range of issues that, while outside the AEH Program remit, likely impact the ability to improve AEH and related health outcomes. This may also reflect many participants' varied understanding of the AEH Program, as outlined previously. However, they are included here to enable full consideration of the reported/perceived needs by communities.

While the findings suggest gaps in service delivery across the sectors that impact AEH outcomes, many community members and stakeholders were very positive about the AEH Program services they received. Some stakeholders working in different sectors stated that they hear very good things about the AEH Program and the program team.

> *"From my perspective, the departmental team have always been fabulous.....when I do go to communities. Over the last, what, 15 years, I've gone to about a hundred of the communities … speaking about services and how they're provided... and, yeah, it's always been glowing reports about this program." (Stakeholder)*

> *"It's always been that they're seen as an essential partner…trying to deliver culturally appropriate services." (Stakeholder)*

However, as the next section on community and stakeholder understandings indicate, there is a perceived level of uncertainty about what some service providers actually deliver, which is an issue that needs to be addressed.

4.6.1.1. *Lack of clarity about Aboriginal Environmental Health service responsibilities*

Several stakeholders and community people were unclear what AEH programs service providers delivered, blurring the distinction between AEH Program responsibilities and municipal and essential services. For example, several community members working in various agencies across the different regions had varied understanding, including being unclear about how often service providers visit their community. Some commented that they had not seen any AEH service providers in 'quite a while'. Similarly, one AEH service provider—discussing the community uncertainty about who does what, the level of unmet need and the expectation that something needs to be done to improve health outcomes—expressed concern that some community people are feeling

> *"…disgruntled or dissatisfied with the level of environmental health service delivery they receive." (Service Provider)*

This lack of clarity about AEH Program and other AEH services is exacerbated by high staff turnover within the other agencies with which AEH service providers partner, resulting in a perceived breakdown in referrals, and 'program amnesia' with staff building local knowledge about the complex issues that families face only to leave without adequately documenting the issues or providing an adequate handover. This situation often fails to follow through on commitments and, even if relating to only a few services, can lead to an associated breakdown in community relationships and trust towards all service providers.

Several stakeholders working within LGAs and relevant non-government organisations stated that while they often have a key coordination role—bringing agencies together to address community

safety, drugs/alcohol, child safety concerns or housing issues—no similar mechanism around AEH exists despite being written into their plans to work actively with AMS and AEH service providers. This results in uncertainty about responsibilities, and

> *"…from a local government point of view, if you get a complaint, one of the first things [we ask] is, are we responsible for it?" (Stakeholder)*

Contributing to the uncertainty about specific Program responsibilities are situations where AEH service providers reported having to take on additional work to fill gaps across elements of essential and municipal service delivery to address serious problems that impact Aboriginal community health and wellbeing, especially when there is an emergency. The main areas where this occurred were roads, water, sewerage, and rubbish collection.

4.6.1.2. *Unsealed roads*

Poor road conditions play a critical role in community health and wellbeing. In the wet season, unsealed roads can prevent access to clinics and, in some cases, people being unable to leave houses to get medication and supplies. Potholes that fill up with water present a range of health hazards, from drowning through to skin infections and transmission of water-borne bacteria that impact health. In the dry season, dust hazes occur in high traffic areas. Unsealed roads contribute to unsafe dust levels, which in most desert communities contain high levels of iron and bacterial contaminants, which contribute to chest infections and skin and eye diseases (see Case Study 1: Dust). Poor road conditions also contribute to road accidents, with injury the second most common cause of total Indigenous burden.

Case Study 1: Dust suppression interventions—Co-design community research

Aboriginal children living in remote communities are twice as likely to be hospitalised or die due to lung, ear, eye, skin and other infections, as other children[105]. Unique environmental exposures, including inhaled geogenic dust (Australia's distinctive 'red dust'), play a significant role. These diseases are particularly prevalent and severe and can have a significant, negative impact across the life course. The burden of disease attributable to outdoor air pollution in the Kimberley was 5% for lung infections; as such reducing exposure to air pollution could prevent 5% of cases[106].

In 2008, the WA Environmental Health Needs Survey[107], reported that 40% of Aboriginal remote communities experienced excessive (12%) or high levels (32%) of dust. Dust was identified as the second highest environmental concern (after overcrowding); however, 65% of communities had no dust suppression or re-vegetation programs, and >75% had unsealed roads[108]. Very little has changed since that time. Despite recognition of dust as a problem in remote Aboriginal communities[109,110,111,112], there is ***normalisation or complacency surrounding the health impacts of dust*** and the recurrent acute infections and chronic diseases in Aboriginal children. Dust is an

[105] Walker R & Clifford, H. Presentation to the Bidyadanga Local Aboriginal Council 2018
[106]McMullen C, Eastwood A, Ward J. Environmental attributable fractions in remote Australia: the potential of a new approach for local public health action. *Aust N Z J Public Health* 2016; 40(2):174–180
[107] Environmental Health Needs Coordinating Committee (EHNCC). Environmental health needs of Aboriginal communities in Western Australia. The 2008 survey and its findings. 2008. http://www.public.health.wa.gov.au/2/121/1/reports.pm
108 W.A. Department of Health and Indigenous Affairs 2008. Environmental Health Needs of Aboriginal Communities in Western Australia
[109]Western Australian Planning Commission. Parnngurr (Cotton Creek) community layout plan report and provisions. 2007. www.planning.wa.gov.au
[110]Western Australian Planning Commission. Punmu (Lake Dora) Community Layout plan, report and provisions. 2007. www.planning.wa.gov.au
[111]Department of Planning. Western Australian Planning Commission. Bidyadanga Layout Plan 3. Background Report. 2013
[112]Environmental Health Needs Coordinating Committee (EHNCC). Environmental health needs of Aboriginal communities in Western Australia. The 2008 survey and its findings. 2008. http://www.public.health.wa.gov.au/2/121/1/reports.pm

under-recognised but relatively easily corrected issue contributing to significant poor health outcomes in these communities[113].


Entrance to school

Dust just outside community


Dust build-up: on the road outside the local community store

Findings from the Review

The surveys show that few communities prioritised dust in their CEHAPs. However, one service provider stated that they had purchased socks or fans due to the dust in houses. One senior government stakeholder commented on the challenges of linking the environmental health sector with other sectors to address dust control to improve health outcomes.

Nevertheless, there are some promising changes; the same stakeholder described how they worked with Telethon Kids to develop a program on dust control in Bidyadanga:

> *"…which is a community we're trying to regularize where they were doing measurements of microbes in dust …the waste water's overflows are impacting the makeup of dust and impacting skin health, which has that link with rheumatic heart disease and rheumatic fever..." (Stakeholder)*

Other services are also addressing these broader concerns. For example, REMs have developed Guides[114] that outline procedures for inclement weather maintenance operations and excessive dust emissions. Contractors must have a Dust Management strategy to ensure dust generated from their operations is not a hazard on the site or adjacent sensitive areas (see photos above).

Further, Healthway dust intervention research in Bidyadanga[115] is demonstrating the need for and effectiveness of such interventions, which have community ownership and can support multilevel policy advocacy. The project includes community co-designed activities that involve the community in decision-making through engagement and active joint design and decision-making with community council, community members, community administration services and other community stakeholders such as the school, health clinic, and other services. This approach supports and promotes changes in community behaviours to implement simple, cost-effective dust control interventions (tree and lawn planting, paving) to minimise dust exposure. Alongside this project, the State Government has commenced the Essential & Municipal Services Upgrade Program (EMSUP) (including road maintenance) in Bidyadanga, which appears to be positively affecting community morale and wellbeing. While this has not been a direct result of the project, the research has informed how the EMSUP is being implemented in Bidyadanga.

[113] Walker, R, Clifford, H., Schultz. A., Bowen. A., Coffin J.2017 Dust control interventions in remote WA Aboriginal communities'. Healthway Intervention Grant

[114] Department of Communities, Remote Essential and Municipal Services – Sealed and Unsealed Internal Road System Maintenance Guides available at https://www.wa.gov.au/system/files/2021-05/Unsealed-Internal-Road-System-Maintenance-Guideline.pdf and https://www.wa.gov.au/system/files/2021-05/Sealed-Internal-Road-System-Maintenance-Guideline.pdf

[115] Walker R & Clifford, H. Presentation to the Bidyadanga Local Aboriginal Council 2018

Future directions

- Implementation of dust minimisation interventions, such as community greening, will significantly improve Aboriginal health outcomes.
- Strengthening community capacity and understanding will enable families to prevent personal exposures and advocate for and maintain community-wide suppression initiatives.
- The Climate Review[116] noted the likelihood of increased dust storms due to stronger winds and drying conditions in regional and remote communities, which will exacerbate existing ear, eye and throat conditions. It will be important to build on recommendations to enhance revegetation, keep houses securely ventilated and promote community awareness and adaptive responses through AEHWs[117].

4.6.1.3. *Rubbish collection and tip maintenance*

The role of AEHWs varies markedly in relation to rubbish collection, depending on community and employer expectations. In most communities, rubbish is picked up weekly either by the LGA or the Australian Government's Municipal and Essential Services program. In some cases, service providers take responsibility for rubbish collections, even though it might be out of scope because the LGA is not meeting the need. Most service providers reported conducting yard tidy-ups to remove larger items of rubbish outside houses. In some towns, AEHWs do the rubbish collection, even when not responsible (e.g. when the LGA will not empty bins due to social issues such as fighting or rioting). Overall, the AEH Program expectation is that AEHW activities are more related to supporting community clean-ups, car body relocations and collecting recyclables—any additional waste activity should be short-term and episodic rather than a regular service[118]. The Department of Communities' REMS program managers have advised EHD that they consider the removal of car bodies a REMS responsibility.

The issues around tip maintenance, tip proximity to communities and the water table were often raised by community members and service providers, along with concerns that remote community rubbish tips are causing health problems, with dust and flies spreading trachoma and other diseases usually only found in developing nations[119]. A few studies in Australia support the possible association between dust and flies and trachoma[120][121][122]. While out of the scope of AEH Program activity, one service provider reported advising remote Aboriginal communities on how to reduce the health impacts caused directly by rubbish tips.

Several stakeholders noted that community and LGA expectations on the AEH service providers managing the rubbish were unrealistic and did not consider the harsh climate impacts in the wet season, the extreme distances involved, the importance of consulting communities about cultural considerations, areas of cultural significance, and the rising water table.

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[116] Department of Health. Climate Health WA Inquiry Public forums summary report. Perth (WA): Government of Western Australia; 20 https://ww2.health.wa.gov.au/~/media/Corp/Documents/Improving-health/Climate-health/Climate-Health-WA-Inquiry-Final-Report.pdf

[117]Aboriginal Health Council of WA. Public submission. 2019; Australian Health Promotion Association WA. Public submission. 2019; Lyttle H. Public submission. 2019

[118] Correspondence Personal communication: Matthew Lester

[119] ABC Kimberley, Calls to overhaul Indigenous community rubbish tips as poor decisions exacerbate health issues https://www.abc.net.au/news/2021-06-09/indigenous-rubbish-tips-health-issues-kimberley-trachoma/100195964

[120] Emerson PM, Bailey RL. Trachoma and fly control. Community Eye Health 1999;12(32):57

[121] Lavett DK, Lansingh VC, Carter MJ, Eckert KA, Silva JC. Will the SAFE strategy be sufficient to eliminate trachoma by 2020? Puzzlements and possible solutions. Scientific World Journal 2013

[122] Lansingh V. Primary health care approach to trachoma control in Aboriginal communities in central Australia [PhD thesis]. Melbourne: University of Melbourne, 2005

One senior government stakeholder expressed concern that LGAs do not ensure Aboriginal communities in regional towns have the same safety standards and state regulations as the mainstream population, including that:

> *"…the issue with rubbish is around the fact that we're not enforcing laws about how it is disposed of in remote communities. We're not treating them [Aboriginal people] in the same way. … They're the canaries. Occasionally, we probably need to give them [Aboriginal communities] a louder microphone." (Stakeholder)*

4.6.1.4. *Housing maintenance*

Many participants commented on major service issues in conducting housing maintenance, including:

- extensive delays in serious repairs such as doors and windows, leaving the home exposed to pests, the elements and security risks.
- infrequent maintenance inspections.
- difficulties in reporting problems to their housing providers and the relevant directorates in the Department of Communities.
- poor workmanship or inappropriate materials used.
- long delays in receiving maintenance due to all work orders being centralised back to Perth (this has now been decentralised, with responsibility now in regional offices).

Several participants and service providers noted that, in some instances, housing damage results from a range of social issues, including overcrowding and a sense of powerlessness resulting in alcohol misuse and family violence, that require improved tenancy support programs and services.

Case Study 2: Housing

The inadequacy of housing for Aboriginal Australians living in rural and remote settings is well recognised by communities and governments alike[123]. Poor housing is a significant determinant of health and is associated mainly with an increased likelihood of skin, eye and respiratory infections[124,125]. Poor housing also impacts wellbeing and mental health, often in a cycle where deteriorating physical/mental health is associated with an increased likelihood of living in poor housing conditions[126].

Findings from the Review

The role of the AEH Program in relation to housing involves inspecting homes to advocate for/organise health hardware maintenance, health promotion and seeking tenancy support services. Housing inspections can be triggered by referrals from clinics (single house) or where they are in a trachoma at-risk community (multiple homes).

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[123] Standen JC, Morgan GG, Sowerbutts T, Blazek K, Gugusheff J, Puntsag O, et al. Prioritising Housing Maintenance to Improve Health in Indigenous Communities in NSW over 20 years. International Journal of Environmental Research and Public Health. 2020;17(16):5946

[124] Melody SM, Bennett E, Clifford HD, Johnston FH, Shepherd CC, Alach Z, Lester M, Wood LJ, Franklin P, Zosky GR. A cross-sectional survey of environmental health in remote Aboriginal communities in Western Australia. Int J Environ Health Res. 2016 Oct-Dec;26(5-6):525-35. doi: 10.1080/09603123.2016.1194384. Epub 2016 Jun 7. PMID: 27267619

[125] Bailie R, Stevens M, McDonald E, Brewster D, Guthridge S. 2010 Exploring cross-sectional associations between common childhood illness, housing and social conditions in remote Australian Aboriginal communities. BMC Public Health. 10(1): 147

[126] Mallett, S, Bentley, R, Baker, E, Mason, K, Keys, D, Kolar, V & Krnjacki, L (2011). Precarious housing and health inequalities: what are the links? Summary report. Hanover Welfare Services, University of Melbourne, University of Adelaide, Melbourne Citymission, Australia

Feeling good about your home was suggested by some community members as a good way to motivate people to take care of their homes. Creating a sense of pride and wellbeing was also a recurrent theme; for example, a government service provider reported success in encouraging home maintenance through initiatives (since ceased through lack of funding) such as local 'tidy towns'/'beautiful homes' competitions.

Analysis of the program activity data (Section 4.3) found that the most commonly reported activities (other than travel) across all regions were housing-related. Despite this focus, only 21% of service provider survey respondents indicated that they work collaboratively with housing providers/agencies. As one Service Provider survey respondent stated:

> *"At present, people cannot afford to maintain their housing. Housing managers don't even check the houses they are supposed to be managing, and this means that there are hundreds of people living in substandard accommodation.*
>
> *Department of Housing taking over maintenance is not working. Contractors are not paying subcontractors and therefore works are not being done on time or at all. Improved communication necessary. Too many people living in 'unliveable' conditions. Subcontractors require improved 'people skills' and the ability to recognise cultural norms."*

Throughout the consultations, poor housing standards and the lack of culturally respectful treatment of tenants were recurrent themes.

Future Directions

Improving the health impacts of poor housing requires integrating building programs with a range of well-resourced environmental health interventions to increase housing stock to be comprehensively activated[127,128]. The AEH Program can best mitigate the impacts of poor housing on health in the areas of housing maintenance, enabling home environments and Healthy Living Practices (including understanding cultural contexts, such as the value placed on close living[129,130]). An existing community-based program to reduce RHD demonstrated that Aboriginal health workers were best placed to support home-based healthy living[131]. Such initiatives need to be community-led, strengthened through partnerships across departments and agencies, and aligned to broader health policies.

4.6.1.5. *Changes in government policies and programs*

Several participants referred to ongoing and extensive changes to Commonwealth policies (e.g. dismantling of Aboriginal and Torres Strait Islander Commission (ATSIC), discontinuation of successful trials) that had occurred over the past 15 years that have adversely impacted the delivery of programs and services to communities, including the delivery of the AEH program. These include changes to funding, the role of Resource Agencies, local education services in the regions, dismantling of ATSIC, and discontinuing successful program trials. For many participants, these changes resulted

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[127] Bailie, R.S., McDonald, E.L., Stevens, M., Guthridge, S. and Brewster, D.R., 2011. Evaluation of an Australian indigenous housing programme: community level impact on crowding, infrastructure function and hygiene. *Journal of Epidemiology & Community Health*, *65*(5), pp.432–437

[128] Pholeros P, Lea T, Rainow S, Sowerbutts T, Torzillo PJ. Improving the state of health hardware in Australian Indigenous housing: building more houses is not the only answer. Int J Circumpolar Health. 2013;72

[129] Memmott, P., Birdsall-Jones, C. and Greenop, K., 2012. *Australian Indigenous house crowding* (Vol. 1001, p. 5). Australian Housing and Urban Research Institute Melbourne, Australia

[130] Greenop, K. and Memmott, P., 2014. We are good-hearted people, we like to share: definitional dilemmas of crowding and homelessness in urban Indigenous Australia

[131] Kerrigan V, Kelly A, Lee AM, Mungatopi V, Mitchell AG, Wyber R, Ralph AP. A community-based program to reduce acute rheumatic fever and rheumatic heart disease in northern Australia. BMC Health Serv Res. 2021 Oct 20;21(1):1127. doi: 10.1186/s12913-021-07159-9. PMID: 34670567; PMCID: PMC8527302

in the unravelling of local community corporations and reversing the gains in Aboriginal environmental health. In particular, several people reflected on how changes to the Community Development and Employment Projects CDP have had direct implications for the employment and utilisation of local AEHWs in communities. For example, one community stakeholder described how they had just completed training 11 people when the government changed the CDP to voluntary, which meant all AEH graduates stopped coming to work. While WA Health does not support routine training of CDP participants in Cert II AEH without opportunities to gain employment at the end of training, CDP service providers sometimes engage a registered training organisation to deliver training that may fulfil a community need without the likelihood of delivering employment outcomes. This is partly driven by Commonwealth employment policy for regional and remote communities/job-seekers. Towards the end of the consultation, a program to replace CDP was being piloted in some communities using a co-design process to consider the diverse needs of remote communities.

A recurring theme was that governments have a political agenda to shutdown small communities by not servicing them; for example, the perception that agencies were deliberately running a community down to suit mining interests and undermine self-determination[132]. Several people believed this to be why the situation has regressed, with many communities now experiencing 'fourth world environmental health conditions'. Some communities claim that both state and local governments are withdrawing services to make it impossible for people to remain in their communities:

> *"…we get left out, the smaller communities. They mainly focus on the larger communities." (Community)*

4.6.1.6. *Filling the gaps for ALT communities*

Approximately 3,000 Aboriginal people live in 37 town-based communities in the Kimberley region, Pilbara, Goldfields and Mid West–Gascoyne regions. Throughout the consultations, several service providers reported finding themselves filling service gaps for communities on ALT land[133] with no housing agreements. Consultations across all regions confirmed that town-based communities or reserves on ALT land do not generally receive municipal services support through LGAs. Four LGAs receive some AEH Program contracts for specific tasks, such as environmental health education and environmental health promotion programs (to increase acceptance and adoption of Healthy Living Practices), CEHAPS and dog health programs. However, as stated earlier, many instances were reported where rubbish removal and housing maintenance were not provided in town camps due to social issues, or not being considered a LGA responsibility.

One stakeholder, when asked if the local shire was responsible for rubbish removal for a town camp, stated:

> *"Not totally. That's sort of part of what we need to sort out. I think it's more of state government managed ... because it was part of ALT land or something … I don't know all the history but I think it is, ... I think the government … they've been potentially removing more houses ... trying to relocate those people in town or back out to community…" (Stakeholder)*

The Department of Communities has assumed the REMS roles and responsibilities, and that of other State entities for communities previously serviced by the Commonwealth, which involves implementing an approach set out in *Resilient Families, Strong Communities*, focusing resources on larger communities and leaving smaller communities to manage themselves[134]. A recent audit of the

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[132]Sullivan P. (2011). The policy goal of normalisation, the National Indigenous Reform Agreement and Indigenous National Partnership Agreements. DKCRC Working Paper 76. Ninti One Limited, Alice Springs

[133] See Appendix 6 regarding Land and Tenure Aboriginal Land Trust

[134] Delivering Essential service to Remote Aboriginal Communities – Follow-Up Report. https://audit.wa.gov.au/reports-and-publications/reports/delivering-essential-services-to-remote-aboriginal-communities-follow-up/

REMS program concluded that there is a risk that the Department's focus on large communities through EMSUP, with limited resources allocated to small and self-managed communities, will not achieve the aims of *Resilient Families, Strong Communities* to improve outcomes for Aboriginal people living in remote communities. In most cases, the LGAs do not provide waste management to small communities unless specifically funded; in some communities in Halls Creek, the AEH service provider assists some people in taking their waste to the tip on an ad-hoc basis.

4.6.1.7. *Influence of social issues on AEH outcomes*

Throughout the consultations, the critical role of social determinants such as unemployment and lack of education opportunities was raised. Several participants pointed to a range of social problems that limit participation in activities that promote good environmental health decision-making and actions, citing substance misuse and domestic violence as having a major impact. A recurrent theme in many consultations was the need for community development and parent support programs to address the social issues. For example:

> *"I think Thrive is something that many families would welcome, and it would be good to run through the AEH service providers. It could employ local people, and provide good role models." (Stakeholder)*

> *"NIAA could be involved in setting up parenting programs for the families who are struggling and living in overcrowded houses, if they could get them into their own place." (Stakeholder)*

There were repeated references to changes in government policies, including a shift from the whole-of-government approach to Indigenous development established through the Office of Indigenous Policy Coordination to support community governance and capacity building through a national network of 30 Indigenous Coordinating Centres in 2004. Several people noted that they felt challenges in addressing environmental health issues were sometimes due to Aboriginal Corporations breaking down or Community councils being run by family groups, resulting in poor governance. The lack of community-level governance and local politics can also be challenging for agencies trying to work with communities to develop more equitable and transparent housing allocation policies to address issues such as overcrowding and housing disrepair.

4.6.2 Specific areas of AEH Program responsibility

This section includes stakeholder, community and service provider perspectives on how well the main AEH Program strategies and related services are working, what challenges exist, areas of potential duplication, areas of unmet need, and what could potentially be improved. Consultation findings are reported based on the existing WA AEH Program, encompassing an 'in-home' environmental health improvement program with the following components:

- Safe bathroom assessments
- Plumbing Emergencies
- Dog health
- Pest control
- Health promotion and education
- Referrals and follow up
- CEHAPs
- Training

Not all service providers offer all of the above-listed components, and some place greater emphasis on certain aspects of the Program based on the level of financial resourcing, available staff resources and geographic coverage required. Specific details of the above-listed AEH Program activities are in Section 2.5.

4.6.3 Safe bathroom assessments

The consultations revealed there are few environmental health services in LGAs and population health units that provide safe bathroom assessments in addition to those undertaken by AEH Program service providers. Some AEHWs indicated that they are reluctant to approach households to undertake

assessments. For some, it is about not wanting families to feel shame. For others, it is because they do not have the capacity or resources to fix bathrooms in poor condition. For others, their reluctance reflects a need for greater training to feel confident to undertake these types of routine assessments.

4.6.3.1. *Emergency plumbing repairs*

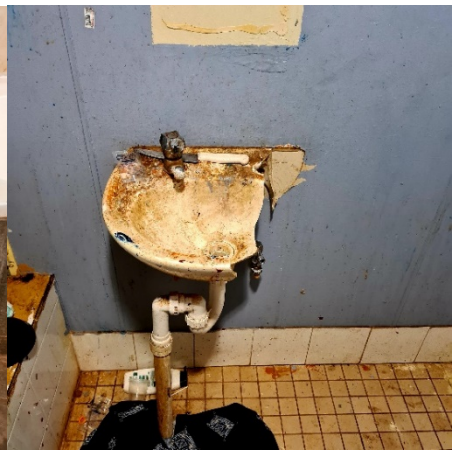
In 2016, changes to Plumbers Licensing and Plumbing Standards Regulations 2000 were approved for performing basic plumbing repair work in remote Aboriginal communities in emergency situations where the community's remote location prevents a licensed plumbing contractor from getting there within a reasonable timeframe to address the issue. Under the changes, a limited range of basic plumbing repair work can be carried out by suitably skilled EHWs in certain situations. Service providers are responsible for environmental health workers performing plumbing work under this scheme to ensure the quality of work is maintained. A register of all work carried out is kept and made available for inspection by a plumbing compliance officer from the Plumbers Licensing Board[135].

Most service providers, stakeholders and communities reported houses having blocked toilets and broken leach drains for months. Administrative procedures through the Department of Housing require forms for funding approvals and prior booking, meaning that contractors cannot complete unscheduled repairs discovered during the visit.

The photos below show the state of some bathrooms.

Shower and basin at safe bathroom check.

Photo courtesy of Meta Maya



Broken drains and leach drains where there is open sewerage.

Photo courtesy of Nindilingarri

Several participants were critical of the government agencies' practice of using a preferred provider contractual model that did not acknowledge the importance and effectiveness of supporting local services where local plumbers and AEHWs were believed to have a better knowledge of the wastewater plumbing and existing pipe configurations than the contracted plumber. Furthermore, the value of using local people to ensure the cultural safety of the service delivery and build local community capacity was widely acknowledged. The need for more flexible services coupled with an ongoing audit and fix process was suggested as a need. In the Kimberley, opportunities exist to promote a regional service and employ local Aboriginal plumbers through NUDJ plumbing, a public benevolent institution.

[135]https://www.commerce.wa.gov.au/sites/default/files/atoms/files/decision_paper_-_final_published_version_-_16_august_2016_0.pdf

Two bathrooms identified in safe bathroom services program audit. The bath on the left was reported to have been in that condition for several months.

Blocked broken drains and a collapsed leach drain showing where there is open sewerage.

4.6.3.2. *Dog health programs*

The key elements in dog health programs include desexing and/or culling dogs to limit numbers and treatment for Parvovirus and ticks and, to a lesser extent, mange. Service providers play a support role for dog desexing surgery when offered by Animal Management in Rural and Remote Indigenous Communities or Murdoch University, including collecting dogs, pre- and post-operative care, and returning to homes. Despite dog health programs being run by AEH Program service providers, LGAs and population health stakeholders in several communities reported that dog numbers are still high, causing serious hygiene and safety problems, with dog packs attacking other animals, clinic staff and community members and defecating inside houses. In some communities, people reported an unmet need for fences around their houses to keep dogs in or out of the property. Several stakeholders and community members acknowledged that controlling dog numbers is a challenge for service providers due to community attitudes and keeping dogs for hunting rather than domestic pets. In addition, the dog health programs are no longer able to use the drug to prevent oestrus and rely solely on surgical means of sterilisation, and as most service providers refuse to put down dogs with Lethabarb, the dog populations will likely continue to grow. One AEH practitioner stated that they work with AEH service providers to cull dogs if communities request it.

4.6.3.3. *Pest control*

Pests including cockroaches, rodents, mosquitoes and flies can spread diseases. Pest control is an important component of the AEH Program. Residents and stakeholders in most communities confirmed frequent pest infestations of cockroaches and mice, and mosquitoes on a seasonal basis.

The AEH Program intention is for service providers to have a supporting role in preparing homes for treatment by qualified pesticide operators, and that pest control should be provided by Housing Management. However, respondents reported that this is not often the case and therefore may be offered by service providers.

Several communities described pest control as "ad-hoc", while others believed that despite AEH service provider efforts, the problems would reoccur if people in the community did not address issues around their houses.

> *"We had that pest person here a couple of weeks ago for cockroaches and ants. …… The problem is that if your neighbours have it and they don't keep up with it, you're going to end up getting it eventually. It's the same with mice, rats." (Community)*

Case Study 3: Murray Valley encephalitis virus and information dissemination

The Climate Health WA Inquiry notes changes in climate and water management, flooding events, and temperature encourage mosquito breeding, increasing community risk of and vulnerability to major disease outbreaks. For example, recent flooding in Victoria resulted in the largest outbreak since 1993 with a 10-fold increase in Ross River virus (1,974 human cases reported, compared to the historical annual mean of 204 cases)[136].

Certain mosquito species found in WA are carriers and transmitters of several serious diseases, including Ross River virus, Barmah Forest virus, and Murray Valley encephalitis virus (MVEV)[137]. Recent submissions to the climate health review confirm that changes to temperature, rainfall, humidity and/or tides influence conditions affecting mosquito distribution and abundance[138].

Findings from the Review

The AEH Program undertakes surveillance activities and engages with local government to ensure integrated mosquito management strategies are implemented to reduce pests or vector mosquitoes. One strategy conducted by the EHD, WACHS and LGAs is the Sentinel Chicken Surveillance Program; an early warning system for MVEV in the Kimberley and Pilbara. This program has 'a strong record in mosquito control in WA', led by a small team of medical entomologists in the EHD working closely with local government to control mosquito populations[139]. Trained environmental health officers employed through AEH service providers or the WACHS bleed the chickens and send blood samples to PathWest for virus antibody detection. When MVEV is detected, the EHD issue an alert and a media statement, warning residents and travellers of the increased public health risk and the need to take protective measures to prevent mosquito bites.

However, during the extensive consultation undertaken as part of this Review, it was evident that, while the EHD sends alerts, many people at the community level had not heard of MVEV and did

[136] Department of Health. Climate Health WA Inquiry Public forums summary report. Perth (WA): Government of Western Australia; 20 https://ww2.health.wa.gov.au/~/media/Corp/Documents/Improving-health/Climate-health/Climate-Health-WA-Inquiry-Final-Report.pdf

[137] WA Country Health Services. Public submission. 2019; Department of Health. Statewide notifiable diseases weekly report. Perth (WA): Government of Western Australia [cited 2020 Feb 14]. Available from: https://ww2.health.wa.gov.au/Articles/F_I/Infectious-disease-data/Statewide-notifiable-diseases-weekly-report

[138] Department of Health. Public submission. 2019; Zhang Y. Public submission. 2019; Bloomfield L. Public submission. 2019

[139] Department of Health. Public submission. 2019 cited in Weeramanthri, T (2020) Climate Health WA Inquiry Final Report, p.45

not recall being informed when recently detected in the Kimberley. Contributing to this is that the usual practice of releasing a media statement does not include clinics, schools and public places. This practice needs to be improved, as one community person stated:

> *"… there should be more notice. If the hospitals are getting people with this disease, they should be telling Nindilingarri, this is what we've found … and then it should be Nindilingarri's job to go around to every community and let people know."*
> *(Community)*

The AEH service providers and WACHS Population Health Unit both play crucial roles in this program due to their local knowledge and experience in chicken bleeding. While there were no cases of MVEV notified to WA Health in 2019 or 2020, the point was made that MVEV symptoms can range from mild to very serious in both children and adults, and people are not likely to visit the doctor, and doctors are only likely to test for the virus when the symptoms are severe.

Future directions

- More attention needs to be focussed towards reducing stagnant water including removing car bodies and old tyres that serve as a breeding ground for mosquitoes in communities and ensuring that plumbing hardware is well maintained.
- Improve and target the dissemination of information from the EHD to AEH service providers and communities (displaying culturally relevant posters such as 'fight the bite' in all public places).
- The increased risks of mosquito-borne diseases and extreme weather events mean 'adaptation capacity will need to keep pace'[140] at a system level over the next decade, providing opportunities for increased community participation through co-design, as recommended by this Review. This will require a more targeted approach to:
    - provide employment opportunities and specialised environmental health workforce training
    - increase agency integration
    - strengthen community resilience and recognise and support increased opportunities for Aboriginal stewardship.

4.6.3.4. *Prevention, health promotion and education*

All participants emphasised the vital importance of health promotion and education for improving AEH outcomes in WA, with the majority indicating it as an area needing more attention. In particular, the need for health education to focus on creating a healthy home environment to promote general health and wellbeing for families was highlighted. Specific activities suggested were:

- Education for parents starting in the early years;
- Service providers doing practical demonstrations with families such as house cleaning;
- Community BBQs to build trusting relationships;
- Community development and co-design of culturally appropriate health promotion; and
- Conceptually meaningful education materials produced in local language or plain English.

These activities all require time allocation for preparation, but some service providers perceive that they are not funded adequately to engage with communities in best-practice health promotion.

[140] Weeramanthri, T (2020) Climate Health WA Inquiry Final Report pxii

Case Study 4: Health promotion

The 2014 Holman Report[141] highlighted the need for a greater focus on prevention and health promotion to keep people healthy. Health promotion aims to engage and empower individuals and communities to incorporate healthy practices. Prevention includes activities such as screening at-risk populations and developing strategies for appropriate management of existing diseases. Australia is a world leader in health promotion, consistently ranked highly in terms of healthy life expectancy and health expenditure per person. However, these successes have largely failed to translate into Aboriginal health outcomes. This reflects a failure to value Aboriginal perspectives, knowledge and practice in health promotion. Aboriginal community-led health promotion presents a way forward[142].

Findings from the Review

Reported as central to the AEH Program is the use of CEHAPs developed for service delivery based on the priority needs of the remote community by consultation[143]. This reflects good Aboriginal health promotion practice. However, the survey findings revealed a reported disparity between service providers' perspectives and program responsibility and community/stakeholder level of awareness of CEHAPs, suggesting that some communities had not been engaged effectively in community consultation processes. The surveys also indicated that some service providers/AEHWs felt the need for additional financial resources to undertake health promotion activities such as '*Getting involved with other health service staff members in environmental health safety and education campaigns (including mental health)*'. The Review consultations found that many service providers experience challenges in providing health promotion services to communities due to issues of community access, lack of funding, lack of staff, lack of training and high staff turnover. However, encouragingly multiple examples from the consultations provide evidence that targeted investments in prevention, together with culturally responsive best-practice health promotion, can improve health outcomes.

Several examples where researchers partnering with ACCOs, ACCHS, health practitioners and AEHWs in the regions have designed, implemented and evaluated effective prevention and health programs that have resulted in policy and practice improvements (many at very little cost) at local, state and national levels to promote infectious and chronic disease prevention and control. The National Healthy Skin Guidelines[144] published by the Telethon Kids Institute (TKI) changed as a direct result of information provided through a collaborative research project. This example demonstrates how such programs can help inform a way forward and align with the requirements identified through the AHWF in terms of needed data, evidence generation and research strategy. While more needs to be done in this area, there are several existing co-designed, culturally responsive, and relevant health promotion resources to draw on, including:

- The Keeping Skin Healthy handbook, adapted from other evidence-based resources and used extensively in the Pilbara and other regions[145].

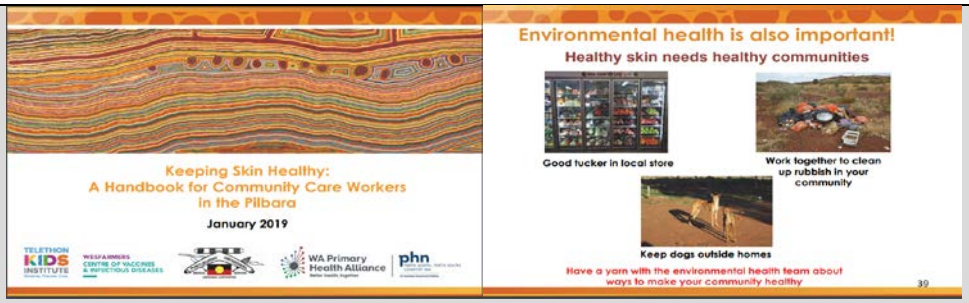
[141]Holman C, Joyce S. A promising future: WA Aboriginal health programs. Review of performance with recommendations for consolidation and advance. Perth: Department of Health Western Australia. 2014

[142] McPhail-Bell, K., Bond, C., Brough, M. and Fredericks, B., 2015. 'We don't tell people what to do': ethical practice and Indigenous health promotion. Health Promotion Journal of Australia, 26(3), pp.195–199

[143] WA Environmental Health Directorate business case

[144] National Healthy Skin Guideline. 2018; https://infectiousdiseases.telethonkids.org.au/resources/skin-guidelines/

[145] Walker, Roz; Wyndow, Paula; Anshelevich, Ellen; Zheng, Andy; Mullane, Marianne and Bowen, Asha. Keeping Skin Healthy: A handbook for community care workers in the Pilbara. Telethon Kids Institute, January 2019



- The SToP trial engages Aboriginal community members in health promotion, improving the understanding of links between environmental health issues and the health and wellbeing of families[146].
- A social marketing campaign promoting handwashing in remote Aboriginal communities noted the high recall of key messages and self-reported handwashing increased after the intervention, suggesting this as an effective tool to change personal hygiene behaviours[147].
- In 2020, the SDWK launched Live Deadly, an environmental health promotion program developed with community members from Pandanus Park, Mowanjum and Looma. The program directly involves community members in the delivery of health promotion materials, focusing on looking after yourself, your house and your community[148].

Future directions

Place- and strengths-based health promotion allows the AEH Program to encourage AEHWs to work with local communities to build on local knowledge to develop solutions using co-design. This will require a significant allocation of time and resources to conduct community engagement, relationship building, community BBQs and information sessions and, where opportunities exist, partnering with universities to conduct health prevention and promotion research.

Health promotion strategies need to acknowledge the limitations when people do not have ownership or control over their homes (due to overcrowding, violence, lack of resources or not being on the lease). This will require supporting AEHWs through training to deliver health promotion activities in a trauma-informed, culturally secure manner.

4.6.3.5. *Referral and follow-up*

Most health clinics and service providers confirmed they had established a referral process whereby tertiary and primary health services can request an AEH service provider to address issues related to environmental health. Overall, the referral form used across the Kimberley was identified as very effective, with referral pathways established between the service providers, clinics and other stakeholders. However, referral processes are not uniform, highlighting the need for more focus and training in this area.

4.6.3.6. *Challenges in referral process*

Challenges were identified by both AEH service providers and mainstream health providers regarding the use of referral forms by AEHWs. They frequently cited complex, interrelated issues of high staff turnover, the ongoing need to train people and the time required to close a referral due to

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[146] Coffey PM, Ralph AP, Krause VL. The role of social determinants of health in the risk and prevention of group A streptococcal infection, acute rheumatic fever and rheumatic heart disease: a systematic review. *PLoS Negl Trop Dis* 2018;**12**:e0006577. doi:10.1371/journal.pntd.0006577

[147] McDonald E, Slavin N, Bailie R, Schobben X. No germs on me: a social marketing campaign to promote hand-washing with soap in remote Australian Aboriginal communities. Glob Health Promot. 2011 Mar;18(1):62-5. doi: 10.1177/1757975910393577. PMID: 21721304

[148] https://www.sdwk.wa.gov.au/news/live-deadly-campaign-launches-in-pandanus-park/27

issues outside their remit, including overcrowding, inadequate housing, serious plumbing and housing maintenance and social issues. While most service providers and stakeholders were very positive about referral forms and processes, there were differences in the level of understanding regarding the purpose of the referral forms, reflecting a need for greater emphasis on training both AEHWs and clinicians on the value of the forms and the importance of implementing the referral process to improve health outcomes. At the same time, several comments indicated instances where clinic staff used a directive, culturally unsafe practice that fails to recognise and respect the valuable role that AEHWs play. For example, one service provider noted:

> *"[the AEHW] didn't like the way the form tells them what to do… they would rather know what the health condition is and make their own choices around what needs addressing in the home." (Service Provider)*

This confirms many other comments by AEHWs about not being regarded equally and being talked down to by white people in the system.

Some stakeholders were unaware of AEH service providers' ability to engage in referrals with agencies outside their roles with ACCHS, possibly due to limited communication between agencies. Moreover, some clinic staff reported that they had "no faith" in the usefulness of referral forms after submitting them and receiving no response. Indeed, in some instances clinical staff were unaware of the existence of these forms, highlighting the critical need to develop processes to ensure referrals are embedded across the health system.

4.6.3.7. *Developing and implementing CEHAPS*

Both the consultations and survey results indicate that although all contracted service providers are aware of the requirement to develop a CEHAP to address the specific health risks and identified needs of the communities they service, this is not always done. In most communities, aside from the CEO and Chairperson, the majority of community members and most stakeholders, including local clinics, indicated that they were unaware of the CEHAP.

4.6.4 Systems perspective

The above sections outline the issues in delivering the AEH Program, including the lack of clarity in roles and responsibilities across sectors/agencies (also identified in the activity analysis and survey data), changes and gaps in government policies and inadequate funding. These broad level challenges require whole-of-government system-level change. Consequently, this section analyses the consultation findings using a framework drawing on the AHWF (2016–2021) directions and Closing the Gap reform priorities to 'promote better health systems'. The framework identifies essential system elements to support improvements in Aboriginal health and wellbeing outcomes (Figure 16).

Figure 16: Essential elements supporting system transformation in Aboriginal Environmental Health

4.6.4.1. *Leadership and governance (decision-making authority)*

This section discusses issues raised by participants in the consultation on how the AEH Program is structured, including leadership, decision-making authority, management structure and accountability.

Aboriginal leadership

While some stakeholders believe the AEH model of service delivery has always been flexible and reflects the need to address service provider or community priorities, others identified the need for greater Aboriginal leadership. For example, Aboriginal leadership has effectively driven the AEH Program in some regions through Aboriginal Health Regional Planning Forums; however, this opportunity was identified as needing further development in other regions. One service provider emphatically stated that effective AEH service delivery requires strong leadership by ACCOs working in partnership with ACCHS and other services. The need for a new governance model to support Aboriginal decision-making reflecting this sentiment was reiterated at an inaugural AEH conference organised by AHCWA in August 2021, where consensus was reached about a vision for AEH and its relationship with the Council. However, the AEH Program team members were not invited to this forum and so were unable have input to these discussions.

Community members also consistently highlighted the need to support strong Aboriginal leadership at the community level. In discussions on CEHAPs, one stakeholder described how better engagement would mitigate the issue of community members not knowing who delivers AEH services, what they do and whom to talk to within the community regarding issues related to housing, plumbing and rubbish.

The consequences of the breakdown of governance in some communities, discussed above, suggests that effective delivery of AEH programs in remote communities requires inter-sectoral strategies to establish/build on appropriate structures at the community level as part of the strategic priority to build community capacity.

EHD accountability and management structure

All service providers were represented in the qualitative interviews. Many positive comments were made by each of the different categories of service providers (ACCOs, Population Health and LGAs) regarding the EHD and the AEH Program, particularly in relation to their willingness to go into the field and work alongside AEHWs.

> *"They do some good work, they are willing to come out and talk with workers on the ground, they have a good understanding of the challenges we face." (Service Provider)*

> *"They attend the health planning forums and make a good contribution and keep up with all the environmental health issues and the difficulties that we are confronted with in the different regions, everything from STIs, to scabies to trachoma and rheumatic heart disease, they do training too." (Service Provider)*

However, several service providers did not believe the EHD operated in a fully reciprocal partnership. For example, some service providers raised concerns about being micro-managed, while others commented on the need for greater focus on equitable partnerships. It became clear as the evaluation progressed that while the AEH Program team is genuinely well-meaning and demonstrably committed to addressing AEH in remote communities, there are opportunities for improvements, as reflected by the following comments representative of recurrent themes raised by participants:

> *"We haven't found them responsive to new ideas, or to working as partners. I know they like to get out on the ground and handout the towels – but we can do that - just give the resources to us to do that." (Service Provider)*

> *"I would like to see more transparency in decision-making, at present, there are people being funded that we don't believe deliver the goods, which seems like they have favourites." (Service Provider)*

One example where there seems to be an opportunity for greater communication and negotiation to avoid misunderstandings between the AEH Program and service providers was around trachoma health promotion and house assessment. While training has been specifically requested by service providers and WACHS on this area, some service providers believed that training decisions were made without discussion and did not respect their knowledge and experience:

> *"They dictated that we have to attend trachoma training, no negotiation. they don't acknowledge our knowledge and experience in this area." (Service Provider)*

Further, some service providers did not feel that they were provided adequate support and guidance during the contract management process.

> *"From our perspective, it seems like the goal posts shift…" (Service Provider)*

The findings suggest that the AEH Program team balances roles between the operational needs of service providers in diverse contexts across the regions and program management administration requirements. In order to fully understand the diverse contexts, the team strive to 'get on the ground', 'hand out towels' and hear about the issues at a local level, while at the same time working with service provider contract managers. They need to manoeuvre between being 'friend/colleague vs policeman/contract and program manager'. This can understandably be challenging but also cause confusion among service providers and communities. It also presents a potential risk of the AEH Program being misunderstood by the service provider contract management staff as interfering with their community workforce.

> *"I guess from the contractor's point of view it can be a bit tricky when [they're] in the field, but you've also got to report to [them]." (Stakeholder)*

Other service providers stated that they would like to see more systemic advocacy by the EHD to address some of the existing legislative and policy issues to enable providers to be more effective in

the communities. They also saw a greater role for the AEH Program within the EHD in promoting improved integration and coordination between relevant agencies that impact on AEH to make service delivery more effective and culturally responsive to community needs.

One senior government participant believed the AEH Program has a critical role in improving Aboriginal health outcomes but felt the program was not adequately recognised within the Directorate. With respect to enhancing and elevating the AEH Program management structure within the EHD, one senior government stakeholder made the following observation:

> *"… any government program is going to be more effective when there's alignment and support from the top levels of the organisations to support what stops being pilot projects and becomes part of strategy with the support and budget to deliver on agreed outcomes… I'm not saying it doesn't happen at the moment but that would be something if we're looking to polish the way this kind of work is delivered, then it's worth starting at a strategic level." (Stakeholder)*

4.6.4.2. *Community partnerships*

Strategies to promote community capacity building, empowerment and self-determination were identified as essential to improve outcomes in the future. The need for a stronger commitment to build the Aboriginal community-controlled sector was also evident throughout the consultations and echoed in service provider presentations at the Aboriginal Health Council of WA inaugural environmental health forum (2021).

The consultations with service providers confirmed that the environmental health programs are generally well-established in most communities, with some communities acknowledging the benefits of forming partnerships with ACCOs providing AEH services. Several service providers acknowledged the important role of AEHWs, Community Elders and the need to gain local community support to deliver their programs effectively.

Aspects such as community co-design, community engagement and empowerment are well-embedded into communities through the AEHWs who work in this holistic and community-centred way. The six-monthly reports provide an opportunity for service providers to report on the importance and effectiveness of addressing these issues in the communities. However, some service providers continue to struggle with the current reporting process, which needs to be resolved in the next procurement round.

Coordination, integration and communication

It was evident that building community partnerships and strengthening the coordination and integration of activities across the environmental health sector was often challenging for environmental health stakeholders managing their own work remit and working in understaffed and under-resourced circumstances. The consultations highlighted the challenges in communication and reporting lines between agencies, including the AEH Program with service providers, AEHWs with clinics (especially for referral follow-ups), all service providers working in the same communities, and service providers with other relevant agencies. Responses highlighted that better communication flows were necessary.

> *"It's difficult because the environmental health side is literally one side of the coin. If you've got a building which is falling down, or has structural problems…, having people come out and do environmental health work and, say, unblock the drain helps but doesn't actually resolve that problem. You have to separate what the team has responsibility for in terms of how they deliver that. Certainly, in places where they've been able to do work and build relationships, we've seen the number of call outs for other kind of services involved where they [AEH Program and service providers] are successful at actually intervening." (Stakeholder)*

Accountability and transparency

As discussed in Section 4.6.1, consultations revealed a lack of clarity regarding AEH service responsibilities. A recurring theme was the need for greater accountability and transparency throughout the system, including by the EHD in allocating contracts and financial resources to services and by the service providers themselves concerning the communities they deliver services to:

> *"The community they don't really know what we do...they think we just drive around to communities dropping off soap and things like that …and talking to kids about washing their hands. They don't understand the range of issues we are dealing with. We are everywhere doing everything from blocked toilets to fixing the lights on the airstrip so some very sick person can be flown out to Broome or Perth…" (Service Provider)*

Service providers spoke of the importance of networking, relationship building, service delivery in partnerships and the need to include such activities into their reports as legitimate activities. While there is a perception among some service providers that they are currently not able to include these activities in their reports, the AEH Program staff confirmed that there is a specific section in the six-monthly reports to include these activities, particularly with the move to an outcomes approach in the next procurement round:

While the consultations with many service providers and stakeholders confirmed the crucial role of the AEH Program, several senior government stakeholders emphasised the need for greater system-wide accountability to address the environmental factors outside the remit of the EHD:

> *"The reality is in lots of Aboriginal communities, the level of service in terms of things like the roads, the rubbish, everything else is not up to the standard that would be acceptable outside in any regional town. Having that information fed back into the loop in terms of policymaking and particularly if we're moving into Closing the Gap targets, which are including some elements of community infrastructure, is going to be vital in terms of being able to say what improvements have happened. It is the ability of them to actually deliver change." (Stakeholder)*

As outlined in the Options Paper, there is real potential for the AEH Program to be a part of the feedback mechanism to identify how the various aspects (such as poor housing, roads, rubbish tips, etc) outside their remit nevertheless adversely impact on their attempts to improve outcomes that align with AHWF and the relevant National Partnership Agreement Close the Gap targets. AEH service providers could provide this information as part of the CEHAPs process and other program activities, such as bathroom and house assessments, or in an audit check within their six-monthly report to AEH Program managers, who in turn could report on aspects that are not up to standard to relevant agencies. This would ensure greater accountability and transparency across the system.

4.6.4.3. *Workforce for Aboriginal Environment Health service provision*

Aboriginal health workforce

The consultations highlighted the value of having local AEHWs to ensure the effective delivery of the AEH programs and services. Many participants stressed the importance of strengthening the Aboriginal health workforce to provide a culturally safe and stable workforce. At the same time, challenges in training and staff retention and recruitment were raised.

Some stakeholders differentiated the roles played by LGA environmental health officers (largely regulatory) and local AEHWs working in ACCOs and WA Country Health Services Population Health, encompassing a range of roles underscored by their cultural and familial connections to community (a factor greatly valued). Government agency stakeholders reported difficulty in recruiting culturally competent and experienced non-Aboriginal staff.

Training

Several service providers highlighted the desire for ongoing training for AEHWs. While training is offered at least annually for all service providers, one service provider reported that they had only

recently had training provided for themselves and their staff which was the first time in three years and only now know what they are required to do to be effective in their role.

One stakeholder emphasised the need for practical training that provides AEHWs and environmental health officers with the knowledge, skills and confidence to shift from mainly working outside (community cleaning yards, collecting rubbish, plumbing repairs and cutting grass) to working inside houses (safe bathroom assessments, housing hardware and repairing windows and doors) where Housing Management Agreement or other housing maintenance arrangements are not in place.

According to AEH Program managers, all AEH service providers are surveyed regularly for their practical training needs with limited response. This is an area that needs further consideration as to how to engage AEH service providers in successful and ongoing training programs to meet the needs of their AEHWs.

Staff turnover and retention

High staff turnover, impacting the ability of service providers and stakeholders to provide effective service delivery across sectors, including the use of referrals, was noted. Continuous turnover for all regional service providers results in inexperienced AEH staff not having the skills, knowledge and understanding needed to take on complex tasks.

Ongoing and cumulative difficulties were reported as creating a sense of frustration and burnout, impacting staff recruitment and retention. These include:

- low income/salary offered to workers (especially when competing with mining jobs);
- amount of travel and time required in the field in extreme conditions (climate, poor accommodation, lack of community engagement, feelings of isolation);
- working with limited resources (tools, health promotion materials);
- lack of clarity about the AEHW role; and
- failure to meet job requirements that reflect systemic disadvantage (e.g. driver's licences and police clearance).

In an attempt to address low income, contract rates were increased by 30% under the Component II NGO Funding initiative to enable AEH service providers to pay above Award rates; however, most contractors have not applied for this salary increase despite advice from the EHD that they can pay above the Award.

Currently, AEHW roles and responsibilities are detailed in the Contract Response document, allowing for flexibility and focuses on responding to the changing needs of communities' circumstances; this may account for the different emphasis on roles and add to a sense of a lack of clarity.

Culturally safe service delivery

The importance of having Aboriginal-controlled service providers and local AEHWs was reflected in the community consultations. Participants referred to the need for AEH service providers, LGAs and housing services to recognise the importance of culture and connection to country, spirituality, family and community to support Aboriginal health and wellbeing.

Many stakeholders acknowledged the centrality of local knowledge for ensuring culturally safe services, with one stakeholder mentioning how the cultural diversity within Aboriginal communities creates challenges when training 'outsiders' in cultural competence. Several service providers and stakeholder consultations emphasised the need to enhance AEH capacity, capability and responsiveness to improve the cultural competency of non-Aboriginal staff working across all sectors involved with AEH. New cultural security protocols introduced due to COVID was cited.

While some stakeholders acknowledged that the non-Aboriginal staff in their organisations had completed Aboriginal cultural awareness training which helped them understand Aboriginal

perspectives about health and the impact of colonisation, they also stated that high staff turnover reduces the capacity of the WA Health workforce to embed Aboriginal cultural understandings in their interactions with Aboriginal clients and staff.

> *"Look, the truth is staff often come up here for an adventure but most of the time they aren't here long enough to get to understand that all the squalor and poverty and overwhelming social issues they have to try to work with are tied into our historical legacy, taking away their lands and their families. They get culture shock quite honestly, they can't see the cultural strengths to work with, and by the time they finally do they are worn-out and they leave…It would be good to invest all the costs of relocation on training and supporting local Aboriginal people, cadetships, scholarships, on the job training that sort of thing." (Stakeholder).*

The high staff turnover across all sectors and lack of financial resources/funding to support a local, preferably Aboriginal workforce was a consistently reported theme affecting the ability to provide culturally safe and effective service delivery. While not a direct AEH Program responsibility, environmental health and communities suffer when organisations do not have culturally competent staff or fail to recognise the contextual challenges. It is expected that planned improvement in Health Service (WACHS) staff orientation in environmental health referrals and other processes will assist here.

4.6.4.4. *Health prevention and health promotion*

As described in the previous section, a strong theme throughout the consultations was the need for a stronger focus on prevention and health promotion, particularly to connect AEH service delivery with comprehensive PHC. That is, at a systems level, a health promotion focus was seen as the 'glue' that can assist in integrating all AEH activities and AEH-related agencies. A local workforce was considered central to providing culturally safe health promotion and education but requires funding allocation.

Case Study 5: Trachoma

Trachoma, an eye infection caused by the bacteria *Chlamydia trachomatis* serotypes A, B, Ba and C, continues to be the world's leading cause of infectious, preventable blindness and the fifth leading cause of blindness. Australia is the only high-income country where trachoma is still endemic with almost all cases occurring in Aboriginal communities[149]. A holistic approach is needed to eliminate trachoma. The WHO's comprehensive strategy (SAFE), which includes S (surgery), A (antibiotics), F (facial cleanliness) and E (environmental health improvements), is changing social norms such as attitudes and behaviours and tackling the social determinants of health in a culturally secure way.

Findings from the Review

PHC pilot data show that about 200 individuals with trachoma were treated in a year at participating Kimberley and Pilbara services, with other diseases susceptible to the physical environment ranking highly, particularly skin infections (including scabies) and otitis media. Community-based health promotion programs ensuring a holistic approach to eliminating trachoma are critical. The WA Trachoma Project and their #endingtrachoma project is an example of long-term planning and hands-on service provisions in partnership with the AEH Program. While this project is achieving positive outcomes, it has been noted that there are some areas need to be strengthened in terms of regionally-based Aboriginal representation in its reference group and throughout its implementation and on-the-ground activities. This extends to other state-based

[149] Shattock AJ, Gambhir M, Taylor HR, Cowling CS, Kaldor JM, Wilson DP. Control of trachoma in Australia: a model-based evaluation of current interventions. PLoS Negl Trop Dis. 2015;9(4):e0003474

reference groups that target specific diseases impacting Aboriginal communities more broadly.

The WA Trachoma Storybook celebrates and shares 13 stories demonstrating that health promotion offers multiple, engaging approaches to help increase awareness and skills around face and hand washing. Some stories tell how health promotion enhanced the understanding the causes of trachoma and how it can be treated. Other stories reinforce the importance of clean faces and hands, while others discuss innovations around safe and functional bathroom and laundry facilities, health hardware, towels, soap and mirrors.

https://www.phaiwa.org.au/wp-content/uploads/2021/06/TheWATrachomaStorybook.pdf

The project also monitors outcomes over time to evaluate its program. Thus, through the Australian Government Closing the Gap initiative, significant funding was allocated to improve eye and ear health services for Indigenous Australians. The National Trachoma Surveillance and Reporting Unit is responsible for data collation, analysis and reporting related to the ongoing evaluation of Trachoma control strategies in Australia.

In 2019, 3,154 children aged 5–9 years were examined in at-risk communities in WA for trachoma with a screening coverage of 92% and a prevalence of 6.4%. Capacity building was an important part of the WA Trachoma Project. As one service provider commented:

> *"A part of our role is to try to build capacity and bring that up to a certain level, working pretty closely with the contractors and also the Directorate to make sure we're all streamlining in the same direction."*

Future directions

The Trachoma Project is an example of a vertical (disease-specific, dedicated resources and focused objectives) national program strengthening the services provided horizontally at the community level (primary health care across health broadly). While this example demonstrates positive outcomes, it could be strengthened by being more purposefully engaged with the Aboriginal community and ACCHS in its implementation. There are additional examples, on a smaller scale to draw on in the future, where projects partnering with the ACCH and ACCO sector have worked directly with researchers to achieve positive results through a collaborative service delivery model[150].

4.6.4.5. *Strengthening community capacity*

The consultations identified AEH Program elements that contribute to community capacity building, including local advocacy, community engagement, and promoting self-determination and community ownership. This is especially the case where people feel engaged and consulted about AEH issues/services. Many participants considered these elements crucial to Aboriginal health and wellbeing. Several service providers stated that these activities should be deemed legitimate in the delivery of AEH services. Although not currently considered by the EHD as part of direct service delivery, service providers are encouraged to include them in their six-monthly reports as part of their model of service provision and administration/consultation/planning/program support activities. However, it will be important in the future to focus on elements in the service design that contribute to community capacity building as activities linked to an outcome.

[150] Partnering with communities to reduce rheumatic heart disease in the Kimberley. 2018; https://www.telethonkids.org.au/news--events/news-and-events-nav/2018/october/partnering-with-communities-to-reduce-rhd/

When asked what was working well, there were several positive comments about the current AEH Program in terms of its flexibility, responsiveness to local needs, commitment to strengthening local capacity and willingness of AEH Program managers to travel to the communities.

Several stakeholders and service providers discussed the importance of building community capacity, including in the Aboriginal community-controlled sector, to improve AEH conditions and health and wellbeing outcomes. It also highlighted the importance of building an evidence base of the need for additional funding to increase the local workforce capacity.

> *"We would like to see more focus on how the Directorate can support Aboriginal organisations with training, with information, with funding and yeah with respectful conversations, consulting with us as they are formulating priorities for our communities… Not just telling what they think needs to happen. They need to be funding us to employ more Aboriginal local people to build local community capacity down the line…So we can have more AEHWs to do referrals and that will be supporting our local clinics too, build their capacity too". (Service Provider)*

Throughout the consultations, there were many examples of the involvement and advocacy of the AEH service providers, highlighting the crucial work required within their role, which is not fully captured within the directorate activity reporting categories and needs to be considered in future outcomes-focused activities.

Community ownership

Many participants expressed a genuine commitment and desire to promote environmental health and quality of life in Aboriginal communities and ensure community goals and aspirations are included in the CEHAPs. However, this commitment was not universal, and some community participants talked of the need for community meetings 'like in the ATSIC days' to promote community ownership around environmental health issues. Some stakeholders stated that many Aboriginal people have the skills and knowledge to recommend strategies and encourage broader engagement, thus are better able to communicate health messages and play an effective role in environmental health programs/services.

Case Study 6: Drinking water and cross-sector advocacy

High levels of toxins are often reported in drinking water and have been linked with gastrointestinal infections, skin infections and kidney and neurological problems [151]. The water in many WA Aboriginal communities is contaminated by traces of arsenic, nitrates, *E. coli* and even uranium, as revealed in the WA Auditor General's 2021 Report[152], leaving Aboriginal communities vulnerable to water-borne diseases, exposures to chemical contaminants and associated health effects. These effects will potentially worsen with ongoing climate change and higher water temperatures.

Findings from the Review

The Remote Essential and Municipal Services program (REMS) provides, maintains and assesses the infrastructure to supply reliable power, safe drinking water and effective wastewater services to some remote communities. The percentage of AEH activities recorded for tasks related to drinking water varied by region (<2.1% in the Mid West and Pilbara, and 3.3–7.9% in the Kimberley and Goldfields from 2017–2021: see Section 4.2). The level of REMS services is not uniform, and water quality is not routinely tested, especially in smaller communities. Additionally, the Department of Communities does not always act promptly on the results. For example, the WA Auditor General's report stated that '*It*

[151] Bradford LEA, Bharadwaj LA, Okpalauwaekwe U, Waldner CL. Drinking water quality in Indigenous communities in Canada and health outcomes: a scoping review. International Journal of Circumpolar Health. 2016;75(1):32336

[152] Western Australian Auditor General's Report. Delivering Essential Services to Remote Aboriginal Communities – Follow-up. Office of Auditor General Western Australia; 2021

took 9 months to issue a 'no drink' notice to one community after a water quality test result exceeded Australian Drinking Water Guidelines in 2019'[153] *resulting in the community being exposed to unsafe water for an extended period. The communities themselves have no formal avenues of raising concerns, as raised by both service providers and other stakeholders*'.

> *"The Department of Communities, test the water — they do their own thing and… They do their own testing, they contact us, say, look, this is what's going on." (AEH Service Provider)*

Participants in one REMS community scheduled to receive essential service improvements through EMSUP described the water issues experienced in the community and adjoining outstations.

> *"The water, I suppose, is a big thing here. The water quality. You can't drink the water at all here. The last CEO was fighting to get the water tested but no one would help. E-Coli, due to the stock and seepage is also an issue with the water. Sometimes signs are posted about the water, but no one comes to talk about it." (Stakeholder)*

Future directions

- In 2019, Murdoch University ran a 'Roundtable on Water', where communities from around WA came together with water planners, tech companies, infrastructure engineers and academics to develop smart solutions to deal with contaminated water in remote communities. The recommendations included:
    - strengthening AEH worker training programs
    - appointment of one paid position for each of the 143 homelands communities
    - homelands and community services research and development hub to develop and evaluate co-designed service delivery models.
- An analysis of two effective programs delivered in remote communities in Qld and NSW identified five important enablers: (1) support, training and cultural competence, (2) cross-agency collaboration, (3) technology fit for purpose, (4) employment of people and sustainable funding, and (5) adopting a systems perspective to coordinate prevention, planning and evaluation by relevant agencies.[154] These findings are similar to the key issues raised in this review.

The water corporation's practice of seeking exemptions from having to provide safe drinking water for small communities may require significant advocacy to obtain a solution that ensures the fundamental rights of all communities to safe drinking water[155].

Health information, monitoring and accountability

Issues around data sovereignty and the importance of relevant health information for monitoring, accountability and funding were raised by participants throughout the consultations and at the AHCWA environmental health forum, particularly the need for service providers to measure EH-related outcomes. The AHCWA values PHC data as a means for services to monitor EH-related health status and service volume at a more local level.

Limited reference was made to population health information being made available or used by communities. In addition, AEH-related information was difficult to collect, record and analyse, as reflected by the activity data (see activity data findings Section 4.3).

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[153] https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines

[154] Hall, N.L., Lee, A., Hoy, W.E. and Creamer, S., 2021. Five enablers to deliver safe water and effective sewage treatment to remote Indigenous communities in Australia. *Rural and Remote Health*, *21*(3), pp.6565–6565

[155] https://www.theguardian.com/australia-news/2021/oct/20/im-doing-this-out-of-my-heart-the-fight-for-clean-water-in-one-remote-wa-indigenous-town

"I know that the Directorate is missing out on a lot of data because the workforce can't complete the form correctly." (Stakeholder)

4.6.4.6. *Data, evidence and research*

Several examples show how service providers have partnered with research projects to improve environmental health outcomes. For instance, the SToP trial (see Skin Case Study below) provides a blueprint for researchers working in partnership with communities, ACCHS and AEH service providers in the co-design of resources and the collection and dissemination of data and evidence. The consultations confirmed that AEHWs are generally highly respected in communities and provide a bridge between researchers and the community, contributing to community empowerment and capacity building.

Case Study 7: Managing and preventing skin infections—Research partnership with ACCHS/ACCOs

Aboriginal people living in remote or very remote communities in Australia are disproportionately affected by skin infections. Up to 45% of children in remote communities have impetigo at any given time[156], with the highest hospital admissions in the Pilbara and Kimberley for children <12 months[157] and 15% of Kimberley Aboriginal infants hospitalised each year[158]. Skin diseases left untreated can result in serious complications, including chronic kidney disease and RHD. Despite skin infections being the most common reason for clinic presentation in remote WA, they are often under-reported in electronic databases compared to clinical notes[159].

Skin infections are associated with socioeconomic factors, including unsafe environments and poverty, limited health literacy, and healthcare access. Research[160] confirms the need to address environmental factors like overcrowding, lack of bedding, washing machines and damaged housing hardware to reduce skin infections in Aboriginal children[161].

Findings from the Review

Rates of hospital admissions for skin infections were the leading environment-related cause in all the (northern) regions to which the KEAFs were applied. Clinical items related to skin infections ranked very highly for all ages in the PHC data pilot and was the single leading condition for children 0–14 years.

The consultations, surveys and activity data provide an overview of the current AEH Program. Many EHS providers carry out activities that address skin infections, including safe bathroom assessments and health promotion and education. They partner with ACCHS and mainstream health services and

[156] Yeoh DK, Anderson A, Cleland G, Bowen AC. Are scabies and impetigo "normalised"? A cross-sectional comparative study of hospitalised children in northern Australia assessing clinical recognition and treatment of skin infections. PLoS Negl Trop Dis. 2017 Jul 3;11(7):e0005726. doi: 10.1371/journal.pntd.0005726. PMID: 28671945; PMCID: PMC5510902

[157] Abdalla T, Hendrickx D, Fathima P, Walker R, Blyth C, Carapetis J, Bowen AC, Moore HC 2017, Hospital admissions for skin infections among Western Australian children and adolescents from 1996 to 2012. *PLOS ONE*

[158] Armgarth-Duff, I., Hendrickx,D., Bowen, A., Carapetis, J., Chibawe, R., Samson, M., Walker, R. 2019, Talking skin: attitudes and practices around skin infections, treatment options, and their clinical management in a remote region in Western Australia, *Rural and Remote Health* 19(3) DOI: 10.22605/RRH5227

[159] Hendrickx D, Bowen A, Marsh J, Carapetis JR, Walker R, 2018, *Ascertaining infectious disease burden through primary care clinic attendance among young Aboriginal children living in four remote communities in Western Australia*. PLoS One. 2018 Sep 17;13(9)

[160] Romani L, Steer AC, Whitfeld MJ, Kaldor JM. Prevalence of scabies and impetigo worldwide: a systematic review. *Lancet Infect Dis.* 2015;15(8):960–967

[161] Bailie, R., Stevens, M., McDonald, E. (2012). The impact of housing improvement and socio-environmental factors on common childhood illnesses: A cohort study in Indigenous Australian communities. Journal of Epidemiology and Community Health, 66(9), 821-831

organisations in other sectors (e.g. Housing, REMS and LGAs) to provide more integrated services.

The Situational Analysis undertaken for the SToP trial reveals significant challenges to reduce the heavy burden of skin infections and related disease complications in the Kimberley[162]. Nevertheless, recent research, policies and protocols have focused simultaneously on surveillance, prevention and treatment to reduce the burden of skin diseases in WA[163], with formalised referral and follow up an important component developed through the Kimberley Aboriginal Health Planning Forum (KAHPF).

Kimberley-based services engaged in several best-practice initiatives that provide important learnings for other regions in WA. Service providers and stakeholders across the region considered the *Kimberley Skin Health Regional Partnership* (signed by KAHPF members in 2015) as foundational to their commitment and ongoing success in improving skin health. Many cited their roles in prioritising environmental health research through the environmental health research subcommittee and the KAHPF as critical to advocating for and pursuing the necessary changes in policy and operational practice in this area.

> *"The Environmental Health Subcommittee is a newer KAHP Subcommittee formed to deepen understanding across the Kimberley of the link between environmental conditions and health. An early achievement of the Subcommittee was the development and signing of the Regional Skin Health Partnership"[164].*

Some described how their involvement with the SToP trial (discussed in Appendix 10) provides an important opportunity and significant injection of research funds to engage Aboriginal community members in health promotion activities (see health promotion case study) and develop a greater understanding of the link between environmental issues and Aboriginal families' health and wellbeing. Engagement in research also enables the KAHPF to have **greater control over the data collection for planning, prioritisation and evaluation**. These initiatives affirm the importance of strengths-based approaches and the power of community control and data sovereignty.

Several service providers and stakeholders spoke positively about the development of the Environmental Health referral form to integrate health care assessment in the clinic with prevention and emergency intervention activities through service providers and other stakeholders across the Kimberley. Several participants also spoke highly of the referral process and commitment across agencies:

> *The hospital Child Health Nurses are pretty good at reporting, when they go to communities they report to the Shire [service provider], and they [The shire] actually went out and addressed situations and the clinic actually does report stuff, and follow up on certain things. (Stakeholder)*

Future directions

- Formalise the processes between primary health care and environmental health services to overcome the ad-hoc process currently occurring across all regions.
- The KAHPF environmental health referral form may be a useful information template and process for agencies and service providers in other regions to adapt to their local circumstances.
- Referral forms should be available on clinical information systems for all PHC clinics, including service-specific forms.

[162] 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

[163] https://www.telethonkids.org.au/projects/the-stop-trial

[164] KAPHF Subcommittee. Accessed 2022; https://kahpf.org.au/subcommittees

- Staff training, information distribution and promotion, and annual uptake assessment in PHC and AEH sectors.
- Other regions to consider the Kimberley research partnership model as an exemplar for community and ACCHS-led research in the AEH area.

4.6.4.7. *Financing, procurement and contracting*

The Holman Report recommendations prioritised the need for further AEH funding[165]. Throughout the consultations for this Review, attention was drawn to several under-funded areas. In particular, service providers reported a lack of funding constraining the level of AEH services and staffing supports, which impacts the ability to focus on health promotion to improve community understanding of the causes and prevention of a range of infectious diseases. Several service providers recommended increased funding to employ more local AEH workers in each community with regular Aboriginal coordination support.

Procurement issues, including financial allocations and funding sources, were raised, with suggestions for alternate funding sources. For example, it was suggested that mining companies be more involved in helping address environmental health issues by supporting local training and employment. Also discussed was the inadequate financial allocation for waste management that only allows short-term planning rather than ongoing strategies, consequently burdening AEHWs outside their remit.

A recurring theme by some service providers was their frustration that the WA Government continues to contract AEH work to LGAs rather than engage in productive negotiation with ACCOs and the ACCHS sector. While some LGAs strongly engage with local Aboriginal communities, the main issue for service providers relates to the need to include Aboriginal partnerships. In some cases, uncertainties of responsibilities and risks of overlapping services could be avoided by differentiating roles and responsibilities in the contracts.

While completely outside the remit of EHD, some service providers were critical of preferred provider housing repairs/maintenance contracts being awarded by the Department of Communities to Lakes, a Queensland company. One service provider pointed to the closure of Aboriginal-owned businesses in their region due to existing procurement practices. Besides the reported poor service provided by Lakes, one service provider stated this practice was outside the spirit of the Aboriginal Procurement Policy (2020), which encourages government departments to contract *local* Aboriginal businesses and strengthen the regional infrastructure in remote communities. The policy specifically refers to funding, '*culturally driven on-country work including environmental services*'. Importantly it refers to opportunities for 'unbundling' and coordinating public sector functions in regional and remote areas to enable more work to be done by local Aboriginal people on country. In contrast, the EHD procurement process is aligned strongly with the Aboriginal Procurement Policy (2020).

Mitigating the lack of clarity regarding AEH service responsibilities through contracting arrangements that allow greater accountability and transparency was often raised during the consultations. For example, to facilitate greater understanding and transparency regarding their roles, service providers need to build partnership, networking and relationship-building activities into their reports as legitimate activities. Some governmental stakeholders stated that reporting, documentation of contract variations and contract management should be the responsibility of PCU who has the knowledge, skills and expertise to do it according to best practice.

[165] Holman C, Joyce S. A promising future: WA Aboriginal health programs. Review of performance with recommendations for consolidation and advance. Perth: Department of Health Western Australia. 2014

4.6.5 Summary of consultation findings

The consultations with service providers, AEH stakeholders and communities confirmed that complex interrelationships between the cultural and social determinants influence the effectiveness and safety of the built environment for people living in remote communities. These have cross-sectoral implications as well as for the success of the WA AEH Program. Specifically, the multiple and cumulative environmental health risks that impact Aboriginal people living in remote communities, and the inter-dependent nature of many environmental risk factors, requires a range of skills and expertise and the resources of key agencies and service providers. The AEH Program provides an integral resource in this network of service providers.

Throughout the consultations, there was widespread recognition of the need to maintain and optimise the AEH Program to improve Aboriginal health and wellbeing outcomes. Overall, the AEH Program makes a significant difference through its focus on health promotion and health education, community capacity building and empowerment strategies and practical 'on the ground' and 'in the home' activities. Although many of the environmental health factors impacting the health and wellbeing of Aboriginal people are outside the remit of the AEH Program, many believe the Program is contributing positively to Aboriginal health and wellbeing outcomes and that '*the situation would be far worse than it is now*' without the AEH Program. The consultations also confirm that many organisations, including Public Health Units and LGAs, are collaborating with ACCOs and ACCHS, and many desire to do more in this area. Some duplication of services signals the need for more formalised inter-agency partnerships to increase the efficiency, effectiveness and integration of environmental health service delivery to streamline effort and address existing gaps and unmet needs.

Concurrently, basic community and environmental infrastructure and services are fragmented, administrative processes around reporting are inadequate, communication channels are intermittent, financial resources are inadequate, and procurement models are outdated. In many communities, the lack of governance structures and processes have eroded local-level community decision-making, action and accountability. Finally, the ongoing challenges with implementing the AEH Program reflects system-level inadequacies resulting from the ad-hoc existing legal frameworks and policies that need to change.

There was widespread acknowledgement among all participants (from review consultations, survey and AHCWA AEH Conference) that there is a crucial need for changes throughout the system. While the AEH Program is committed to delivering a culturally-responsive, community needs-driven model of best-practice, this will require a broad range of whole-of-government and system-level strategies underpinned by the AHWF and Close the Gap priorities to create sustainable environmental health programs and outcomes. These issues are addressed in the Report Recommendations, included in Section 3 of the Executive Summary, and the Options Paper.

5. REPORT CONCLUSIONS

Drawing together the findings from all data sources, the Review found that there is a strong need for the AEH Program and assurance of ongoing funding from WA Health. In addition, extensive evidence highlighted the need for additional new funding to address needs currently outside the remit of the current AEH Program. Despite many examples of good practice in the current AEH Program, the findings also indicate a need for system changes, greater Aboriginal leadership and co-design processes to meet the environmental health needs of the communities served. In particular, given the diverse government sectors, agencies and funding streams responsible for providing environmental health services, there needs to be more formal inter-sectoral communication, greater transparency, greater executive-level engagement with the Aboriginal controlled sector, and greater high-level advocacy. The system strengthening policy drivers inherent in the AHWF and the National Agreement on Closing the Gap confirm the mandate for implementing recommendations from the AEH Program Review (see Options Paper).

The AEH Program has a strong focus on improving the built environment of Aboriginal communities, a potent way to break the link between the ongoing impacts of colonisation, associated socioeconomic factors and poor health in Aboriginal populations. This Review, undertaken between June 2021 and March 2022, draws together data and information from diverse sources, offering insights into the need for enhanced co-design and implementation of AEH services. Throughout the data collection and analysis (literature reviews, surveys, community consultation involving 179 in-depth interviews, PHC pilot and case studies), there was a strong strengths-based focus on options for the future. The depth and breadth of these data reflect the strength of the involvement of Aboriginal service providers, stakeholders and community members throughout the review process (as co-researchers and participants). Further informing the development of a recommended AEH service delivery and procurement model are the service activity reporting data, AEH Program costing data and epidemiological burden of disease data (including costs).

The epidemiological and PHC data indicate that the WA Aboriginal population experiences a very high burden of environment-attributable diseases, particularly in the state's northern regions, which comes at a high cost to Aboriginal communities and contributes to the persistent health gap. Many factors influencing Aboriginal health are beyond the health sector—this is a challenge and an opportunity for the AEH Program.

The potential for AEH change has been pursued for more than three decades, yet little progress has been made at the WA population level. Our literature search identified that innovative community-led interventions have made inroads but not been implemented broadly, highlighting the need for greater translation of research into policy and practice. Surveys corroborated the consultation findings regarding the challenges faced when delivering an AEH program, characterised by communication inadequacies, system constraints, and inadequate resourcing. The AEH activity and service cost data were difficult to access reliably, signalling weaknesses in AEH Program monitoring and evaluation mechanisms.

In recommending strategic directions to deliver a best-practice model of environmental health and health promotion actions, this report builds on current advances in policy and system strengthening. There is growing recognition in the Australian policy context of the significant impact of the environment on Aboriginal health and wellbeing and an increasing emphasis on the need to improve health system deliverables related to environmental health. Critically, AEH has recently been embedded into Closing the Gap reporting requirements for the first time. In WA, Aboriginal health frameworks and the Sustainable Health Review build the foundations to leverage the required resourcing and systems strengthening for AEH.

The Review findings are synthesised below in terms of a proposed model and corresponding service contract requirements.

5.1 Proposed AEH Program Model

This model (outlined in detail in the Options Paper) represents an evidence-informed guide to facilitate future co-designed reform, supporting the Review's findings that a best-practice AEH Program model should be one that:

- Involves robust co-design with the Aboriginal community-controlled sector;
- Identifies and addresses adverse local environmental health risks;
- Integrates across sectors and providers and advocates to address service provision gaps;
- Formally embeds CEHAPs (or an appropriate similar planning tool) using co-design to identify and address placed-based community environmental health needs;
- Embeds the nine Healthy Living Practices and Safe Bathroom and Healthy Homes AEH assessment, as advocated for in the Expert Reference Panel on Aboriginal Environmental Health (ERPATSIEH) Action Plan;
- Embeds clinic referrals to promote AEH assessments as part of the early prevention of infectious and other environment-attributable diseases;
- Ensures tailored, culturally responsive, regionally-based training and workforce development;
- Develops and applies quality outcome indicators and a robust reporting framework to capture service delivery activity based on program logic; and
- Develops and uses program logic to establish an outcomes-based reporting framework for ongoing evaluation and service co-design.

5.2 Service Contract Requirements

Service Contracts for AEH activity should be based on the following to ensure effective delivery of the proposed model for AEH presented in the Options Paper:

- Appropriate monitoring of outcomes and outputs using service, PHC and hospital data, as defined in the proposed AEH Program Logic Model (see Options Paper);
- Genuine involvement of Aboriginal people in co-designed service design and delivery within WA Health, in accordance with the WA Closing the Gap jurisdictional plan and commissioning strategy;
- Service design incorporating human-centred design principles[166] where service satisfaction is determined through culturally responsive mechanisms for community feedback
- Strong partnerships and clear lines of communication between the EHD Policy Directorate, WA Health Procurement Teams and the Aboriginal community-controlled sector (as well as Aboriginal peak bodies) that optimise commissioning and contract management processes; and
- Service agreements that allow for culturally responsive activities with accountability by service providers, recognising and supporting Aboriginal people's cultural identity, cultural continuity, connection to country and right to be self-determining.

The above model and corresponding service contract requirements underpin the Review Recommendations (outlined in the Executive Summary). The Options Paper builds on the Review Recommendations by providing an initial starting point or guide for future co-designed program reform and procurement.

[166] Human-centred design principles: Loudon, G. 2021. "Indigenous research methodologies: The role of human-centred design in indigenous research" In: Heritage, Paul, (ed.) Indigenous Research Methods: Partnerships, Engagement and Knowledge Mobilisation. People's Palace Projects, London, UK, pp. 54-70. ISBN 978-1-3999-0787-3

APPENDICES

Appendix 1. Glossary of Terms

Aboriginal – using the term
Within Western Australia, the term Aboriginal is used in preference to Aboriginal and Torres Strait Islander, in recognition that Aboriginal people are the original inhabitants of Western Australia. Aboriginal and Torres Strait Islander may be referred to in the national context, and Indigenous may be referred to in the international context. No disrespect is intended to our Torres Strait Islander colleagues and community.

Aboriginal Community Controlled Health Organisations (ACCHOs) /Aboriginal Community Controlled Health Services (ACCHS) / Aboriginal Community Controlled Organisation (ACCOs)
Are organisations, run by Aboriginal and Torres Strait Islander people for Aboriginal and Torres Strait Islander people. ACCHS include:

- complex multi-disciplinary services delivering health, social and emotional wellbeing, early childhood, family, youth and aged care support
- smaller organisations providing vital health and wellbeing services to regional and remote communities.

ACCHS are based in Aboriginal and/or Torres Strait Islander communities. They are incorporated organisations, governed by a majority Aboriginal and/or Torres Strait Islander board which the community elects. The terms Aboriginal Community Controlled Health Organisation (ACCHO) and Aboriginal Medical Service (AMS) are often used interchangeably with ACCHS. In some regions, like Victoria, these services are also known more broadly as Aboriginal Community Controlled Organisations (ACCO). While this Health Plan refers to ACCHS, it includes services across the community-controlled health services sector.

Aboriginal health and wellbeing
Not just the physical wellbeing of an individual but the social, emotional and cultural wellbeing of the whole community, where everyone can achieve their full potential as a human being, improving the total wellbeing of their community. It is a whole-of-life view and includes the cyclical concept of life–death–life.

Aboriginal Lands Trust (ALT)
Established in 1972, the ALT is responsible for administering Aboriginal lands covering approximately 27 million hectares or 11% of the WA's landmass, previously held by the Native Welfare Department and other State Government agencies. The land comprises different tenures, including reserves, leases and freehold properties. A significant proportion of this land comprises reserves that have Management Orders with the ALT (generally the power to lease), mainly for the use and benefit of Aboriginal inhabitants. See map in Appendix 6.

Aboriginal mental health
Refers to the understanding that assessment, treatment and intervention for Aboriginal people must cover additional components that may be risk or causative factors for diagnosis, including genetic, biological, environmental, cultural, spiritual and specific generational trauma-based components of risk. This includes issues of identity, inter-generational trauma and historical impacts of removal policies.

Aboriginal and Torres Strait Islander social and emotional wellbeing
Aboriginal and/or Torres Strait Islander Social and Emotions Wellbeing (SEWB) refers to a broad and holistic concept that reflects the Aboriginal and Torres Strait Islander holistic understanding of life and health. It includes mental health and also considers cultural, spiritual and social wellbeing factors. It encompasses not just the individual's wellbeing but also the wellbeing of their family and community. The SEWB definition includes the accurate assessment of Aboriginal people experiencing mental ill-health by ensuring that all contributors to mental ill-health are understood and explored for their relevance.

Age-standardised rate
Summary rates that consider varying age structures of different populations or samples.

The Aboriginal Advisory Council of Western Australia
Formalises links within and between agency-specific Aboriginal advisory bodies, improving whole-of-system alignment and collaboration on Closing the Gap and Aboriginal affairs more broadly.

Aboriginal Strategic Advisory Group
Supports the Department of Communities to exercise governance, strategy and responsibilities within a culturally secure framework.

Avoidance relationships
Relationships in traditional Aboriginal society where certain people were required to avoid others in their family or clan. These customs are still active in many parts of Australia, to a greater or lesser extent. Avoidance relationships are a mark of respect. There are also strong protocols around avoiding, or averting, eye contact, and speaking the name of the dead.

Co-design
The principle of co-design ensures programs and services are community-driven and led and designed with local Aboriginal communities. Co-designed needs-based programs and initiatives are crucial to reducing the inequities in Aboriginal health and environmental health outcomes.

Cultural accountability
Being open, transparent and accountable in all our interactions and consultations with the Aboriginal community is paramount. Practitioners should be fully conscious of the need to validate culturally (refer to definition in this Glossary) information obtained from the community to ensure that it is accurate and appropriate to use in written or other forms to external parties as part of the practice of quality assurance.

Cultural competence
A distinct but cumulative relationship between cultural awareness (knowing), cultural sensitivity (appreciating), cultural competence (practising, demonstrating) and cultural proficiency (embedding as organisational practice). As such, it can be viewed as a developmental process underpinned by the ability to acknowledge issues and experiences from another's perspective and within a cultural context. Cultural competence in practice must be attained at individual and organisational levels to ensure effective practice with Aboriginal people. At the individual level, practitioners must first consider their own potential for prejudice and how mainstream training may create a mono-cultural view of their approach to service delivery. Following this self-reflective process, planning must occur around increasing cultural knowledge, specific counselling, therapy and assessment skills, attitudes and beliefs shifts and access to culturally specific resources. This will ensure that movement towards true cultural competence can be realised. At the organisational level, it is essential that organisations provide their staff with policies, procedures, programs and systems that have been developed within and validated by the culture for which the services are delivered. Ensuring that the Aboriginal community is incorporated within the delivery, design, development and ongoing evaluation of services is an essential aspect of cultural competence.

Cultural determinants of health
Cultural determinants of health originate from and promote a strength-based perspective, acknowledging that stronger connections to culture and country build stronger individual and collective identities, a sense of self-esteem, resilience and improved outcomes across other health determinants, including education, economic stability and community safety. Cultural determinants include, but are not limited to:

- Self-determination
- Freedom from discrimination
- Individual and collective rights
- Importance and value of Aboriginal culture
- Protection from removal/relocation
- Connection, custodianship and utilisation of country and traditional lands
- Reclamation, revitalisation, preservation and promotion of language and cultural practices
- Protection and promotion of traditional knowledge and Aboriginal intellectual property
- Understanding of lore, law and traditional roles and responsibilities[167].

Cultural governance
Refers to structures developed within service delivery models that allow the Aboriginal community to have an ongoing role in developing, refining and evaluating service delivery models for their communities. For models to be effective in terms of cultural governance, it is essential that those involved in the governance structure:

- Represent the target population in which the services are delivered
- Continue to live within the community in which the services are delivered
- Vouched for from within that community as holding appropriate regard
- Clearly align their values and philosophies with those of the organisation.

Cultural respect
The recognition, protection and continued advancement of inherent rights, cultures and traditions of Aboriginal people. Cultural respect is about shared respect. It is achieved when the health system is a safe environment for Aboriginal people and where cultural differences are respected.[168] (Australian Health Ministers' Advisory Council (AHMAC), 2016).

Cultural safety
Involves understanding, learning and respecting the diversity between different Aboriginal groups and not assuming absolute knowledge based on a common cultural background or interactions with select Aboriginal groups. For practitioners to operate in a culturally safe manner, they must fully understand and apply cultural validation and respect the need for cultural accountability. Cultural safety can only occur when cultural differences are recognised and respected, and these differences are incorporated into health service delivery. Importantly, cultural safety requires individuals to explore their own cultural make-up.

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[167] Aboriginal Health and Wellbeing Framework. 2015; https://ww2.health.wa.gov.au/-/media/Files/Corporate/general-documents/Aboriginal-health/PDF/12853_WA_Aboriginal_Health_and_Wellbeing_Framework.pdf
[168] Australian Health Ministers Advisory Council. (2016). Cultural respect framework 2016–2026 for Aboriginal and Torres Strait Islander health: A national approach to building a culturally respectful health system.

Cultural security
A commitment to the principle that the design and provision of programs and services offered by the health system will not compromise legitimate cultural rights, values and expectations of Aboriginal people. Cultural security focuses primarily on systemic change that seeks to assist health professionals to integrate culture into their program and service delivery and adopt a cultural lens to view practices from the perspective of Aboriginal people and culture. It emphasises that the provision of culturally secure health care lies with the system and not just the individual health practitioner. Culturally secure programs and services need to:

- Identify and respond to the cultural needs of Aboriginal people
- Work within a holistic framework that recognises the importance of connection to country, culture, spirituality, family, and community
- Recognise and reflect on how these factors affect health and wellbeing
- Work in partnership with Aboriginal leaders, communities, and organisations.

Data sovereignty
Maintaining authority and control of data and how it is used. Indigenous data sovereignty in Australia refers to Aboriginal and Torres Strait Islander people's inherent right to govern their communities, resources, and country (including lands, waters and sky). It is the right of Aboriginal and Torres Strait Islander people to exercise ownership over Indigenous data. Data ownership can be expressed through the creation, collection, access, analysis, interpretation, management, dissemination and reuse of Indigenous data.

Elders
Highly respected Aboriginal people held in the highest regard by the Aboriginal community for their wisdom, cultural knowledge, and community commitment. Elders are responsible for making important community decisions and are the traditional custodians of knowledge and lore/law (see definition below). Elders hold the knowledge and beliefs of their tribal group and have permission to disclose their traditional Aboriginal knowledge and beliefs in circumstances only they are aware. In some communities, older people refer to themselves as Elders; however, it is important to acknowledge differences that *may* exist between a traditional Elder and an Elder based on age.

Environmental determinants of health
Environmental factors, such as access to clean water and hygienic sanitation services, housing conditions, air quality, work environment and exposure to extreme weather conditions, are estimated to be responsible for 13–20% of the burden of disease in Europe[169].

Environmental health
A branch of public health dealing with aspects of natural and built environments that affect people's health. Physical, chemical, biological environmental factors, in combination with social, demographic and cultural factors, are strong determinants of health. Establishing and maintaining healthy environments contributes to the primordial prevention of disease and disability by addressing upstream causes of disease burden.

Healthy Living Practices
https://www.healthabitat.com/what-we-do/safety-and-the-9-healthy-living-practices/

- **Safety** and life-threatening issues always come first.
- **HLP 1:** Washing people

[169] WHO Health Organisation Social and environmental determinants of health and health inequalities in Europe: fact sheet. 2012; https://www.euro.who.int/__data/assets/pdf_file/0006/185217/Social-and-environmental-determinants-Fact-Sheet.pdf

- **HLP 2:** Washing clothes and bedding
- **HLP 3:** Removing wastewater safely
- **HLP 4:** Improving nutrition, the ability to store, prepare and cook food
- **HLP 5:** Reducing the negative impacts of overcrowding
- **HLP 6:** Reducing the negative effects of animals, insects and vermin
- **HLP 7:** Reducing the health impacts of dust
- **HLP 8:** Controlling the temperature of the living environment
- **HLP 9:** Reducing hazards that cause trauma

Kinship ties
Recognise the extent of connection and the ties that Aboriginal people have to their extended family and community members whom they grew up with.

Lore (law)
Aboriginal lore (law) includes the accepted and traditionally patterned ways of behaving and shared understandings relating to land, language, way of living/being, kinship, relationships and identity. It is important to recognise the diverse range of Aboriginal people throughout Australia and that each language group has their unique spirituality, beliefs and lore (law). Traditional lore/law has rules for every aspect of life and includes rules that make *not* doing things an offence, such as not sharing food. Traditionally, through traditional lore/law, Aboriginal people had a clear guide to appropriate and inappropriate behaviour. Lore exists to maintain the sacredness of Aboriginal culture. Certain aspects of lore remain secret only to those who have undertaken specific rites of passage to access its sacred teachings.

Statistical area
The Australian Statistical Geography Standard is social geography that classifies the country into a hierarchy of statistical areas, in use since 2011. Statistical Areas-Level 2 are medium-sized general-purpose areas built up from Statistical Areas-Level 1.

Statistical local area
An Australian Standard Geographical Classification defined area, used until 2011 and replaced by Statistical Areas-Level 2s.

Social determinants of health
The circumstances in which people grow, live, work and age, which can be measured by indicators that reflect an individual's personal situation (e.g. income, education, employment, levels of social support and social inclusion) or their external natural environment (e.g. levels of air pollution and hazardous materials).

Early life experiences, housing conditions, transportation and access to health services are other commonly accepted social determinants of health[170]. Most social determinants of health are closely related; for example, higher levels of education usually lead to better employment prospects and higher incomes, and thus healthier housing conditions.

For Aboriginal and Torres Strait Islander people, the social determinants of health also include factors such as cultural identity, family, participation in cultural activities and access to traditional lands. Factors related to Indigenous community functioning are also important determinants of Indigenous health and wellbeing[171].

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[170] Wilkinson R, Marmot M. Social determinants of health (2nd edition). The solid facts. Copenhagen; WHO 2003
[171] Social determinants and Indigenous health. Australian Institute of Health and Wellbeing 2020; https://www.aihw.gov.au/reports/australias-health/social-determinants-and-indigenous-health

Social and emotional wellbeing
Social and emotional wellbeing is a multidimensional concept of health that includes mental health and encompasses domains of health and wellbeing such as connection to land/country, culture, spirituality, ancestry, family and community. The domains and guiding principles that typically characterise social and emotional wellbeing are outlined and situated within a framework that places Aboriginal and Torres Strait Islander world views and culture as central.

Sorry time or sorry business
The ceremony or ritual that occurs in Aboriginal communities to pay respects to someone who has passed away. Sorry time involves specific rituals that involve key individuals depending on their relationship with the deceased. Funerals can involve entire communities, and the expression of grief can include self-injury (sometimes known as sorry cutting). There are often distinct grieving behaviours within sorry time that differ from one region/community to the next. It is also common practice that the community refrains from using the name of the deceased.

Stakeholders
Include Aboriginal communities, families, carers and individuals, Aboriginal Community Controlled Health Organisations, Aboriginal Health Council of WA, WA health system (comprising Department of Health, Health Service Providers and Health Support Services), Regional Partnership Forums, other State Government agencies, Commonwealth Government Stakeholders, Registered Training Organisations, vocational education and training, tertiary education providers and non-government organisations.

State-wide Aboriginal health network
An overarching mechanism to improve health outcomes for Aboriginal people across WA (chaired by the WA Health Director-General). Membership includes health service providers, Commonwealth Department of Health and AHCWA.

WA Aboriginal Health Partnership Forum
Brings together key stakeholders from across the health sector, including government, non-government and ACCHOs, to effect sustainable improvements in Aboriginal health and wellbeing.

Strategic Aboriginal Health Group
An internal committee of Aboriginal health leaders established to align and coordinate strategic planning with the direction and priority areas of the WA AHWF. It provides cultural leadership to influence, drive and embed Aboriginal policy, program and service initiatives across the health system.

A range of regional project-specific Aboriginal advisory groups could play a role in environmental issues.

Appendix 2. Review Scope

Response to Request for Quote (Request) – Provision of service review and procurement advisory services for the delivery of the West Australian Aboriginal Environmental Health Program

Reference No: DoH20217412

Requirements Overview

Provision of service review and procurement advisory services of the twenty service/grant agreements managed by the Department of Health (the Department) for the delivery of the West Australian (WA) Aboriginal Environmental Health Program.

The Requirement

The Department is seeking an independent consultant to undertake a service review of twenty service agreements/grants managed by the Department for the delivery of the West Australian (WA) Aboriginal Environmental Health Program (the Program). The purpose of the scope of work is to review the current program and make recommendations on a contemporary program service model that meets operational requirements and supports a sustainable model for the provision of Aboriginal Environmental Health (AEH) services into the future.

Scope of Work / Other Requirements:

Liaise with the Department and the AEH service providers to undertake a service review of:

1. Service Agreements DoH201682/1 - DoH201682/13 and DoH2016102/1, DoH2016102/2, DoH2016102/3, DoH2016102/4 and DoH20106102/6 to ensure the effective and efficient delivery of AEH services.
2. Grant Agreements: DoH20205839 and DoH20205840.
3. Provide recommendations on the structure of the future service agreement.

The scope of services is divided into six (6) parts:

1. Overview current state
2. Review of other jurisdictions
3. Community consultation and stakeholder engagement
4. Gap Analysis
5. Service Models
6. Options Paper

1. Overview current state	High-level executive summary: • Program structure Outcome Details: • Service provider activities • DoH/internal activities • Other agency activities Performance Management: • Performance issues/concerns • Reporting requirements • Risks • How are they being managed? • Is value for money being achieved?
2. Review other jurisdictions	Programs in place
3. Develop and implement a Community Consultation and Stakeholder Engagement plan	Develop a consultation plan detailing a complete list of the stakeholders that will be consulted at each stage of the project, including the consultation process to seek information, identify issues and gain input to inform the comprehensive review and Options Paper. Implement the Community Consultation and Stakeholder Engagement Plan once it is approved.
4. Gap Analysis	Including Financial Assessment. Identify community need and service delivery gaps to inform proposed community outcomes.
5. Service Models	What the potential program will provide in the future: • What current services should be retained and what new and emerging services should be introduced • How is the service model best informed – consultation, review and assessment, desired health outcomes and reporting requirements. Facilitate alignment of service agreement outcomes with the Departments' key strategic priorities: • Sustainable Health Review (SHR) • ERPATSIEH Strategic Plan 2018–2023 • Outcomes Framework from the WA Aboriginal Health and Wellbeing Framework 2015–2030 (implementation guide and monitoring and reporting plan) • National Agreement on Closing the Gap Principles
6. Options Paper	Recommendation for the Program future service delivery, including the needs/gaps that would be addressed. Recommendations, including risks, costs and benefits of implementing each option. Appropriate cost modelling. Current Funding Envelope

Qualitative Criteria: Suitability of Proposed Products and/or Services

Respondent's Response: Aboriginal Environmental Health Review

Aboriginal Environmental health (AEH) seeks to empower communities and advocate for their identified environmental needs and priorities to improve preventable and chronic diseases in ways that differ substantially to the traditional regulatory function of local government. The AEH works with Aboriginal families/communities to offer a range of services that can be delivered in their home environment. AEH is the bridge between health and non-health agencies that provide housing, utilities (i.e. electricity, water, solid waste disposal), sanitation, dog programs and dust suppression. The Department has requested a review of the existing AEH Program being delivered in Western Australia to determine the most effective and cost-effective model of delivery to improve health outcomes.

1. Review purpose:

To improve the effectiveness and sustainability of WA Health's AEH Program through an independent review. Specifically, to enable the AEH Program to achieve the objectives listed below:

a) Process objectives

- The AEH Program has a service model that meets operational requirements
- Contract management is robust, sustainable and outcomes-based
- Reporting/monitoring incorporates some health outcome measures in addition to activity-based reports
- Procurement processes for the AEH services are efficient
- Placed-based services are driven and led by communities they serve
- Strengthened linkages and partnerships between agencies from other health sectors and WA Health's AEH Program

b) Workforce objectives

- There are sufficient and skilled providers and workforce who can deliver services to Aboriginal communities to the level required

c) Health outcomes objectives

- Infectious disease outcomes related to environmental conditions are optimised
- Chronic disease outcomes related to environmental conditions are optimised
- Quality of life for residents of Aboriginal communities is optimised

d) Funding objectives

- Future funding bids to expand reach and types of AEH activities are better supported by quality data and evidence of strengthens

2. Approach

The aim of this review is to achieve the purposes identified above using the following approach.

- Acknowledge and take into account the diverse cultural contexts and community environmental needs and priorities related to chronic and infectious disease prevalence
- Establish Aboriginal governance and ensure Aboriginal community engagement
- Work in close collaboration with the Aboriginal cultural consultant being contracted through the Aboriginal Health Branch
- Be cognisant of the roles of the environment in holistic health, including social and emotional wellbeing in accord with the *WA Aboriginal Health and Wellbeing Framework 2015–2030*
- Harness quantitative and qualitative evidence on which to base recommendations, with enhanced monitoring data incorporated into the review
- Be cognisant of the difference in regional planning between different agencies whose activities affect environmental health and consult across the Kimberley, Pilbara, Goldfields and Mid West regions

3. Governance structure

A steering committee comprised of representatives from organisations with interests in or potentially impacted by the Review findings and recommendations.

4. Methods

A. Quantitative and qualitative desktop work:

1. Desktop evaluation of current AEH services from existing data
2. Literature review to identify other similar programs and Aboriginal environmental/health and wellbeing frameworks
3. Finalisation of qualitative data analysis from field work and integration into Final Report
4. Gap analysis between best practice and current AEH services
5. Describe future possibilities for AEH service delivery and outcome measurements – Options Paper
6. Produce final deliverables

B. Field work/community/stakeholder engagement and consultation:

1. Attending 4-5 regional Aboriginal Health Planning Forums (Environmental sub-committee workshop) (part of Milestone 5)
2. Attending Environmental health conference – state-wide membership (workshop) (part of Milestone 5)
3. Targeted individual community visits, based on the AEH and other organisations investment, representation of different models of service delivery eg Shire delivery compared to Aboriginal Community Controlled models (part of Milestone 5)
4. Stakeholder engagement (part of Milestone 5)
5. Engagement and consultation with cultural consultant
6. Initial data analysis (part of Milestone 6)

5. Deliverables:

1. A <u>service review report</u> on the provision and delivery of the current AEH Program 18 (+2) WA, in three parts:

Part 1:

- Synthesis of existing relevant WA health services data regarding health outcomes impacted by environmental conditions
- Overview of structure of current AEH Program, including procurement processes
- Desktop review of current AEH services in WA, that includes:
    - Types of services delivered
    - Number/frequency of activities undertaken by Service providers
    - Alignment of activities with Community Environmental Health Action Plans (CEHAPs)
    - DoH/Internal activities
    - Other linked agency activities
- Stakeholder and community consultation across the Kimberley, Pilbara, Goldfields and the Mid West regions. Consultations to focus on the experiences and perceptions related to service delivery:
    - Enablers and barriers
    - How service delivery could be improved
    - Extent/examples of capacity building/community empowerment
    - Performance issues, concerns, risks in current AEH services
    - Support required to be more effective in delivering the AEH Program

- Relationships with other agencies and sectors including housing
- Opportunities to increase partnerships, alignment with other programs/agencies
- The acceptability and feasibility of the three-level intervention approach proposed

Part 1 Conclusion - Summary of current AEH services

Part 2:

- Literature review to identify:
  - What other programs are in place, locally and nationally (and in NZ and Canada)
  - What works, what doesn't work, and why
  - Review Aboriginal environment/health and wellbeing models or frameworks, including evaluation frameworks
- Gap analysis between best-practice models/frameworks and current AEH service delivery considers
  - What gaps exists?
  - How could these gaps be addressed and/or existing programs and services be improved?
  - Aligning AEH Program with *WA Aboriginal Health and Wellbeing Framework 2015–2030,* implementation guide and monitoring and reporting plan
  - Financial assessment

Part 2 Conclusion - Summary of options recommendations? for the future

Part 3:

- Synthesis of findings from Parts 1 and 2, providing an analysis of the current AEH services
- Summary of literature review
- Summary of gap analysis
- Options for future program models for AEH

Part 3 Conclusion

An Options Paper based on the Report conclusions/recommendations (possibilities for future AEH Program models) containing key recommendations for:

- procurement of AEH services (funding mix)
- contract management framework
- ongoing program monitoring and evaluation
- contractual options – with stakeholders, local councils, utilities, community organisations
- aligning the AEH Program with the Aboriginal health and wellbeing Framework
- alignment between the AEH Program and the work of other agencies

Appendix 3. Full Primary Health Care Pilot Report

Title:

A pilot to examine the feasibility and potential of automated data extraction from electronic clinical record systems in primary health care to provide evidence to support outcomes-based funding for diseases due to environmental conditions among Aboriginal people in Western Australia

December 2021

Undertaken by:

University of Western Australia
In collaboration with
Aboriginal Health Council of Western Australia

Background

The WA AEH Program is funded by the WA Health Department and contracted out to around 20 service providers for delivery in remote Aboriginal communities. In March 2021 the WA Health Department initiated an independent service review of the WAAEHP for the purpose of identifying a sustainable model for the provision of Aboriginal Environmental Health (AEH) services into the future and provide a robust contract management framework.

In July 2021, a team based at UWA was appointed by WA Health Department to conduct this review overseen by a Steering Committee which included three independent Aboriginal members outside of the WA Department of Health. The UWA Review Team comprised Prof David Preen, Assoc Prof Judith Katzenellenbogen, Dr Emma Haynes, Assoc Prof Roz Walker and Dr Sanji Gudka (henceforth UWA Review Team). The UWA Review Team also worked closely with independent Aboriginal consultant Mandy Gadsdon. The team was advised by the Steering Committee to consider a range of existing policies and frameworks, both Aboriginal-specific and other, when undertaking the review (see Main Report). Central to the review are the WA Aboriginal Health and Wellbeing Framework 2015-2030, the Outcomes Framework for Aboriginal Health 2020-2030 and the Implementation Guide for the WA Aboriginal Health and Wellbeing Framework 2015-2030.

In August 2021, the Steering Committee and the UWA Review Team agreed a pilot should be undertaken by the Review Team to produce an estimate of the burden of demand presenting to Aboriginal Community-Controlled Health Organisations (ACCHOs) clinics due to the environment for the purpose of informing review recommendations. This estimate would entail extractions from the electronic health record systems from primary health care (PHC). The Purchasing & System Performance Division of WA Health was particularly interested in how PHC data might support a future evidence- and outcomes-based procurement process. The focus of the pilot was to examine how easy it might be to measure the pattern of environmental health-related presentations and learn about the process required and practicalities in doing so. The pilot was undertaken by Assoc/Prof Judith Katzenellenbogen from the UWA Review Team with Prof Jeanette Ward, appointed by the ACCHO sector to provide technical input, and staff within the participating ACCHO services. The Review Team provided comments during the write-up.

This was an additional component to the WA AEH Program Review and is reported here separately as a stand-alone Appendix. The support of the Steering Committee was and remains greatly appreciated in progressing this pilot in partnership with the Aboriginal community-controlled health sector including the participating ACCHOs.

Rationale and pilot objectives

- To provide AHWCA, the WA Aboriginal Health Branch, the EHD and the Purchasing & System Performance Division with a focused experience of how to measure environmental health outcomes in PHC through a small co-designed pilot
- To identify technical, methodological and co-design issues that could not be fully resolved in the pilot that will likely affect the accuracy, feasibility, acceptability and credibility of environmental health outcomes measurement in primary health care
- To offer written recommendations to AHWCA, the WA Aboriginal Health Directorate, the EHD and the Purchasing & System Support Division about next steps for improving measurement of environmental health outcomes in the context of a transition to outcomes-focused contracting in WA Health

Given the limited time frame, it was anticipated that estimates would not be comprehensive as data would not be WA-wide and would not include all environmental health related conditions. There would also not be opportunities to fully check the extracted data, including validation of choice of clinical items and development of consistent data definitions between the data information systems.

Data security

The Steering Committee considered a draft Information sheet and draft Data Agreement at its meeting in August 2021. After incorporating comments out-of-session from members of the Steering Committee, a revised draft Data Agreement and Information sheet (see Pilot Attachments 1 and 2 below) was circulated to those seven ACCHOs indicating interest in participating in the pilot. After their changes were incorporated, a final standardised Data Agreement was signed by each of the five responding services and UWA before data access commenced.

As can be seen, the final Data Agreement committed the signing Parties to collaborate in good faith and abide by the commitments specified. As an entity of UWA, the UWA Review Team complies with the strategic goals of the UWA Indigenous Strategy. Any future use of these pilot data beyond the review without shared decision-making with AHCWA would be inconsistent with the WA Government's commitments in the National Agreement for Closing the Gap. Any breach of the Data Agreement by UWA Review Team or other party could be reported to the UWA Pro Vice-Chancellor (Indigenous Education), Prof Jill Milroy.

With these guarantees in place, the request from UWA for access to ACCHO data to inform the AEH Program Review was supported by the AHCWA Chair who was also one of the three Aboriginal members of the Steering Committee. Under these safeguards, the Steering Committee also accepted there was no need for ethics committee approval due to the timeframe of the WAAEHP review. It was agreed that the data presented to the Health Department would be indicative only.

Participating Aboriginal Community-Controlled Organisations

Those services able to participate in the pilot and signed Data Agreements comprised:

- Kimberley Aboriginal Medical Service (KAMS) which provides services to five remote communities in the Kimberley (Beagle Bay, Bidyadanga, Balgo, Mulan, Bililuna)
- Derby Aboriginal Health Service (DAHS)
- Broome Aboriginal Medical Service (BRAMS)
- Derbarl Yerrigan Aboriginal Medical Service (DY)
- South West Aboriginal Medical Service (SWAMS)
- Puntukurnu Aboriginal Medical Service (PAMS).

Primary care electronic health record systems in use

Two primary care electronic health record systems are used in Western Australian ACCHOs, namely MMEx (used in the Kimberley) and CommuniCare (used elsewhere). MMEx maps clinical items to the SnoMed system while CommuniCare maps to the International Classification of Primary Care (ICPC) system. This meant that any automation would need to ensure each system maps to the environment-attributable health conditions/diseases. Some variation exists in the extent to which dropdown menus are used in the clinics. Dropdown 'fixed' fields are desirable from an information management and reporting perspective, as data are easy to extract. For example, in the Kimberley, KAMS clinical staff are 'forced' to use fixed fields from a dropdown menu, allowing no discretion. DAHS staff can use fixed fields but also can override the menu and enter text. This means that some part of every field at DAHS would require a search of free text as well.

Measuring the burden of environment-attributable diseases

A broad range of diseases are known to be related to different aspects of the natural and built environment. The environment is not the sole attributable cause of all conditions known to have an environmental component. In other words, counting all cases of specific conditions would over-estimate the environmental attributable burden. It is rare that the claim can be made that the environment causes 100% of cases of a specific disease or condition. Hence, the UWA team sought

environmental attributable fractions by which to adjust the caseload of presentations to primary health care (PHC) that can be attributable to the environment. Furthermore, environment-attributable fractions (EAFs) provide a useful tool that can be applied for different purposes: 1. To determine the burden of environment-attributable disease in a region; 2. To provide environmental health service providers with an evaluation/monitoring tool using health data with which to feedback how they are performing and 3. To provide an evidence base to future co-design to inform funding levels, outcomes-based procurement, and ways of monitoring provider performance.

Three potential sources of EAFs were considered by the UWA team for application with the pilot PHC dataset.

WHO Environmental Attributable Fractions

The WHO published a classification system developed to measure modifiable environmental impacts on health. The 2006 publication included a list of environment-related conditions as well as corresponding environmental attributable fractions based on literature reviews and surveys of experts worldwide[172]. The second edition (2016)[173] updated the original list using more robust methods, enabling the estimation of the disease burden attributable to the environment globally (Pilot Attachment 3).

Australian Institute of Health and Welfare (AIHW)

The AIHW published a report in 2011[174] outlining a classification system for environmental risk factors based on an extensive literature review, but no EAFs. While acknowledging the need for tools to quantify the impact of environmental factors on health in Australia, no methodology was developed for quantification of this burden.

Kimberley Environment-Attributable Fractions (KEAFs)

The Kimberley Population Health Unit instigated the original KEAF methodology in 2014175, whereby the WHO disease list and fractions were used as a starting point to obtain input from health practitioners in the region. After a period of consultation, the list was expanded, finalised and applied to various data176. A small number of diseases such as Q fever and meliodosis were not in the KEAF list, which has not been updated or revised. These omissions have been documented during the process of undertaking the pilot and can be rectified in future work. Some diseases never or very rarely result in hospitalisation. The KEAFs have not been validated outside of the Kimberley.

1. Approach taken in the AEH Program Review to measure the burden of environment-attributable disease

As described in the main body of the report, the Epidemiology Branch of the WA Health Department undertook the analysis for hospital admission data, calculating two sets of estimates by using both the fractions developed in the Kimberley (KEAFs; limited to the four northern/eastern health regions of WA) and those developed by the World Health Organization (WHO; applied to all WA regions) to

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[172] Pruss-Ustun, A. & Corvalan, C. (2006). *Preventing disease through healthy environments: Towards an estimate of the environmental burden of disease*. Geneva: World Health Organization

[173] Prüss-Üstün, Annette, Wolf, J., Corvalán, Carlos F., Bos, R. & Neira, Maria Purificación. (2016). Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks.World HealthOrganization. https://apps.who.int/iris/handle/10665/204585

[174] Australian Institute of Health and Welfare 2011. Health and the environment: a compilation of evidence. Cat. no. PHE 136. Canberra: AIHW. https://www.aihw.gov.au/getmedia/0567e647-f152-4aa9-9e4f-f0404b139574/11937.pdf.aspx?inline=true

[175] McMullen C, Eastwood A, Ward J. Environmental attributable fractions in remote Australia" the potential of a new approach for local public health action. Aust NZ J Public Health;2016; 40:174-180

[176] KAHPF Environmental Health Sub-Committee. Hospitalisations in 2016 of Aboriginal people due to their environment: Demand, costs and Kimberley solutions. KEHF, Broome 2018

estimate the burden that could be prevented if environmental conditions were improved. Both approaches were used because the Epidemiology Branch personnel considered that not all regions are the same and the WHO list does not include all conditions considered important in WA. These results are available in the full Review Report.

For the PHC pilot, only the KEAFS were used because of time limitations and because the AEHP focuses mainly on remote regions where the method generating KEAFS was originally developed and applied (e.g. skin infections, acute rheumatic fever). In addition, only highly environment-sensitive conditions were selected for the pilot (see below for definition, description, and justification).

What was done and key decisions

Preparing the data program

Early on, it was agreed that the period to be covered by PHC data extraction in the pilot would be July 2020 to June 2021. The data would be provided for age groups 0–14 years; 15–24 years; 25+ years and only from Aboriginal or Torres Strait Islander client records. Analysis would be for clinical items entered for all people attending the service, not regular patients only.

Selecting disease codes

A full mapping of ICPC codes against each disease with an environmental component was necessary. As a first step, the Review Team proposed to the Steering Committee that the top 15 diseases on the KEAF list (those which have ≥80% environmental attributable fractions) be extracted in the pilot (Minutes of the meeting 30 August 2021). In this report, these 15 diseases with the highest KEAFs are termed 'highly sensitive environmentally attributable diseases' to distinguish them from all 46 diseases with a KEAF. Confining analysis to those 15 diseases did exclude many diseases of interest with high KEAFs but did keep the list consistent with diseases highly sensitive to environmental amelioration (Pilot Attachment 4 in yellow) and thus may prove to be useful tool for monitoring environmental health service outcomes.

Supporting data extraction undertaken by CommuniCare users

On 2 September, Paul Connolly from Telstra Health (who manage CommuniCare) reported that his supervisor suggested that UWA should contact ACCHOs directly to develop the data extraction program. The SWAMS health informatics team (Farai Cheneka and Elijah Glass) were approached to provide such support.

For each of 15 selected conditions, the respective ICPC codes were identified among the possible ~6,000 ICPC codes provided to the team by Elijah Glass at SWAMS. Clinical items mapped to each of the 15 diseases with >80% environmental attribution in the Kimberley were compiled independently by three different experts working within AHCWA (Luke Austin, Katy Wedderburn and Prof Jeanette Ward, with support from Dr Marianne Wood) with disagreements resolved by Judith Katzenellenbogen. This resulted in a comprehensive list of 357 CommuniCare clinical items mapped to the 15 diseases selected for the pilot. These are available from the Review Team and AHCWA on request.

It would have been ideal to include external peer review of this disease code mapping by experts in EH, public health and primary health care. However, this was beyond the resources and timeline available to the Review Team and will be considered further in recommendations. Additionally, among ACCHOs using CommuniCare, clinical items might differ somewhat by ACCHO.

For the purposes of this report, we refer to the 15 diseases (out of 46) selected for the pilot as highly sensitive environment-attributable conditions, based on the high KEAF allocated to these diseases.

Besides counts of the highly sensitive environment-attributable conditions, we also extracted total numbers of individuals attending for highly sensitive environment-attributable conditions as well as total numbers of people attending the clinics (for any item). This was to allow the calculation of the

number people attending for highly sensitive environment-attributable conditions as a percentage of all clinic attenders during the year (by age group). We also hoped to calculate the number of clinical items for highly sensitive environment-attributable conditions as a percentage of all clinical items for the year (by age group).

Following a series of meetings to outline the aggregated data required to fill in a draft table, Elijah wrote the data extraction report in SQL that could produce the items required (available from Review Team on request; copy also supplied to AHCWA). In all, Elijah spent 13 hours on the project, including planning meetings and testing his script.

Supporting data extraction undertaken by MMEx users:

KAMS health informatics team (Lucy Falcocchio and Kris Hamagutchi) were sent the abridged list of CommuniCare clinical items that mapped to the selected disease categories. Kris mapped these to corresponding clinical items using SNOMED. This was later checked. He was also sent the draft table to see how the data would be used.

Kris then wrote and ran the data extraction program, aggregating relevant information related to each of the following:

- Presenting complaint (allowed one item)
- Diagnosis (allowed multiple items)

Only KAMS organisations force clinical coding, while the other ACCHS using MMEx have this as optional. Kris thus ran text searches as well for services that allowed health staff to override the dropdown menus. This enabled him to pick up non-coded clinic entries that included key words provided in their presenting complaints. Some re-extraction of the data was required in late-November to ensure all clinical item fields were included.

Feasibility and resource requirements

Elijah wrote the CommuniCare reporting program (SQL) and produced his clinic's data. As mentioned earlier, this required 12 hours on the project. The analyst who ran the SQL script at the second clinic then reported taking less than a minute, showing that it was completely automated once run. This was also true for the analyst who ran the data from the third clinic.

The MMEx analyst took about 20 hours to produce the output. He had a more laborious task, as he first had to map items from the CommuniCare disease items against the MMEx items, and then had to accommodate the need for searching open-text fields for DAHS. He also had to run the report for five KAMS clinics, to produce one overall KAMS combined clinic report and two other service reports (DAHS and BRAMS). The code used to extract the data has now been saved as a report and can be repeated for other MMEx clinics.

A joint meeting of Judy and Jeanette and the data information programmers from KAMS and SWAMS was held to review the two data extraction approaches. Some inconsistencies were identified. Corrections were applied to optimise comparability between services although time limitations did not allow full verification. We were also not able to fully verify the extent to which the total clinical items extracted from the two systems (to calculate the percentages) were completely the same.

ACCHOs were not remunerated or compensated for the staff time required to develop the report or extract the data.

Indicative data tables

The Data Agreement with AMSs states that each clinic would be sent the results of their own data. Consequently, once the reports are finalised in 2022, each clinic will be sent their results in a file by encrypted email. The Review Team will offer to present the overall process and results of the pilot to

CEOs in a face-to-face or Teams format, depending on what is deemed as appropriate by the CEO group/AHCWA.

To allay any concerns that these PHC data as produced by IT staff might be used by other parties reading the report in ways that the participating ACCHOs had not approved and without the necessary shared decision-making and co-design now explicit in the National Agreement on Closing the Gap, the Review Team agreed to provide indicative data for the Main Report. In other words, 'dummy' data would appear in the tables, with numbers being randomly changed while still giving an indication of how the data might appear and of the patterns emerging. Services will receive their actual data separately.

Adherence of the UWA team to strategies relevant to Aboriginal Health

In this pilot, as outlined earlier, the UWA Review Team were guided by its own University Indigenous Framework (see https://www.indigenous.uwa.edu.au/indigenous-strategy).

Given the nature of the review as a rapid program review for government and its short timeframe, the strategies of relevance undertaken included:

Building Indigenous research:
Through guidance by the Steering Committee and engagement with AMS staff, the pilot addressed an important agenda item that meets Indigenous needs, with relevance to provision of an evidence base for service provision, funding and procurement to address a priority health need -environmental health. The pilot highlighted the resources with the sector to extract useful data that has the potential to build Indigenous data use and research in the future.

Community and engagement:
The pilot was collaboratively developed by the Review Team and AHCWA. Indigenous engagement comprised a central part of the process, including an Information Sheet and Data Agreement that the sector had input into and was unanimously approved by participating CEOs. Furthermore, feedback to the ACCHO sector was built into the process. Resources within the ACCHO sector were made available to support the pilot.

People, policy and planning:
The data sovereignty principles of control of the data ecosystem (through initiation/ support of the pilot, approval, dissemination), disaggregated/contextual data (analysis by AMS, by age), accountability (to AHCWA and Steering Committee) and relevance to effective self-governance, were adhered. In this way, the data will be available to AHCWA and WA Health to support evidence-based, collaborative and culturally responsive decision-making.

2. Results

Pilot attachment 5 provides the indicative raw numbers of disease-specific clinical items, KEAFs and attributable clinical items for all AMSs combined. The results are summarised in dot points pertaining to these raw numbers and the graphs provided.

Overview of AMSs and age group contribution to clinical items

- The six AMSs who participated in the pilot treated approximately 27,000 Aboriginal patients between 1 July 2020 and 30 June 2021, covering an estimated 25% of the Aboriginal population of Western Australia.
- A total of about 27,000 clinical items were recorded for highly sensitive environment-attributable conditions, i.e. conditions which were ≥80% attributable to the environment. Once the fractions were applied, this translated into approximately 25,000 clinical items estimated to be directly attributable to the environment using KEAFs.
- The number of presentations for highly sensitive environmental attributable clinical items seen during the year by each AMS ranged from 650 to 8,500.
- The three Kimberley AMSs combined (covering the largest population) contributed over 85% of clinical items for highly sensitive environment-attributable conditions from all six participating AMSs combined.
- The 25-year and older group (covering the largest age range) accounted for about 6 in 10 of the clinical item load from highly sensitive environment-attributable conditions in all six participating AMSs combined (Figure 3.1; pie chart). Over a quarter of such clinical items were in the 0 to 14-year age group.
- PAMS was the only service where children 0–14 years had the largest number of presentations of highly sensitive environment-attributable conditions.

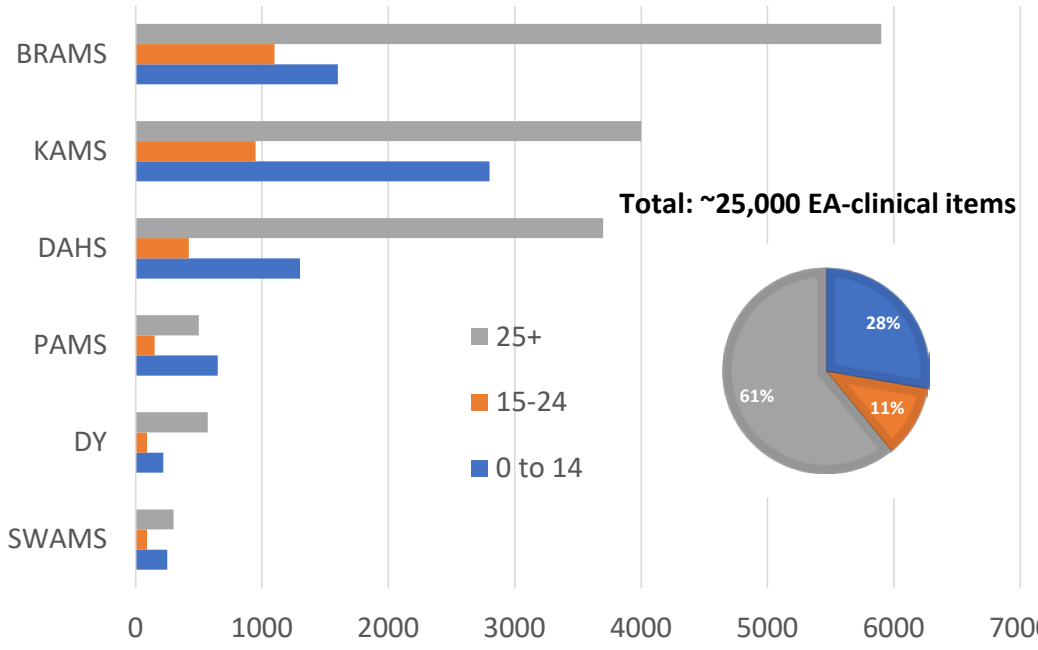

Figure 3.1: Total highlysensitive environment-attributable clinical items by Aboriginal Medical Service and age group: July 2020- June 2021 (indicative data)

BRAMS Broome Aboriginal Medical Service; DAHS Derby Aboriginal Health Service; KAMS Kimberley Aboriginal Medical Service; PAMS Puntukurnu Aboriginal Medical Service; DY Derbarl Yerrigan Aboriginal Medical Service; SWAMS South West Aboriginal Medical Service

Contribution of different environmental-related conditions to clinical items recorded by AMS

- Over all AMSs combined, unintentional injury (e.g. road accidents and accidental injuries) and skin infections contributed the highest number of highly sensitive environment-attributable conditions recorded (Figure 3.2). Skin infection was the highest contributor to highly sensitive environmental clinical items in children 0–14 years. AMS-specific data will be made available to the services separately.

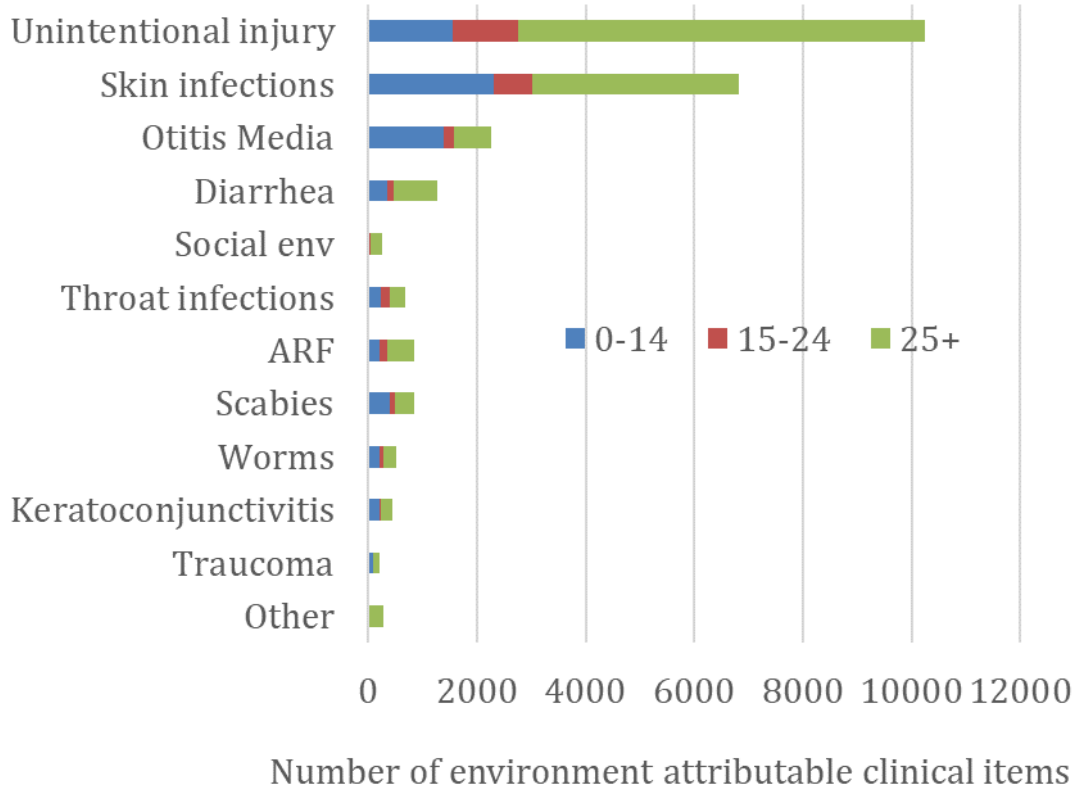

Figure 3.2: Number of highly sensitive environment-attributable conditions from all six Aboriginal Medical Services combined, by environment-sensitive disease and age group (indicative data).

Numbers of people with environmental-related conditions attending clinics

As opposed to counting of clinical items, this section shows how many people attended for these conditions. Such data are available for each AMS and will be fed back to those organisations individually.

Figure 3.3a shows how many children 0–14 years presented with highly sensitive environment-attributable conditions with some presenting for more than one condition.

- Over one-third of all patients under 15 years of age (36% = 2,340 unique patients) presenting to the services presented for a highly sensitive environment-sensitive condition.
- Almost one-third (31.1%) of clinic attenders of this age were recorded as having a skin infection, with otitis media and unintentional injuries ranking second.

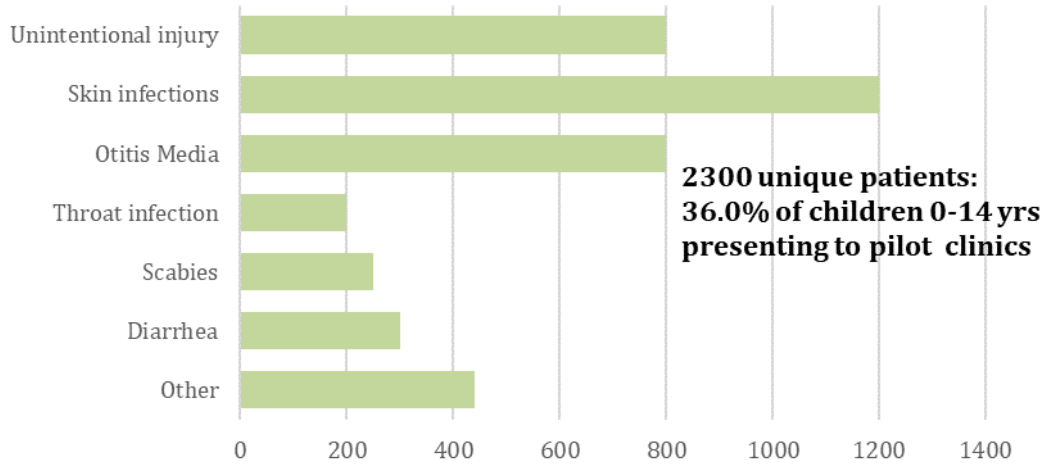

Figure 3.3a: Number of persons at all pilot sites for whom highly sensitive environment-attributable conditions were recorded: 0–14 years (indicative data)

Figure 3.3b shows how many young people 15-24 years presented with highly sensitive environment-attributable conditions with the highest number of clinical items recorded.

- About a quarter (27% = 1,100 unique patients) of people 15-24 years presenting to the services for highly sensitive environment-attributable conditions.
- Most people of this age recorded with highly sensitive environment-attributable conditions attended for unintentional injuries and skin infections.

Figure 3.3c shows how many adults 25 years and older years presented with highly sensitive environment-attributable conditions.

- About a quarter (29% = 4,500 unique patients) of adults 25 years and over presenting to the services presented for highly sensitive environment-attributable conditions.
- Most people of this age recorded with highly sensitive environment-attributable conditions attended for unintentional injuries and skin infections.

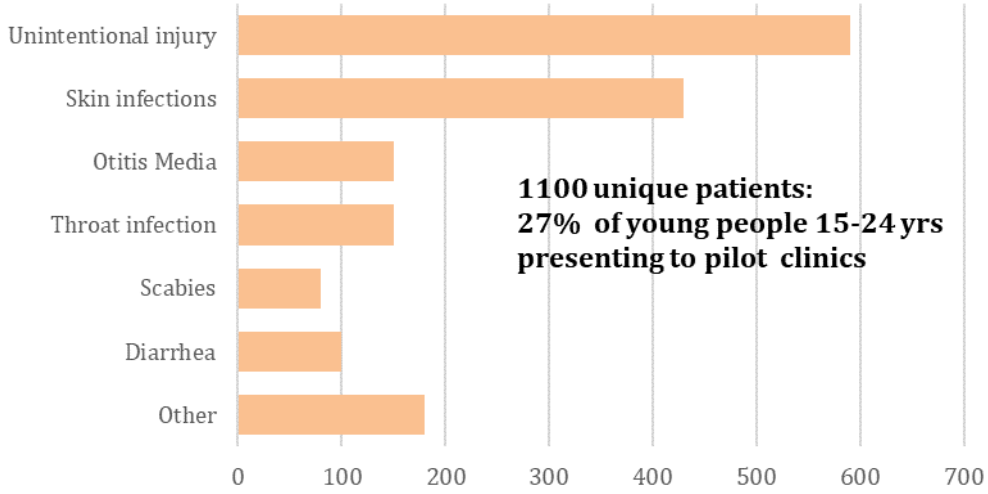

Figure 3.3b: Number of persons at all pilot sites for whom highly sensitive environment-attributable conditions were recorded: 15-25 years

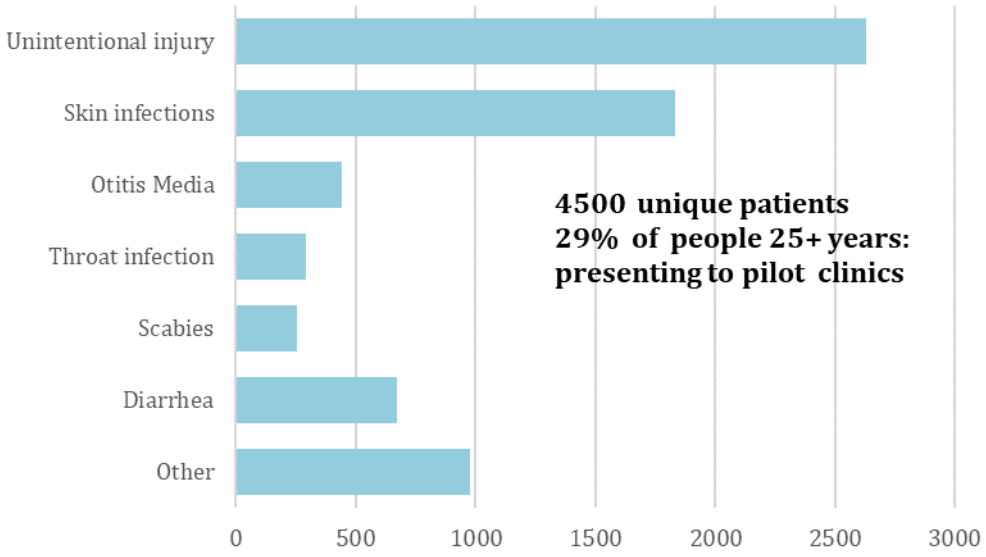

Figure 3.3c: Number of persons at all pilot sites for whom highly sensitive environment-attributable conditions were recorded: 25 years and over

Environmental-related clinical items as a percentage of all clinical items

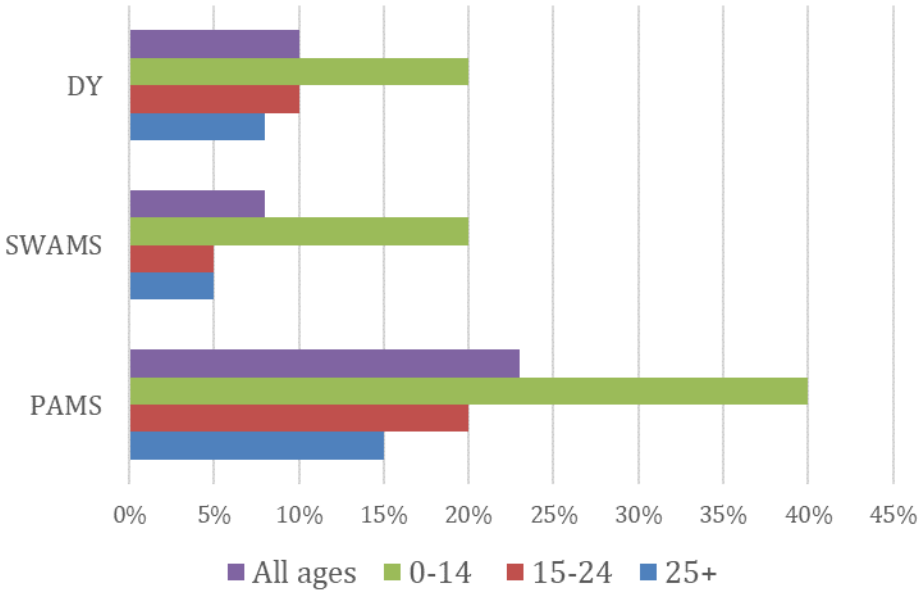

Figure 3.4: Highly sensitive environment-attributable clinical items as a percentage of all clinical items in three Aboriginal Medical Services, by service and age group (indicative data)

- In the three services outside Kimberley, clinical items highly sensitive to the environment in the 0–14-year age group comprised a much higher percentage of the total clinical items within their group compared with other age groups (Figure 3.4).
- Nonetheless, clinical items highly sensitive to the environment contributed 23% of all clinical items recorded at PAMS for all ages, with DY and SWAMS having a lower proportion (8% and 10% respectively) of their items being highly sensitive environment-attributable conditions.
- Currently a comparable percentage is not available for Kimberley-based sites due to differing methods of data extraction.

3. Reflections

What was learned from the results?

Given this was a pilot undertaken in a very short time frame, the results shown are indicative only. The results are not representative of WA ACCHO use overall, and MMEx and CommuniCare data tables are not completely comparable. Hence, these findings should be interpreted with caution. Nevertheless, some important messages emerge from the data.

Different services and regions had different profiles of environment-attributable diseases contributing most to their case load. This reflects both the physical environments in which people live, work and play as well as how reasons for attendances are recorded and captured in the health information system. Nonetheless, the burden of demand due to the environment is high in all services.

Unintentional injuries like falls, burns, cuts, and poisonings was the highest-ranking environment-sensitive condition for which Aboriginal patients attended over all participating primary health services. This finding is consistent with other studies which show that burden from injury is the highest-ranking contributor to the burden of disease/injury among Aboriginal Western Australians[177].

Skin infection ranked very highly in all primary health care services over all ages combined. For all regions skin infection in young people – a condition known to put people at risk of various serious chronic diseases (e.g. rheumatic fever/heart[178,179]), yet is often normalised - was the most frequent environment-sensitive condition recorded in children 1 to 14 years, reflecting the importance of monitoring this condition, whether on its own or as one condition on a list of EAFs.

The results also show that it is not only children that have a significant disease burden from highly sensitive environment-attributable diseases, but that the burden is across all ages.

What was learned about the process and technical approach?

This pilot had strong support from the ACCHO sector, which through its peak body AHCWA had convened an environmental health workshop prior to the pilot being initiated. Because of trust and Aboriginal leadership of the process, usually time-intensive phases of project development were expedited and allowed the completion of a unique pilot in a relatively short period of time. The strong collaboration between the Review Team and participating ACCHOs enriched the process further and facilitated adherence to data sovereignty principles. This outlines the importance of co-design, transparency and both-way consultation.

Given time restraints, this pilot used only KEAFS as a source of environmental attribution and, furthermore, limited the clinical items to those with fractions ≥80% ie 15 conditions. This pilot also identified an additional item in both MMEx and CommuniCare that allow a clinician to enter social condition (overcrowding). Moving forward, the issue of which conditions should be added to these 15 generally and which EAFs are best suited to the different regions in WA should be discussed further and addressed. As mentioned, some diseases were not assigned KEAFs in the original research (e.g. Q fever and meliodosis). There is also a possibility that some unintentional injuries may have been inconsistently included in our analysis, which may have influenced the high numbers in this category. Resolution of these issues including an exercise to adapt/develop EAFs suitable for other WA region including Perth requires a robust and co-designed process, with input from people working in the

[177] Department of Health Western Australia (2020). Western Australian Burden of Disease Study 2015 – Aboriginal Report: 2020. Perth: Department of Health WA.
[178] Wyber R, Wade V, et al. Rheumatic heart disease in Indigenous young peoples. Lancet Child Adolesc Health. 2021;5(6):437–46.
[179] Davidson L, Knight J, Bowen A. Skin infections in Australian Aboriginal children: a narrative review. Med J Aust 2020; 212(5):231–237

different regions, epidemiologists/public health staff, environmental health specialists, specialists in comparative risk assessment and the ACCHO sector. UWA also encourages a framework that could allow a national approach.

Whichever EAF set is decided upon, there may be different combinations of disease categories are used for different purposes. For example, a subset of environmental attributable health conditions with very high fractions as selected here may be more useful for monitoring environmental health services than including those which have smaller fractions (such as mental health conditions, or UTIs). Nonetheless, an agreed and comprehensive EAF list is required as a basis for quantifying the true burden of environmental causes or confining focus on an agreed subset. In the short-term, a list of highly environmentally-sensitive conditions could be compiled by consensus for monitoring outcomes, with the rationale for choice of condition based on the concept of EAFS with as robust a method as possible for deciding on the diseases.

The pilot has shown that the ACCHO sector in WA has skilled work force to co-design and extract useful aggregated data from PHC systems, particularly when the design of what is needed is Aboriginal-led and sufficient time is allocated to the process. Central extraction by Telstra is not required for successful and standardised data extraction from CommuniCare systems used in some WA ACCHOs.

The actual data extracted attempted to generate tables beyond crude totals, for example by age group and with suitable denominator information. Some person-based counts further increased the utility of the data. Health informatics staff in ACCHOs rose to the challenge once they saw what data were required. Future extractions would have to decide on which denominators would be most useful depending on the purpose of the extraction. For example, if the counts of clinical items relate to all services provided, then the denominator will also need to reflect clinical items for all clients attending, not only regular clients. Similarly, consideration would have to be given when a person-based calculation is made. Definitions for each of these terms would also need to be workshopped and agreed.

This pilot extracted counts of clinical items that provided a diagnosis. Related procedure data were not incorporated, such that the current pilot does not reflect all resource use. For example, ARF cases receive injections, every 28 days for 5-10 years and these may be more typically coded as ‘medication’ without reference to ARF. People with skin sores requiring frequent dressings may be more typically coded as ‘wound dressing’. These related procedural consultations would have been missed using the ICPC/SnoMed codes used in the pilot. Similarly, home visits ‘missed’ or ‘failed attempts’ as a component of care plans for environment-related conditions.

Through the availability of Diagnostic Related Groups codes in hospital admission data, EH-attributable admissions can be easily used to calculate hospital costs associated with EH-attributable disease. With PHC data however, calculating costs are not easily mapped to clinical items/diagnoses in this way. There is no standardised cost list. Estimating costs of environment-related disease in terms of health service utilisation will need a similar level of methodological investment as required to develop hospital pricing lists. Costs will also differ between urban to remote services. Other costs such as time off school or work have not, to our knowledge, been calculated yet these are clearly costs to be avoided by preventing morbidity due to the environment.

Aligning the data from MMeX and CommuniCare remains a challenge. A robust system should be developed to ensure the consistency of data across systems. Denominator information (total number of clinical items and patients) also needs to be consistent. Further checking on mapping of items between CommuniCare and MMEx is required to facilitate standardised data extraction. A detailed technical manual, including data definitions and selection criteria for types of patients and items, would be essential to ensure consistency across systems and services. This may be time-consuming but extremely valuable long-term.

Because of their locations, the 25 ACCHOs in WA currently serve only about half of the Aboriginal population of WA. The remainder of the Aboriginal population in WA access primary care services

from private GPs or, most commonly in regional and remote WA, through WACHS government-managed clinics or Royal Flying Doctor Service (RFDS) primary care. The clinical record system used by WACHS (and RFDS when working in WACHS clinics) is Community Health Information System (CHIS), which also uses CommuniCare. To obtain a sufficiently accurate quantification for the entire state, additional work would be required to ensure data extraction from CHIS.

4. Recommendations

This pilot has progressed the development of processes to utilise PHC data from ACCHO clinics to support program design and Aboriginal health outcomes, with a specific focus on environmental health. UWA strongly encourages continued investment in data systems and approaches for Aboriginal environmental health outcomes measurement and program funding.

Continued development of any data system to measure demand from and outcomes sensitive to environmental health programs in PHC and therefore, possible constructs for outcomes-focused contracting, should be co-designed by AHCWA, member services and the WA Government. Academic partners whether UWA, ECU, Curtin or UNDA could be enlisted to provide a supporting technical role consistent with their respective institutional Aboriginal engagement strategies and policies.

Allocating resources and building capacity in AHCWA as the peak Aboriginal health body in WA would ensure this co-design could be undertaken in lockstep with Aboriginal data sovereignty. This would also ensure that WA Department of Health fulfills its requirements regarding its commitments to data sovereignty.

The governance for continued work using PHC data will need to be decided upon jointly with the ACCHO sector. UWA recommends that actions are overseen by a Steering Committee co-chaired between AHCWA and WA Department of Health.

Given the centrality of PHC data for outcomes-based funding to support improved Aboriginal health in general, infrastructure/mechanism should be developed to ensure ongoing work to optimise the use of PHC data. To that end, it is recommended that a data management and analysis group in AHCWA be established to undertake the following:

- Develop data sovereignty principles and policies for endorsement by all stakeholders.
- Establish and oversee a process in conjunction with the various geographic regions and their respective Aboriginal Health Planning Forums (or the State-wide Aboriginal Health Planning Forum) for use in future data extraction, analysis, needs assessment and potential service contracting for environmental as well as other areas of health.
- Establish a formal network of health information analysts in the sector to encourage collegial support, facilitate consistent data definitions and comparable data extraction processes between MMEx and CommuniCare systems. This will likely encourage innovation.
- Expand and ensure a comprehensive data list for extracting disease data from ACCHO systems, with disease codes and items mapped thoroughly between MMEx and CommuniCare.
- Develop accessible ways of sharing outputs from the PHC data with staff to illustrate how the data they enter is used, thus encourage accurate data entry.
- Specific to AEH, consider the implications of care plans for diagnoses with high environmental attributions and how the associated procedures/medications/ dressings/home visits might be credibly apportioned to environmental causes.
- Conduct a pilot study with WACHS to assess how data from CHIS can be extracted and produce credible data. CHIS using CommuniCare makes this highly feasible.
- Consider what comparisons between locations and services make sense in terms of caseload, percentages and rank order of disease presentations.

- Undertake analyses that use follow-up data at the individual level to address outcomes (e.g. recurrence, complications, adherence) in order to evaluate the impact of services.

5. Conclusions

This pilot was undertaken to investigate processes and feasibility of accessing, extracting and analysing PHC data from Aboriginal Medical Services in WA. Despite the short time frame (September to November 2021), AHCWA took decisive leadership, with six services signing up to a Data Agreement with UWA, making health information staff available to assist with planning and extracting data, and providing data for analysis. While several challenges remain, the pilot provides a way forward for better use of data for service planning and outcomes-based funding. A critical review of EAFs is needed so that AHCWA and other stakeholders has a suitable tool adaptable to all regions in order to represent important conditions contributing to the Aboriginal burden of disease. These data could be shared through the State-wide Aboriginal Planning Forum with AEH and WA Health to fulfil Priority 4 of the National Agreement on Closing the Gap. In the short-term, an agreed-upon list of conditions that are highly sensitive to the environment and quality of environmental health services should be compiled and used for monitoring this important contributor to the burden of disease among Aboriginal Western Australians.

Acknowledgements

- The Steering Committee for the AEH Program Review, who motivated for a pilot to explore the feasibility of obtaining PHC data to support the planning and procurement of AEH services
- Vicki O'Donnell, Chair of AHCWA, who facilitated the process of support from AMSs
- CEOs of the five AMSs who participated in the pilot
- Prof Jeanette Ward for technical advice and partnership guidance with ACCHOs
- Elijah Glass who wrote the SQL program for data extraction from CommuniCare databases
- Kris Hamagutchi and Lucy Falcocchio from KAMS who extracted data from MMEx
- Luke Austin and Katy Wedderburn from AHCWA who contributed to the selection of ICPC clinical items mapped to the environment-sensitive disease groups

Attachments from Primary Health Care Pilot

Pilot Attachment 1:
DATA AGREEMENT SIGNED BY ABORIGINAL MEDICAL SERVICES

Data Agreement between _____ [insert name of service] and Dr Judith Katzenellenbogen on behalf of the Western Australian Aboriginal Environmental Health Program (AEH Program) Review Team from the University of Western Australia.

BEFORE SIGNING THIS DATA AGREEMENT, PLEASE ENSURE ALL PARTIES HAVE READ THE ATTACHED INFORMATION SHEET

In 2021, the WA Department of Health contracted the University of Western Australia (UWA) to undertake an independent review of the WA Aboriginal Environmental Health Program (see information sheet for list of the Review Team). This review is overseen by a Steering Committee, including five Aboriginal members (three not affiliated to the WA Health Department, two from within the Health Department) and other non-Aboriginal members.

The UWA Review Team and the Steering Committee have agreed that primary health care data will add value to the review in terms of a pilot project to outline the types of processes and data that might be used in the future to monitor health outcomes related to environmental conditions. Given the nature of the pilot and limited time frame for the Review, not all Aboriginal Community Controlled Health Organisations (ACCHOs) are able to be included in this pilot. However, a sufficient number of ACCHOs will be asked to participate to adequately address the objective of the pilot as outlined above.

This Agreement specifies that UWA's data access is solely for the purpose of providing analyses for the pilot project as part of the current review.

This Agreement communicates the purpose, conditions and responsibilities between the participating ACCHO and the AEH Program Review Team for UWA to access, analyse and report aggregated/grouped primary health care data from the participating ACCHO for the period 1 July 2020 to 30 June 2021. The primary health care data comprise the number of visits to the service for selected conditions known to be related to environmental health conditions. No information will be provided at the patient level so no individual person will be identifiable. In the situation where small numbers (<5) exist in the data, results will be presented in the final report by AEH Program Review Team as <5.

By signing below, both Parties commit to execute this Data Agreement in good faith complying with the following:

- Data extraction, analysis and reporting to WA Department of Health by UWA Review Team is undertaken to support investment in Aboriginal environmental health consistent with the Priority Reforms of the National Agreement for Closing the Gap
- The Parties agree to align at all times with aspirations and processes in (1) the WA Aboriginal Health Policy Directorate policy *Outcomes Framework for Aboriginal Health 2020–2030: Outcomes-focused approach to funding community-based healthcare service* (2) *A Path Forward: Developing the Western Australian Government's Aboriginal Empowerment Strategy: Discussion Paper* and (3) *Closing the Gap Jurisdictional Implementation Plan: Western Australia (September 2020)*
- Participating ACCHOs do not agree to WA Health having access to the data. The processes of the pilot, including mechanisms, barriers and opportunities will inform the WA Health Department of potential ways to operationalise outcome-based procurement. In the final report, dummy data will

be generated by UWA and presented to the WA Health Department to illustrate the type of information that can be produced.

- The dummy data presented to the Department could contribute to the design of outcome measurement depending on the recommendations of the Steering Committee and UWA Review Team. Future service design and procurement activities to be carried out by the WA Health Department abide by the principles and behaviours of the *Delivering Community Services in Partnership Policy*, thereby ensuring co-design.
- The UWA Review Team will never share, present, use, publish or reference the data in any way other than in a summarised form in the Review report provided to the WA Department of Health. Any other use of the real data will require the written prior and informed consent of the ACCHO.
- The UWA Review Team will provide clear instructions to participating ACCHOs to enable efficient data extraction and secure transfer to UWA for analysis
- Data will be stored on the UWA secure network and will only be accessible by the Review Team. The data will be archived, and as this is a pilot project without ethics approval, destroyed after 12 months
- Participating ACCHOs will communicate early with the UWA Review Team regarding logistics, more pressing / more urgent priorities or other capacity challenges which present a risk to their timely provision of data to UWA Review Team according to the agreed instructions provided by the UWA Review Team
- UWA Review Team will produce a short summary of the service findings and overall findings for each ACCHO on or before 20 December 2021 which contains their data analysed in a form to support partnerships with Aboriginal environmental health services.
- In addition, _____ [service] requires these undertakings:
    - [ACCHO TO ADD IF REQUIRED]
    - [ACCHO TO ADD IF REQUIRED]

Any breach of this Data Agreement by UWA Review Team or other party will be reported immediately to the UWA Pro Vice-Chancellor (Indigenous Education), Prof Jill Milroy on +61 8 6488 7829 or email jill.milroy@uwa.edu.au

CEO signature:	J Katzenellenbogen signature:
DATE:	DATE:
Board Chair/Director signature:	Prof Colleen Fisher:
DATE:	DATE:

ACCHO DETAILS:

CEO NAME & CONTACT DETAILS:

HEALTH INFORMATION MANAGER/OFFICER NAME & CONTACT DETAILS:

ELECTRONIC CLINICAL HEALTH RECORD SYSTEM (select which applies)

MMEx / Communicare

Please forward this signed Data Agreement to Judy Katzenellenbogen as below:

Dr Judith Katzenellenbogen
Assoc/Prof & National Heart Foundation Future Leader Fellow
Aboriginal Heart Disease and Stroke
School of Population and Global Health
The University of Western Australia
M431, 35 Stirling Highway, Perth WA 6009 Australia

T +61 8 6488 1001 M +61 (0)421 776749
E Judith.katzenellenbogen@uwa.edu.au

Pilot Attachment 2:

INFORMATION SHEET FOR COMMUNITY-CONTROLLED ABORIGINAL MEDICAL SERVICES

In July 2021, UWA was appointed by WA Health Department to review the WA Aboriginal Environmental Health Program. This review is being overseen by a Steering Committee which includes three independent Aboriginal members outside of the WA Department of Health. The UWA Review Team comprises Prof David Preen, Assoc Prof Judith Katzenellenbogen, Dr Emma Haynes, Assoc Prof Roz Walker and Dr Sanji Gudka. (henceforth UWA Review Team). The UWA Review Team is working closely with independent Aboriginal consultant Mandy Gadsdon.

In August 2021, the Steering Committee and the UWA Review Team agreed a pilot should be undertaken by the Review Team to produce an estimate of the burden of demand presenting to ACCHO clinics due to the environment for the purpose of informing review recommendations. The focus of the pilot will be to measure the pattern of environmental health-related presentations and learn about the practicalities in doing so. Given the limited time frame, estimates will not be comprehensive as data will not be WA-wide and will not include all environmental health related conditions.

Participating ACCHOs will be given instructions by UWA for data extraction from their electronic medical records systems (either Communicare or MMEx as appropriate). At this stage, the estimated time this will take up for ACCHO staff is not known. The requested data period comprises 1 July 2020 to 30 June 2021. Instructions will include how to provide data in age groups: 0–14 years; 15–24 years; 25+ years.

The environment is not the only cause of all the listed environmental health-related conditions. Hence, UWA will calculate the proportion (fractions) of the burden that can be attributable to the environment. They will calculate two sets of estimates by using both fractions developed in the Kimberley (KEAFs) and those developed by the World Health Organization (WHO) to estimate the burden that could be prevented if environmental conditions were better. UWA will use both fractions because not all regions are the same and the WHO list does not include all conditions considered important in WA.

The accompanying Data Agreement must be signed by UWA and the participating ACCHO before data access can commence. This Data Agreement commits the signing Parties to collaborate in good faith and abide by the commitments specified. Each participating ACCHO can insert additional requirements if needed prior to both Parties signing. Data extraction and provision to the UWA Review Team is required on or before 1 October 2021.

As an entity of UWA, the UWA Review Team complies with the strategic goals of the UWA Indigenous Strategy. Any breach of the Data Agreement by UWA Review Team or other party will be reported to the UWA Pro Vice-Chancellor (Indigenous Education), Prof Jill Milroy on +61 8 6488 7829 or email jill.milroy@uwa.edu.au

There will be a special joint meeting scheduled in September with CEOs /Boards who want to be involved at which UWA will discuss the draft Data Agreement which will be circulated to CEOs/Boards beforehand. With these guarantees in place, the request from UWA for access to ACCHO data to inform the AEH Program Review is supported by the AHCWA Chair. Under these safeguards, the Steering Committee also accepted there is no need for ethics committee approval due to the timeframe of the AEH Program Review.

Pilot Attachment 3: Environment-attributable fractions for diseases, WHO & KEAFs

Conditions	KEAF	WHO_EAF
1 = 'Acute Rheumatic Fever (ARF)'	0.8	
2 = 'Asthma'	0.55	0.44
3 = 'Cancer'	0.16	0.19
4 = 'Cardiovascular disease (Not RHD)'	0.56	0.14
5 = 'Cataracts'	0.7	0.08
6 = 'Chronic lung disease including COPD'	0.12	0.27M; 0.09F
7 = 'Conjunctivitis (Infective)'	0.6	
8 = 'Deafness'	0.4	0.08
9 = 'Dental caries, abscess, extractions'	0.6	
10 ='Diarrhoeal diseases'	0.8	0.42
11 ='Drowning'	0.66	0.54
12 ='Failure to thrive'	0.6	
13 = 'Falls'	0.6	0.26
14 = 'Fires/ burns'	0.3	0.07
15 = 'Intestinal nematodes (hookworm)'	0.9	1
16 = 'Keratoconjunctivitis'	0.8	
17 = 'Low birth weight'	0.27	0.08
18 = 'Lower respiratory infections'	0.47	0.2
19 = 'Malnutrition and nutritional concerns'	0.78	0.5
20 = 'Mental health / psychosocial'	0.2	0.13
21 = 'Miscarriage'	0.07	
22 = 'Murray Valley Encephalitis'	0.8	
23 = 'Other arboviruses (Barmah Forest)'	0.8	0.95
24 = 'Otitis Media'	0.9	0.12
25 = 'Poisonings'	0.2	0.71
26 = 'Post-streptococcal glomerulonephritis'	0.75	
27 = 'Premature birth'	0.07	
28 = 'Pterygium'	0.8	
29 = 'Rheumatic heart disease (RHD)'	0.65	
30 = 'Road traffic accident'	0.6	0.17
31 = 'Ross River Virus'	0.8	0.95
32 = 'Scabies'	0.95	
33 = 'Shingles'	0.05	
34 = 'Skin cancer'	0.95	
35 = 'Skin infection inc pustules, abscess, cellulitis, impetigo'	1	
36 = 'STD'	0.05	0.08
37 = 'Intentional self-harm'	0.09	0.16
38 = 'Throat infection'	0.8	
39 = 'Trachoma'	0.9	1
40 = 'Tuberculosis'	0.33	0.19
41 = 'Unintentional injuries including dog bite'	0.95	0.3
42 = 'Urinary tract infection'	0.1	

Pilot Attachment 4: Provided to Health Informatics staff to illustrate data required
CommuniCare codes for primary health care presentations attributable to the environment
Coding frame for diseases: International Classification of Primary Care (ICPC)
Field searched in Communicare: **Dates:** July 2020-June 2021

DISEASE CONDITION	ICPC codes in category	KEAF	WHO fraction
Skin infection	Multiple codes, worth mapping and including all	**1.0**	n/a
Scabies	Mentioned in a few different codes, worth mapping and including all	**.95**	n/a
Unintentional injuries incl. dog bite*	Multiple codes, worth mapping and including all	**.95**	0.3
Skin cancer	Mentioned in a few different codes, worth mapping and including all	**.95**	n/a
Otitis media	Multiple codes, worth mapping and including all	**.90**	0.9
Trachoma	Mentioned in a few codes, worth mapping and including	**.90**	0.3
Intestinal nematodes (hookworm)	Multiple codes, worth mapping and including all	**.90**	1.0
Diarrhoeal diseases	Multiple codes, worth mapping and including all	**.80**	0.42
Acute Rheumatic Fever (ARF)	Mentioned in a few different codes, worth mapping and including all	**.80**	n/a
Throat infection	Mentioned in a few different codes, worth mapping and including all	**.80**	n/a
Ross River Virus	Mentioned in a few different codes, worth mapping and including all	**.80**	0.95
Other arboviruses (Barmah Forest)	Mentioned in a few different codes, worth mapping and including all	**.80**	0.95
Murray Valley Encephalitis	Mentioned in a few different codes, worth mapping and including all	**.80**	n/a
Pterygium	Mentioned in a few different codes, worth mapping and including all	**.80**	n/a
Keratoconjunctivitis	Mentioned in a few different codes, worth mapping and including all	**.80**	n/a
Malnutrition and nutritional concerns	Multiple codes, not worth mapping and including	.78	0.5
Post-streptococcal glomerulonephritis	Mentioned in a few codes, worth mapping and including	**.75**	n/a
Cataracts	Mentioned in a few codes, worth mapping and including	**.70**	0.08
Drowning	Unlikely to be mentioned in ICPC – not worth mapping and including	.66	0.54
Rheumatic heart disease (RHD)	Mentioned in a few codes, worth mapping and including	**.65**	n/a
Falls	Multiple codes, not worth mapping and including	.60	0.26
Conjunctivitis (infective)	Multiple codes, worth mapping and including all	**.60**	n/a
Road traffic accident	Unlikely to be mentioned in ICPC – not worth mapping and including	.60	0.17

Dental caries, abscess, extractions	Multiple codes, worth mapping and including all	**.60**	n/a
Failure to thrive	Multiple codes, not worth mapping and including	.60	n/a
Cardiovascular disease (Not RHD)	Multiple codes, not worth mapping and including	.56	0.14
Asthma	Multiple codes, not worth mapping and including	.55	0.44
Lower respiratory infections	Multiple codes, not worth mapping and including	.47	0.20
Deafness	Occasional codes, not worth mapping and including	.40	0.08
Tuberculosis	Mentioned in a few codes, worth mapping and including	**.33**	0.19
Fires/ burns	Multiple codes, not worth mapping and including	.30	0.07
Low birth weight	Mentioned in a few codes, not worth mapping and including	.27	0.08
Violence	Multiple codes, not worth mapping and including	.25	0.16
Musculoskeletal diseases	Multiple codes, not worth mapping and including	.25 ??	n/a
Poisonings	Mentioned in a few codes, not worth mapping and including	.20	0.71
Mental health / psychosocial	Multiple codes, not worth mapping and including	.20	0.13
Cancer	Multiple codes, not worth mapping and including	.16	0.19
Chronic lung disease incl. COPD	Multiple codes, not worth mapping and including	.12	0.27 m 0.09 f
Urinary tract infection	Multiple codes, not worth mapping and including	.10	n/a
Suicide / self-harm	Multiple codes, not worth mapping and including	.09	0.16
Perinatal infections	Mentioned in a few codes, not worth mapping and including	.08	
Miscarriage	Mentioned in a few codes, not worth mapping and including	.07	n/a
Premature birth	Mentioned in a few codes, not worth mapping and including	.07	n/a
Perinatal deaths	Mentioned in a few codes, not worth mapping and including	.05	n/a
STD	Multiple codes, not worth mapping and including	.05	0.08
Shingles	Mentioned in a few codes, not worth mapping and including	.05	n/a

Pilot Attachment 5: Combined raw indicative data from services pertaining to highly sensitive environment-attributable conditions, by age group and disease

All pilot sites (six Aboriginal Medical Services) - INDICATIVE DATA ONLY

	0-14				15-24				25+ years				0+ years			
Clinical items super-sensitive to Environmental factors	# persons	# clinical items	KEAF	EH-related	# persons	# clinical items	KEAF	EH-related	# persons	# clinical items	KEAF	EH-related	# persons	# clinical items	KEAF	EH-related
Skin infections	1200	2300	1.00	2300	430	700	1.00	700	1850	3780	1.00	3780	3480	6780	1.00	6780
Social Cat 16	10	10	1.00	10	20	30	1.00	30	170	230	1.00	230	200	270	1.00	270
Scabies	250	400	0.95	380	80	120	0.95	114	250	360	0.95	342	580	880	0.95	836
Unintentional injury	800	1650	0.95	1568	580	1300	0.95	1235	2650	7900	0.95	7505	4030	10850	0.95	10308
Skin Cancer	0	0	0.95	0	<5	5	0.95	5	70	200	0.95	190	#VALUE!	205	0.95	195
Otitis Media	800	1500	0.90	1350	150	220	0.90	198	450	750	0.90	675	1400	2470	0.90	2223
Traucoma	75	90	0.90	81	20	20	0.90	18	100	140	0.90	126	195	250	0.90	225
Worms	110	230	0.90	207	40	70	0.90	63	150	280	0.90	252	300	580	0.90	522
Acute rheumatic feve	70	250	0.80	200	70	180	0.80	144	230	650	0.80	520	370	1080	0.80	864
Diarrhea	300	450	0.80	360	100	130	0.80	104	650	1000	0.80	800	1050	1580	0.80	1264
Keratoconjunctivitis	180	230	0.80	184	30	40	0.80	32	200	300	0.80	240	410	570	0.80	456
Other arboviruses	0	0	0.80	0	0	0	0.80	0	0	0	0.80	0	0	0	0.80	0
PTERYGIUM	0	0	0.80	0	<5	5	0.80	4	50	60	0.80	48	50	65	0.80	52
Ross River Virus	0	0	0.80	0	0	0	0.80	0	<5	5	0.80	4	<5	5	0.80	4
Throat infection	200	280	0.80	224	150	200	0.80	160	300	300	0.80	240	650	780	0.80	624
# unique persons with EH-sensitive encounters	2340	7390		6900	1100	3020		2807	4500	15955		14952	7940	26365		24622
	% of service pts			% all cl items	% of service pts			% all cl items	% of service pts			% all cl items	% of service pts			% all cl items
	35.7%			9.0%	26.8%			5.4%	28.5%			5.0%	30.0%			5.8%
Total All clinical items in service	n/a	82,000			n/a	55,500			n/a	320,000			n/a	457,500		
Total number people attending service	6550	n/a			4100	n/a			15800	n/a			26450	n/a		

Appendix 4. Routinely Collected Health Data Related to Aboriginal Environmental Health in Western Australia

Attributable Fractions in Public Health and Environmental Health

In public health, the population attributable fraction (PAF) of a risk factor is the proportional reduction in the population burden (cases, hospitalisations or deaths) that would occur if the exposure to the factor was removed or reduced to an achievable, alternative exposure distribution.[180]

To calculate the PAF of a risk factor to a disease, the following information is needed:

- the exposure distribution to the risk factor within the population of interest,
- the relative risk (RR) linking each level of exposure to the specific disease or injury
- an alternative (counterfactual) exposure distribution to which environmental risks could be reduced.

The formulas used include:

$$PAF = \frac{P(RR-1)}{P(RR-1)+1} \times 100$$

When the risk factor has multiple categories of relative risks and exposure levels, the following formula is used:

$$PAF = \frac{\sum_c P_c\,(RR_c-1)}{\sum_c P_c\,(RR_c-1)+1} \times 100$$

Until relatively recently, analysis of disease and mortality due to risk factors was frequently undertaken in the context of individual risk factors and for selected population, thus restricting comparability. Comparative risk assessment (CRA) is a method developed by the Global Burden of Disease Project involving systematic evaluation of changes in population health that would result from modifying the population distribution of exposure to a risk factor or a group of risk factors, using consistent and comparable methods.

Like most risk factors, the environment is not the sole cause of all conditions known to have an association with the environment. The environment rarely causes 100% of cases of a specific disease or condition, consequently counting all cases would over-estimate the environmental attributable burden. Using the PAF approach, environment-attributable fractions (EAFs) are used to adjust the burden that can be attributable to the environment.[181,182]

EAFs synthesise information from a wide range of environmental factors/exposures and their relationship to different diseases. This requires selection of which factors to include (e.g. water, air pollution, sun exposure, housing, sanitation), knowledge about what diseases they are associated with and how strong that relationship is for each risk factor-outcome pair. Consideration is also given to the prevalence of the various risk factors in the population.

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[180] World Health Organization. Metrics: Population Attributable Fraction (PAF) [Internet]. undated. Available from: http://www.who.int/healthinfo/global_burden_disease/metrics_paf/en/index.html

[181] Prüss-Üstün, Annette, Wolf, J., Corvalán, Carlos F., Bos, R. & Neira, Maria Purificación. (2016). Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks.World HealthOrganization. https://apps.who.int/iris/handle/10665/204585

[182] McMullen C, Eastwood A, Ward J. Environmental attributable fractions in remote Australia: the potential of a new approach for local public health action. Aust NZ J Public Health;2016; 40:174-180

The WHO classification system for modifiable environmental impacts on health has increased in scope since the first publication in 2006. The most recent study[183] included exposures to:

- pollution and chemicals (e.g. air, water, soil)
- physical exposures (e.g. noise, radiation)
- the built environment (e.g. housing, land use patterns, including roads and sanitation facilities)
- other anthropogenic changes (e.g. climate change, vector breeding places), related behaviours
- the work environment.

The WHO EAFs are based on literature reviews and meta-analyses on population health impacts, effects of interventions, exposure-response relationships, transmission pathways and causality. Four different approaches were used in order of priority: CRA (highest level of evidence; method of choice); other somewhat less rigorous data sources; diseases fully attributed to the environment on the basis of their transmission pathway; and a survey of more than 100 experts worldwide. Experts were selected on the basis of their publications in the area of the disease or the relevant environmental risk factor. They were provided with abstracts of search results of the systematic reviews described earlier, as well as an initial estimate that was based on pooled estimates from the literature. Three or more experts were chosen for each disease or injury. The method thus involves a complex synthesis of data.

High and low non-optimal temperatures have been added as risk factors for the most recent estimates of the Global burden of risk factors in 204 countries[184] but this has not yet been added to the WHO list. Indeed, many well-established environmental health risk-outcome pairs are not included in the GBD[185]. The WHO published separate EAFs the different world regions, with developed and developing countries differentiated. In the Australian Indigenous context, a number of diseases with a strong environmental association that cause significant health inequities were not included, for example skin infections and rheumatic heart disease.

As outlined in the 2016 Australian Burden of Disease Report[186], the GBD authors maintain that there is increasing evidence to support the view that relative risks reflect intrinsic biological relationships which are common across all humanity[187]. Reflecting this principle of generalisability, the previous and current Australian Indigenous burden of disease studies have used relative risk estimates which were based on meta-analyses that pooled the findings of both national and international epidemiological studies. It is assumed that these risk estimates are applicable to the Indigenous population as there is little evidence to support the view that Indigenous Australians may have a greater risk of some diseases due to genetic predisposition; and publications of relative risks specific to the Indigenous Australian population are extremely limited.

In the Australian Aboriginal context, the major drawbacks of the WHO methodology are 1. that several important diseases contributing to current and future Aboriginal disease burden are not on the disease list and 2. That the fractions recommended for Australia are a single set for developed countries in the West Pacific, with no adjustment for regional/community variation in exposure risk. Environmental exposures are known to differ by remoteness and socioeconomic conditions.

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[183] GBD 2019 Risk Factors Collaborators* Murray C et al. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet 2020.396(10258):1223–1249
[184] GBD 2019 Risk Factors Collaborators* Murray C et al. ibid
[185] Shaffer RM, et al. Improving and Expanding Estimates of the Global Burden of Disease Due to Environmental Health Risk Factors. Environmental Perspectives 2019. 127(10): https://ehp.niehs.nih.gov/doi/10.1289/EHP5496
[186] Australian Institute of Health and Welfare 2016. Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2011. Australian Burden of Disease Study series no. 3. BOD 4. Canberra: AIHW
[187] Danaei G, Ding EL, Mozaffarian D, Taylor B, Rehm J, et al. (2011) Correction: The Preventable Causes of Death in the United States: Comparative Risk Assessment of Dietary, Lifestyle, and Metabolic Risk Factors. PLOS Medicine 8(1): 10.1371/annotation/0ef47acd-9dcc-4296-a897-872d182cde57

The Aboriginal environmental health sector in Kimberley developed their own fractions (Kimberley Environmental Attributable Fraction, KEAF) to address these shortcomings[188]. They added diseases considered important in remote Aboriginal contexts and change the fractions, based on a survey of health practitioners in the region. The KEAFS have been estimated for the Kimberley region using hospital data as well as primary health care data. No other attempts have been made to develop/adapt EAFs to accommodate different environmental conditions around Australia.

Environment-attributable fractions used in this report

Counting all cases of specific conditions would over-estimate the environmental attributable burden. As outlined above, it is rare that the claim can be made that the environment causes 100% of cases of a specific disease or condition. Hence, the UWA team used environmental attributable fractions by which to adjust the cases that can be attributable to the environment.

Environment-attributable fractions (EAFs) provide a useful tool that can be applied for different purposes: 1. To determine the burden of environment-attributable disease in a region; 2. To provide an evaluation/monitoring tool evaluate how programs are performing and 3. To provide an evidence base to inform funding levels and outcomes-based procurement.

Two methods of attributing diseases to environmental health were used; one developed by the World Health Organization (WHO) for developed countries in the Western Pacific[189] and one (Kimberley Environment-Attributable Fractions, KEAF[190]) developed by the Kimberley Aboriginal Health Planning Forum, more suitable for the Aboriginal and rural context in WA (. The WA Epidemiology Branch only applied the KEAFS to the four northern health regions of WA (Kimberley, Pilbara, Mid West and Goldfields), as these regions were considered the most comparable to the Kimberley, in terms of the level of remoteness of Aboriginal communities, the life circumstances/environment and health burden. Both estimates are provided here to provide results from comparative measures, to aid decision-making as to the best methods of monitoring these health conditions in the future.

The complete set of aggregated output tables provided to the UWA Review Team by the different data custodians are presented below.

[188] McMullen C, Eastwood A, Ward J. Environmental attributable fractions in remote Australia: the potential of a new approach for local public health action. Aust NZ J Public Health;2016; 40:174–180

[189] Prüss-Üstün, Annette, Wolf, J., Corvalán, Carlos F., Bos, R. & Neira, Maria Purificación. (2016). Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks.World Health Organization. https://apps.who.int/iris/handle/10665/204585

[190] McMullen C, Eastwood A, Ward J. Environmental attributable fractions in remote Australia" the potential of a new approach for local public health action. Aust NZ J Public Health;2016; 40:174–180

Appendix Table 1: Environmental attributable fractions used in this report (sources overleaf)

Conditions	KEAF	WHO_EAF
1 = 'Acute Rheumatic Fever (ARF)'	0.8	
2 = 'Asthma'	0.55	0.44
3 = 'Cancer'	0.16	0.19
4 = 'Cardiovascular disease (Not RHD)'	0.56	0.14
5 = 'Cataracts'	0.7	0.08
6 = 'Chronic lung disease including COPD'	0.12	0.27M; 0.09F
7 = 'Conjunctivitis (infective)'	0.6	
8 = 'Deafness'	0.4	0.08
9 = 'Dental caries, abscess, extractions'	0.6	
10 ='Diarrhoeal diseases'	0.8	0.42
11 ='Drowning'	0.66	0.54
12 ='Failure to thrive'	0.6	
13 = 'Falls'	0.6	0.26
14 = 'Fires/ burns'	0.3	0.07
15 = 'Intestinal nematodes (hookworm)'	0.9	1
16 = 'Keratoconjunctivitis'	0.8	
17 = 'Low birth weight'	0.27	0.08
18 = 'Lower respiratory infections'	0.47	0.2
19 = 'Malnutrition and nutritional concerns'	0.78	0.5
20 = 'Mental health / psychosocial'	0.2	0.13
21 = 'Miscarriage'	0.07	
22 = 'Murray Valley Encephalitis'	0.8	
23 = 'Other arboviruses (Barmah Forest)'	0.8	0.95
24 = 'Otitis Media'	0.9	0.12
25 = 'Poisonings'	0.2	0.71
26 = 'Post-streptococcal glomerulonephritis'	0.75	
27 = 'Premature birth'	0.07	
28 = 'Pterygium'	0.8	
29 = 'Rheumatic heart disease (RHD)'	0.65	
30 = 'Road traffic accident'	0.6	0.17
31 = 'Ross River Virus'	0.8	0.95
32 = 'Scabies'	0.95	
33 = 'Shingles'	0.05	
34 = 'Skin cancer'	0.95	
35 = 'Skin infection including pustules, abscess, cellulitis, impetigo'	1	
36 = 'STD'	0.05	0.08
37 = 'Intentional self-harm'	0.09	0.16
38 = 'Throat infection'	0.8	
39 = 'Trachoma'	0.9	1
40 = 'Tuberculosis'	0.33	0.19
41 = 'Unintentional injuries including dog bite'	0.95	0.3
42 = 'Urinary tract infection'	0.1	
43 = 'Violence'	0.25	0.16

The attributable fractions are documented in the following websites:
https://apps.who.int/iris/bitstream/handle/10665/204585/9789241565196_eng.pdf?sequence=1&isAllowed=;
https://onlinelibrary.wiley.com/doi/epdf/10.1111/1753-6405.12425

Results of routine data analysed for the Aboriginal Environmental Health Review

Appended Table 2: Leading EnvR age-standardised hospitalisation rate per 100,000 Aboriginal people, 2015-2019, by health region (WHO method)

Appendix Table 2.1: Number of Environment-related (EnvR) hospital admissions, length of stay and cost, by health region, for Aboriginal people, 2019 (using WHO EAF)

Health region	Total admissions	No. EnvR admissions	Age-standardised hospitalisation rate			EnvR bed days	EnvR cost ($M)
			EnvR rate per 100,000	95% CI: lower	95% CI: upper		
Kimberley	5,370	838	5,395.28	4,975.57	5,814.99	2,753	5.31
Pilbara	2,315	368	4,051.74	3,439.85	4,663.64	1,240	2.54
Mid West	1,805	281	3,828.01	3,314.33	4,341.68	1,058	2.03
Goldfields	1,364	222	3,519.13	2,984.02	4,054.24	946	1.75
Wheatbelt	845	141	4,120.17	3,335.76	4,904.58	511	0.93
South West	709	115	2,737.18	2,103.19	3,371.17	418	0.76
Great Southern	530	86	3,965.51	2,714.16	5,216.87	366	0.62
North Metro	1,506	248	4,360.08	3,504.90	5,215.26	1,255	1.89
East Metro	3,580	581	4,027.37	3,556.85	4,497.89	2,524	4.4
South Metro	1,972	335	3,643.85	3,083.92	4,203.78	1,417	2.59
WA	19,996	3,215				12,488	22.82

Appendix Table 2.2: Number of environment-related (EnvR) hospital admissions, length of stay and cost, by health region, for non-Aboriginal people, 2019 (using WHO EAF)

Health region	Total admissions	Number of EnvR admissions	Age-standardised hospitalisation rate			EnvR bed days	EnvR cost ($M)
			EnvR rate per 100,000	95% CI: lower	95% CI: upper		
Kimberley	1,630	256	1,682.32	1,440.33	1,924.30	820	1.85
Pilbara	2,491	338	1,016.07	873.49	1,158.65	1,226	2.56
Mid West	7,039	1,094	1,791.25	1,679.99	1,902.51	4,844	8.66
Goldfields	4,562	706	1,538.02	1,422.05	1,653.98	3,101	5.63
Wheatbelt	9,791	1,508	1,708.02	1,614.23	1,801.80	7,950	11.87
South West	21,348	3,302	1,655.50	1,596.58	1,714.42	14,410	25.18
Great Southern	7,599	1,234	1,753.18	1,647.59	1,858.76	6,529	9.4
North Metro	77,957	11,560	1,489.43	1,461.99	1,516.87	60,981	91.87
East Metro	70,024	10,943	1,543.03	1,513.84	1,572.23	52,118	88.2
South Metro	70,419	10,742	1,497.00	1,468.22	1,525.78	49,236	83.55
WA	272,860	41,683				201,215	328.77

Appended Table 3: Leading EnvR age-standardised hospitalisation rate per 100,000 Aboriginal people, 2015-2019, by health region (WHO method)

Appendix Table 3.1: Leading EnvR age-standardised hospitalisation rate per 100,000 Aboriginal people, 2015-2019, Kimberley

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Unintentional injuries including dog bite	821	980.3	904.6	1056.0	2716	5.49
Lower respiratory infections	623	901.3	816.6	986.1	1715	3.82
Falls	436	710.2	627.5	792.9	1765	3.21
Violence	471	536.2	486.2	586.2	945	2.34
Mental health / psychosocial	309	364.5	321.1	407.9	2049	2.32
Cardiovascular disease (Not RHD)	236	423.5	361.3	485.8	768	2.06
Cancer	116	208.6	164.4	252.8	766	1.42
Diarrhoeal diseases	348	391.1	338.9	4432.3	678	1.31
Chronic lung disease including COPD	127	255.0	205.1	304.8	376	0.76
Asthma	177	212.7	178.5	246.9	300	0.64

Appendix Table 3.2: Leading EnvR age-standardised hospitalisation rate per 100,00 Aboriginal people, 2015-2019, Pilbara

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Unintentional injuries including dog bite	333	596.0	509.4	682.5	1257	2.53
Lower respiratory infections	302	745.9	616.3	875.5	834	1.93
Falls	184	559.0	423.9	694.1	978	1.70
Cardiovascular disease (Not RHD)	144	413.3	333.8	528.7	476	1.26
Mental health / psychosocial	147	255.2	206.7	303.8	796	1.07
Violence	185	300.8	249.9	351.6	423	1.06
Cancer	59	208.6	129.6	287.6	462	0.99
Diarrhoeal diseases	158	282.3	215.4	349.1	381	0.83
Chronic lung disease including COPD	68	353.6	247.1	460.2	160	0.43
Asthma	111	208.7	158.7	258.8	225	0.42

Appendix Table 3.3: Leading EnvR age-standardised hospitalisation rate per 100,000 Aboriginal people, 2015–2019, Mid West

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Unintentional injuries including dog bite	255	615.3	530.9	699.6	944	1.87
Falls	150	500.1	401.3	598.8	722	1.33
Lower respiratory infections	154	473.9	385.4	562.3	583	1.23
Cardiovascular disease (Not RHD)	122	477.4	378.4	576.3	500	1.20
Mental health / psychosocial	152	393.2	326.7	459.8	817	1.16
Cancer	70	257.3	188.3	326.4	525	0.89
Violence	90	218.8	172.2	265.5	185	0.58
Diarrhoeal diseases	132	326.7	259.4	394.1	297	0.58
Chronic lung disease incl COPD	65	257.4	186.0	328.9	230	0.51
Poisonings	91	220.6	170.5	270.7	158	0.45

Appendix Table 3.4: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, Goldfields

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($)
Unintentional injuries including dog bite	166	496.4	408.9	583.8	565	1.27
Lower respiratory infections	155	575.8	466.4	685.2	553	1.17
Mental health / psychosocial	149	456.8	376.2	537.5	736	1.11
Cardiovascular disease (Not RHD)	101	445.4	345.4	545.3	378	0.89
Falls	94	350.0	260.2	439.8	570	0.89
Violence	70	202.2	153.4	250.9	188	0.45
Poisonings	62	171.0	126.7	215.2	146	0.45
Diarrhoeal diseases	97	253.6	189.8	317.4	247	0.44
Cancer	32	160.7	94.9	226.5	224	0.36
Chronic lung disease incl COPD	40	181.7	119.3	244.2	119	0.27

Appendix Table 3.5: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, Wheatbelt

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Falls	82	554.9	404.9	704.9	415	0.61
Unintentional injuries including dog bite	96	442.4	346.5	538.4	241	0.60
Cardiovascular disease (Not RHD)	63	424.4	307.9	540.8	264	0.56
Lower respiratory infections	65	395.4	282.9	507.9	201	0.54
Poisonings	75	405.9	310.5	501.3	152	0.41
Cancer	29	181.4	107.8	254.9	165	0.34
Chronic lung disease incl COPD	37	217.5	138.0	296.9	128	0.25
Diarrhoeal diseases	43	227.5	147.8	307.1	93	0.16
Asthma	40	235.2	138.6	331.8	78	0.13

Appendix Table 3.6: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, South West

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Mental health / psychosocial	86	363.1	274.6	451.6	628	0.61
Unintentional injuries including dog bite	88	351.0	262.4	439.7	270	0.58
Falls	58	328.6	208.3	448.9	286	0.50
Cardiovascular disease (Not RHD)	43	327.6	200.9	454.4	173	0.36
Lower respiratory infections	48	300.8	184.5	417.2	184	0.35
Cancer	28	190.1	97.5	282.6	149	0.34
Poisonings	62	241.5	177.4	305.6	107	0.31
Violence	23	105.4	61.3	149.6	50	0.14
Asthma	31	144.9	72.9	216.9	72	0.14
Diarrhoeal diseases	27	155.1	69.1	241.1	49	0.08

Appendix Table 3.7: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, Great Southern

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Mental health / psychosocial	91	749.6	577.0	922.3	516	0.69
Cardiovascular disease (not RHD)	35	462.7	255.5	669.8	136	0.41
Unintentional injuries including dog bite	47	361.2	239.7	482.7	182	0.38
Lower respiratory infections	30	327.3	150.3	504.3	116	0.25
Cancer	23	254.7	131.6	377.9	129	0.24
Falls	28	296.5	155.1	437.9	157	0.24
Poisonings	42	311.1	214.0	408.2	133	0.20
Asthma	31	239.3	109.5	369.2	57	0.10
Diarrhoeal diseases	23	214.6	100.6	328.5	44	0.08

Appendix Table 3.8: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, North Metro

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Mental health / psychosocial	219	599.3	494.4	704.3	1829	1.58
Unintentional injuries including dog bite	181	477.2	365.8	588.6	676	1.43
Poisonings	158	390.9	322.6	459.1	336	1.23
Falls	115	444.0	319.8	568.2	476	0.96
Cancer	48	273.9	157.7	390.1	320	0.71
Cardiovascular disease (Not RHD)	62	375.2	231.2	519.1	236	0.67
Lower respiratory infections	70	353.2	207.7	498.7	295	0.64
Chronic lung disease including COPD	35	206.5	98.3	314.7	112	0.30
Asthma	59	191.7	132.4	251.1	273	0.24
Diarrhoeal diseases	61	205.3	125.3	285.2	122	0.23

Appendix Table 3.9: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, East Metro

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Mental health / psychosocial	493	596.1	531.6	660.6	5584	3.85
Unintentional injuries including dog bite	407	473.9	405.8	541.9	1388	3.36
Cardiovascular disease (Not RHD)	189	425.5	338.2	512.7	659	2.04
Falls	230	456.0	356.6	555.3	1331	2.01
Lower respiratory infections	182	314.2	241.2	387.2	606	1.70
Cancer	115	233.8	170.9	296.8	668	1.66
Poisonings	290	359.4	302.6	416.2	557	1.59
Violence	142	156.7	127.2	186.3	323	0.83
Chronic lung disease including COPD	88	187.6	137.3	237.8	332	0.67
Diarrhoeal diseases	168	234.6	180.0	289.2	342	0.67

Appendix Table 3.10: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, South Metro Health Service (using WHO EAF)

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Mental health / psychosocial	245	445.4	377.6	513.2	2631	2.20
Unintentional injuries including dog bite	256	409.8	339.4	480.1	784	1.72
Poisonings	157	261.7	216.4	307.0	302	1.18
Falls	137	413.1	298.1	528.2	616	1.07
Cardiovascular disease (Not RHD)	103	407.0	300.1	513.9	378	1.07
Cancer	73	250.7	169.7	331.8	410	0.97
Lower respiratory infections	100	302.3	210.4	394.2	339	0.78
Diarrhoeal diseases	95	216.0	149.8	282.2	174	0.34
Chronic lung disease including COPD	40	182.5	109.9	255.2	130	0.32
Cataracts	22	121.9	60.5	183.4	22	0.06

Appendix Table 4: Environment-related hospitalisations (age-specific rate, LOS and cost in 2019 by health region, Aboriginality and age groups (WHO method)

Health region	Race	LOS sum (days)			Cost sum ($M)			Age-specific rate (/100,000)		
		0–14	15–24	25+	0–14	15–24	25+	0–14	15–24	25+
WA	All	7,588	14,486	191,626	$20.298	$23.495	$307.778	770.2	1,114.8	2,092.9
WA	Non-Indigenous	6,531	12,863	181,821	$17.622	$20.640	$290.486	720.0	1,046.4	2,023.0
WA	Indigenous	1,057	1,623	9,806	$2.675	$2.855	$17.292	1,486.9	2,177.8	4,442.0
East Metropolitan Health Service	All	2,007	3,592	49,043	$5.501	$6.070	$81.022	752.3	1,055.0	1,965.4
East Metropolitan Health Service	Non-Indigenous	1,813	3,233	47,072	$4.886	$5.425	$77.886	727.9	1,008.3	1,917.8
East Metropolitan Health Service	Indigenous	194	359	1,971	$0.616	$0.646	$3.135	1,233.6	2,039.1	4,299.9
North Metropolitan Health Service	All	1,929	5,061	55,246	$5.073	$6.824	$81.856	684.6	1,062.1	1,998.8
North Metropolitan Health Service	Non-Indigenous	1,863	4,923	54,196	$4.915	$6.544	$80.407	675.4	1,039.5	1,980.8
North Metropolitan Health Service	Indigenous	66	139	1,050	$0.158	$0.280	$1.449	1,096.7	2,127.9	4,056.7
South Metropolitan Health Service	All	1,569	3,247	45,837	$4.280	$5.566	$76.295	677.7	979.2	2,128.4
South Metropolitan Health Service	Non-Indigenous	1,469	2,975	44,792	$3.993	$5.132	$74.420	659.0	946.4	2,107.7
South Metropolitan Health Service	Indigenous	100	271	1,045	$0.286	$0.434	$1.875	1,172.3	1,906.1	3,526.1
Goldfields Health Region	All	263	294	3,490	$0.636	$0.534	$6.220	1,134.1	1,307.3	1,957.3
Goldfields Health Region	Non-Indigenous	161	166	2,775	$0.399	$0.343	$4.893	946.6	1,161.9	1,715.0
Goldfields Health Region	Indigenous	102	128	716	$0.237	$0.191	$1.327	1,863.5	1,817.0	4,088.2
Great Southern Health Region	All	207	314	6,374	$0.537	$0.607	$8.881	961.4	1,696.7	2,558.0
Great Southern Health Region	Non-Indigenous	188	262	6,080	$0.468	$0.531	$8.406	946.2	1,612.6	2,502.4
Great Southern Health Region	Indigenous	19	52	294	$0.070	$0.076	$0.475	1,135.4	2,609.3	4,126.1
Kimberley Health Region	All	365	422	2,785	$0.739	$0.775	$5.645	1,795.6	2,912.3	3,574.6
Kimberley Health Region	Non-Indigenous	63	67	691	$0.149	$0.167	$1.529	967.0	1,626.6	1,616.5
Kimberley Health Region	Indigenous	302	355	2,095	$0.590	$0.608	$4.116	2,254.4	3,436.0	6,086.6
Mid West Health Region	All	242	296	5,365	$0.743	$0.642	$9.298	1,073.2	1,610.6	2,635.5
Mid West Health Region	Non-Indigenous	150	175	4,519	$0.496	$0.403	$7.757	937.8	1,434.1	2,434.0
Mid West Health Region	Indigenous	92	121	845	$0.247	$0.239	$1.541	1,488.5	2,140.6	4,316.0
Pilbara Health Region	All	283	176	2,007	$0.739	$0.354	$4.005	1,072.2	1,368.7	1,247.1
Pilbara Health Region	Non-Indigenous	158	86	981	$0.428	$0.175	$1.952	833.6	1,161.6	731.6

Pilbara Health Region	Indigenous	125	89	1,025	$0.311	$0.179	$2.053	1,772.1	1,701.1	3,999.9
South West Health Region	All	524	823	13,481	$1.422	$1.559	$22.951	814.8	1,251.3	2,327.5
South West Health Region	Non-Indigenous	489	742	13,179	$1.330	$1.415	$22.432	803.9	1,221.7	2,312.8
South West Health Region	Indigenous	35	81	303	$0.092	$0.144	$0.519	1,007.7	1,734.7	3,049.5
Wheatbelt Health Region	All	199	263	7,998	$0.628	$0.564	$11.605	837.5	1,307.4	2,621.6
Wheatbelt Health Region	Non-Indigenous	177	235	7,537	$0.559	$0.505	$10.803	815.1	1,304.5	2,516.2
Wheatbelt Health Region	Indigenous	22	28	461	$0.069	$0.060	$0.802	1,009.3	1,327.9	5,131.9

Appendix Table 5: Environment-related hospital admissions, length of stay and cost, by health region for Aboriginal people (KEAF method)

Appendix Table 5.1: Number of Environment-related (EnvR) hospital admissions, length of stay and cost, by health region, for Aboriginal people, 2019 (using KEAF)

Health region	Total admissions	Number of EnvR admissions	Age-standardised hospitalisation rate			EnvR bed days	EnvR cost ($M)
			EnvR rate per 100,000	95% CI: Lower	95% CI: Upper		
Kimberley	**5,307**	**2,776**	17,134.02	16,402.25	17,865.79	8,970.00	18.00
Pilbara	**2,315**	**1,210**	12,248.73	11,236.95	13,260.50	3,700.00	7.89
Mid West	**1,805**	**947**	12,586.84	11,664.27	13,509.40	3,178.00	6.80
Goldfields	**1,364**	**680**	10,590.15	9,654.85	11,525.44	2,656.00	5.35
Wheatbelt							
South West							
Great Southern							
North Metro							
East Metro							
South Metro							
Total	**10,791**	**5,613**				**18,504.00**	**38.04**

Appendix Table 5.2: Number of Environment-related (EnvR) hospital admissions, length of stay and cost, by health region, for non-Aboriginal people, 2019 (using KEAF)

Health region	Total admissions	No. EnvR admissions	Age-standardised hospitalisation rate			EnvR bed days	EnvR cost ($M)
			EnvR rate per 100,000	95% CI: lower	95% CI: upper		
Kimberley	1,630	927	6,234.65	5,760.33	6,708.97	2,377	5.85
Pilbara	2,491	1,394	3,641.73	3,366.97	3,916.48	3,336	7.94
Mid West	7,039	3,798	6,213.12	6,006.00	6,420.23	12,866	25.23
Goldfields	4,562	2,422	5,261.39	5,047.26	5,475.53	8,198	16.72
Wheatbelt							
South West							
Great Southern							
North Metro							
East Metro							
South Metro							
Total	**15,722**	**8,541**				**26,777**	**55.74**

Appended Table 6: Leading EnvR age-standardised hospitalisation rate per 100,000 Aboriginal people, 2015-2019, by four northern health regions (KEAF method)

Appendix Table 6.1: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, Kimberley

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Skin infection	2,853	3,331.3	3,192.2	3,470.5	8,601	17.79
Unintentional injuries including dog bite	2,598	3,104.3	2,969.6	3,239.1	8,600	17.38
Lower respiratory infections	1,464	2,118.1	1,988.2	2,248.0	4,030	8.98
Cardiovascular disease (not RHD)	946	1694.1	1,569.5	1,818.6	3,073	8.24
Falls	1,005	1,639.0	1,513.3	1,764.6	4,072	7.42
Violence	736	837.8	775.3	900.3	1,477	3.66
Mental health / psychosocial	475	560.7	506.9	614.6	3,152	3.58
Diarrhoeal diseases	662	744.9	672.8	816.9	1,292	2.50
Otitis media	551	413.2	376.4	449.9	662	1.91
Cataracts	349	730.7	645.5	815.9	395	1.04

Appendix Table 6.2: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, Pilbara

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Skin infection	1,629	2,868.8	2,684.3	3,053.3	4,523	10.67
Unintentional injuries including dog bite	1,055	1,887.2	1,733.1	2,041.2	3,981	8.00
Cardiovascular disease (not RHD)	576	1,725.1	1,530.2	1,920.0	1,905	5.04
Lower respiratory infections	709	1,752.9	1,554.3	1,951.5	1,960	4.54
Falls	425	1,290.0	1,084.7	1,495.3	2,256	3.93
Road traffic accident	187	286.1	243.5	328.6	817	2.11
Violence	290	469.9	406.3	533.5	661	1.66
Mental health / psychosocial	226	393.0	332.4	452.9	1,225	1.64
Diarrhoeal diseases	301	537.7	445.4	630.0	726	1.58
Cataracts	174	713.9	572.5	855.4	176	0.53

Appendix Table 6.3: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, Goldfields

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Skin infection	645	1,782.0	1,622.2	1,941.8	2,186	4.25
Unintentional injuries including dog bite	526	1,571.8	1,416.2	1,727.4	1,790	4.01
Cardiovascular disease (not RHD)	403	1,781.5	1,581.6	1,981.4	1,514	3.57
Lower respiratory infections	365	1,353.1	1,185.4	1,520.8	1,300	2.76
Falls	217	807.7	671.2	944.2	1,315	2.05
Mental health / psychosocial	229	702.4	602.8	802.9	1,132	1.71
Diarrhoeal diseases	185	483.1	395.1	571.2	470	0.83
Violence	109	315.9	254.9	376.8	294	0.71
Otitis media	149	264.7	217.3	312.2	254	0.52
Cataracts	113	647.5	510.4	784.5	116	0.34

Appendix Table 6.4: Leading EnvR age-standardised hospitalisation rate per 100,000 people, Aboriginal people, 2015-2019, Mid West

Minor disease grouping	No. EnvR admissions	EnvR rate per 100,000	95% CI: lower	95% CI: upper	EnvR bed days	EnvR cost ($M)
Skin infection	1,009	2,361.0	2,198.4	2,523.6	2,813	6.41
Unintentional injuries including dog bite	808	1,948.4	1,798.3	2,098.5	2,990	5.92
Cardiovascular disease (not RHD)	486	1,909.4	1,711.5	2,107.4	2,001	4.81
Falls	346	1,154.0	1,004.0	1,304.0	1,667	3.01
Lower respiratory infections	363	1,113.5	978.0	1,249.1	1,371	2.88
Mental health / psychosocial	234	605.0	522.5	687.5	1,257	1.79
Road traffic accident	160	350.3	291.3	409.3	681	1.64
Diarrhoeal diseases	251	622.3	529.4	715.3	565	1.10
Violence	140	341.9	283.6	400.2	290	0.91
Cataracts	152	606.0	496.5	715.6	154	0.44

Appendix Table 7: Environmental attributable hospitalisations (age-specific rate, LOS and cost in 2019 by health region, Aboriginality and age groups (KEAF method)

Health region	Race	LOS sum (days)			Cost sum ($M)			Age-specific rate (/100,000)		
		0–14	15–24	25+	0–14	15–24	25+	0–14	15–24	25+
Kimberley Health Region	All	1,867	1,037	8,443	3.956	2.217	17.678	8,167.7	8,481.3	11,531.4
Kimberley Health Region	Non-Indigenous	201	194	1,982	0.524	0.505	4.824	3,295.5	5,488.9	5,944.7
Kimberley Health Region	Indigenous	1,666	843	6,461	3.432	1.712	12.854	10,866.1	9,700.3	18,698.6
Pilbara Health Region	All	1,169	460	5,407	3.125	1.044	11.657	4,527.6	3,859.6	4,131.7
Pilbara Health Region	Non-Indigenous	560	202	2,574	1.564	0.511	5.861	3,269.1	3,157.6	2,637.0
Pilbara Health Region	Indigenous	609	258	2,833	1.562	0.534	5.796	8,219.2	4,986.2	12,113.8
Goldfields Health Region	All	948	736	9,171	2.313	1.715	18.037	4,017.9	3,993.1	6,538.4
Goldfields Health Region	Non-Indigenous	485	415	7,297	1.294	1.071	14.352	3,084.8	3,633.0	5,986.5
Goldfields Health Region	Indigenous	462	321	1,873	1.019	0.645	3.685	7,647.7	5,255.8	11,392.7
Mid West Health Region	All	1,000	752	14,292	3.086	2.052	26.897	4,188.8	5,296.4	8,992.1
Mid West Health Region	Non-Indigenous	548	454	11,864	1.801	1.351	22.082	3,467.6	5,060.9	8,381.7
Mid West Health Region	Indigenous	452	298	2,428	1.285	0.701	4.815	6,401.2	6,003.6	14,081.1

Appendix Table 8: COMMUNICABLE DISEASES DATA: Environment-related notifications*

Appended Table 8.1: Environment-related notifications for Aboriginal people, by disease and region, WA 2020 (no fractions applied)

Year: 2020	Region									
Condition	**Kimberley**	**Pilbara**	**Goldfields**	**Mid West**	**Metro**	**Wheatbelt**	**S West**	**Gr Southern**	**WA**	**% of total**
APSGN	4	0	1	0	0	0	0	0	5	0%
Barmah Forest virus infection	1	0	0	0	0	0	0	0	1	0%
Chancroid	0	0	0	0	0	0	0	0	0	0%
Chlamydia	457	193	142	147	487	20	29	19	1,494	42%
Donovanosis	0	0	0	0	0	0	0	0	0	0%
Flavivirus infection - MVE	0	0	0	0	0	0	0	0	0	0%
Food or water-borne gastroenteritis	0	0	0	0	0	0	0	0	0	0%
Gonococcal infection	529	232	155	83	303	18	20	7	1,347	38%
Listeriosis	0	0	0	0	0	0	0	0	0	0%
Rheumatic fever (new episodes)	57	14	8	5	6	1	0	1	92	3%
Rheumatic heart disease (new notifications)	38	4	4	2	6	2	1	0	57	2%
Ross River virus infection	4	2	1	0	2	1	2	1	13	0%
Rotavirus infection	2	4	0	1	5	0	0	0	12	0%
Shiga toxin-producing E.coli infection	0	0	0	0	1	0	0	0	1	0%
Shigellosis	53	14	7	32	8	3	0	0	117	3%
Syphilis	92	78	39	17	100	4	9	3	342	10%
Tuberculosis	1	0	0	0	0	0	1	0	2	0%
Varicella-zoster virus - shingles	23	5	6	3	17	0	6	4	64	2%
	1261	**546**	**363**	**290**	**935**	**49**	**68**	**35**	**3,547**	100%
	36%	15%	10%	8%	26%	1%	2%	1%	100%	
***These numbers are available by year (2019, 2020), region and broad age-group on request**										

Appended Table 8.2: Difference between 2019 and 2020 in numbers of environment-related notifications for Aboriginal people, by disease and region (no fractions applied)

Condition	Kimberley	Pilbara	Goldfields	Mid West	Metro	Wheatbelt	S West	Great Southern	WA
STIs:									
Chlamydia	15	–28	–18	37	–92	–10	–7	4	–99
Gonococcal infection	210	42	34	5	43	10	5	2	351
Syphilis	2	–16	–18	6	52	0	8	–1	33
APSGN	–3	0	0	0	0	0	0	0	–3
Barmah Forest virus infection	0	0	–1	0	0	0	0	0	–1
Chancroid	0	0	0	0	0	0	0	0	0
Donovanosis	0	0	0	0	0	0	0	0	0
Flavivirus infection - MVE	0	0	0	0	0	0	0	0	0
Food or water-borne gastroenteritis	0	0	0	0	0	0	0	0	0
Listeriosis	0	0	0	0	–2	0	0	0	–2
Rheumatic fever (new episodes)**	26	9	3	–6	2	1	–1	1	35
Rheumatic heart disease (new notifications)**	9	–6	0	–3	3	2	1	0	6
Ross River virus infection	4	1	1	–1	0	1	0	1	7
Rotavirus infection	0	–2	–4	–5	–4	–1	–2	–1	–19
Shiga toxin-producing E.coli infection	–1	–1	0	–1	0	0	0	0	–3
Shigellosis	10	1	–17	22	–5	1	0	0	12
Tuberculosis	1	0	0	0	0	0	1	0	2
Varicella-zoster virus - shingles	–3	–4	0	–4	8	–2	2	0	–3

Appended Table 8.3: Environment-attributable notifications, by disease, age group and type of environment-attributable fraction (EAF): WA 2020

	Kimberley EAF				WHO EAF			
	0–14 years	15–24 years	25+ years	Total	0–14 years	15–24 years	25+ years	Total
APSGN	4	0	0	4	0	0	0	0
Barmah Forest virus infection	0	0	1	1	0	0	1	1
Chancroid	0	0	0	0	0	0	0	0
Chlamydia	3	47	25	75	5	75	40	120
Donovanosis	0	0	0	0	0	0	0	0
Flavivirus infection - MVE	0	0	0	0	0	0	0	0
Food or water-borne gastroenteritis	0	0	0	0	0	0	0	0
Gonococcal infection	2	33	33	67	3	52	52	108
Listeriosis	0	0	0	0	0	0	0	0
Rheumatic fever (all episodes)*	34	16	23	74	0	0	0	0
Rheumatic heart disease (new notifications)*	8	6	23	37	0	0	0	0
Ross River virus infection	1	2	8	10	1	2	10	12
Rotavirus infection	10	0	0	10	5	0	0	5
Shiga toxin-producing E.coli infection	1	0	0	1	0	0	0	0
Shigellosis	46	11	36	94	24	6	19	49
Syphilis	0	5	12	17	0	8	19	27
Tuberculosis	0	0	1	1	0	0	0	0
Varicella-zoster virus - shingles	0	0	3	3	0	0	0	0
	110	119	164	393	39	143	141	323
	28%	30%	42%	100%	12%	44%	44%	100%

Appendix Table 9: Acute rheumatic fever and rheumatic heart disease tables from the RHD register

Appendix Table 9.1 Number of ARF notifications for Aboriginal people (all episode types) by region and age – 2019 and 2020

Age group at diagnosis (years)	2019				Grand Total	2020				Grand Total
	0–14	15–24	25–44	45+		0–14	15–24	25–44	45+	
Current Public Health Unit										
Goldfields	3	2			5	5	2	1		8
Great Southern						1				1
Kimberley	11	6	12	2	31	23	11	18	5	57
Mid West	6	3	2		11	2	2	1		5
Metro North		1			1	2	1		1	4
Not in WA	4	1			5	1		2		3
Pilbara	2	1	1		4	7	4	2	1	14
Metro South	3				3	2				2
Wheatbelt						1				1
South West			1		1					0
Grand total	**29**	**14**	**16**	**2**	**61**	**44**	**20**	**24**	**7**	**95**

Appendix Table 9.2 Number of first-ever ARF notifications for Aboriginal people, by region and age – 2019 and 2020

	2019				Grand Total	2020				Grand Total
Age group at diagnosis (years)	0–14	15–24	25–44	45+		0–14	15–24	25–44	45+	
Current Public Health Unit										
Goldfields	2	2			4	4	1	1		6
Great Southern						1				1
Kimberley	8	5	8	2	23	18	10	12	4	44
Mid West	5	1	1		7	2	1	1		4
Metro North		1			1	2	1		1	4
Not in WA	4				4	1		1		2
Pilbara	1				1	5	1	1	1	8
Metro South	3				3	2				2
Wheatbelt						1				1
South West										
Grand total	**23**	**9**	**9**	**2**	**43**	**36**	**14**	**16**	**6**	**72**

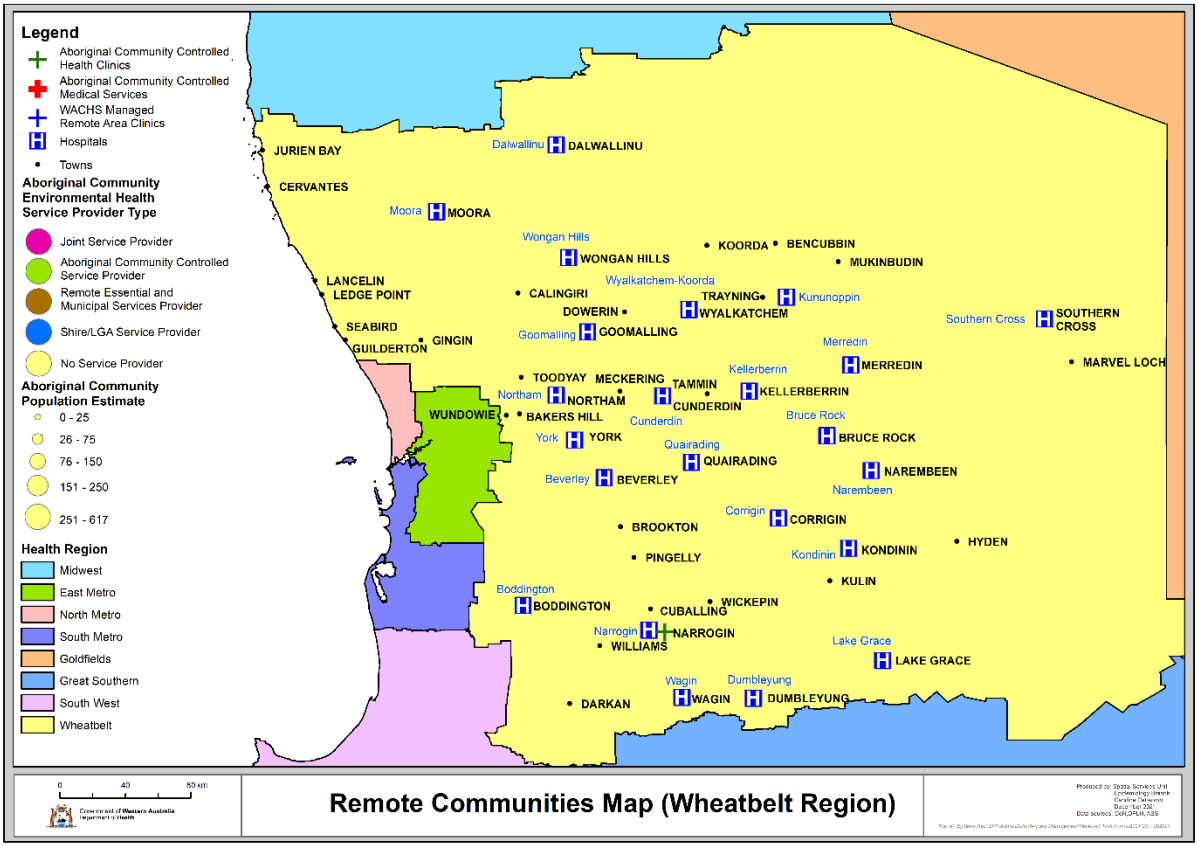
Appendix Table 9.3: Number of RHD notification among Aboriginal people, by health region and age

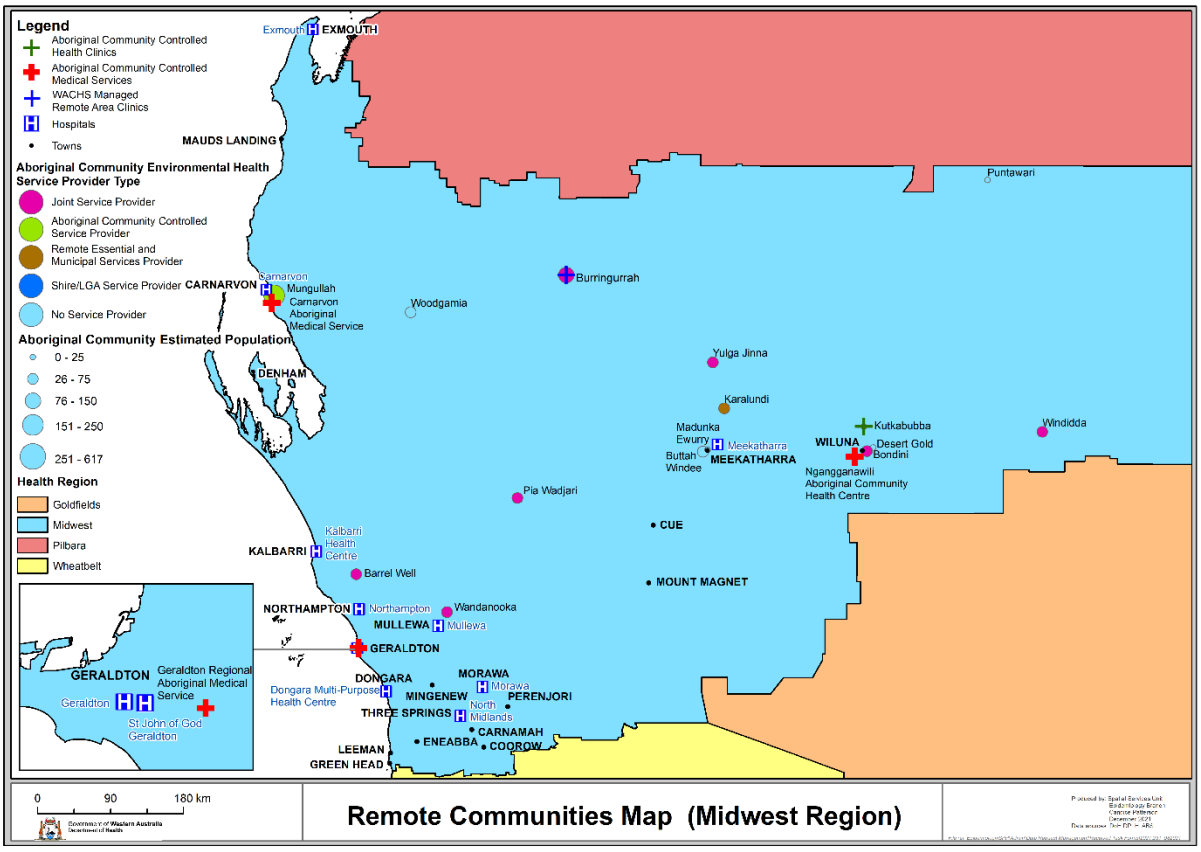
	2019					2020				
Age group at diagnosis (years)	0–14	15–24	25–44	45+	Grand Total	0–14	15–24	25–44	45+	Grand Total
Current Public Health Unit										
Goldfields	1	1	2		4	3		1		4
Great Southern										
Kimberley	8	9	6	6	29	6	5	18	9	38
Mid West	1	2		2	5	1	1			2
Metro North	1	1		1	3	1	1			2
Not in WA						1				1
Pilbara	2	2	4	2	10	1		3		4
Metro South						1	1		2	4
Wheatbelt						1		1		2
South West							1		1	2
Grand total	**13**	**15**	**12**	**11**	**51**	**14**	**9**	**23**	**12**	**58**

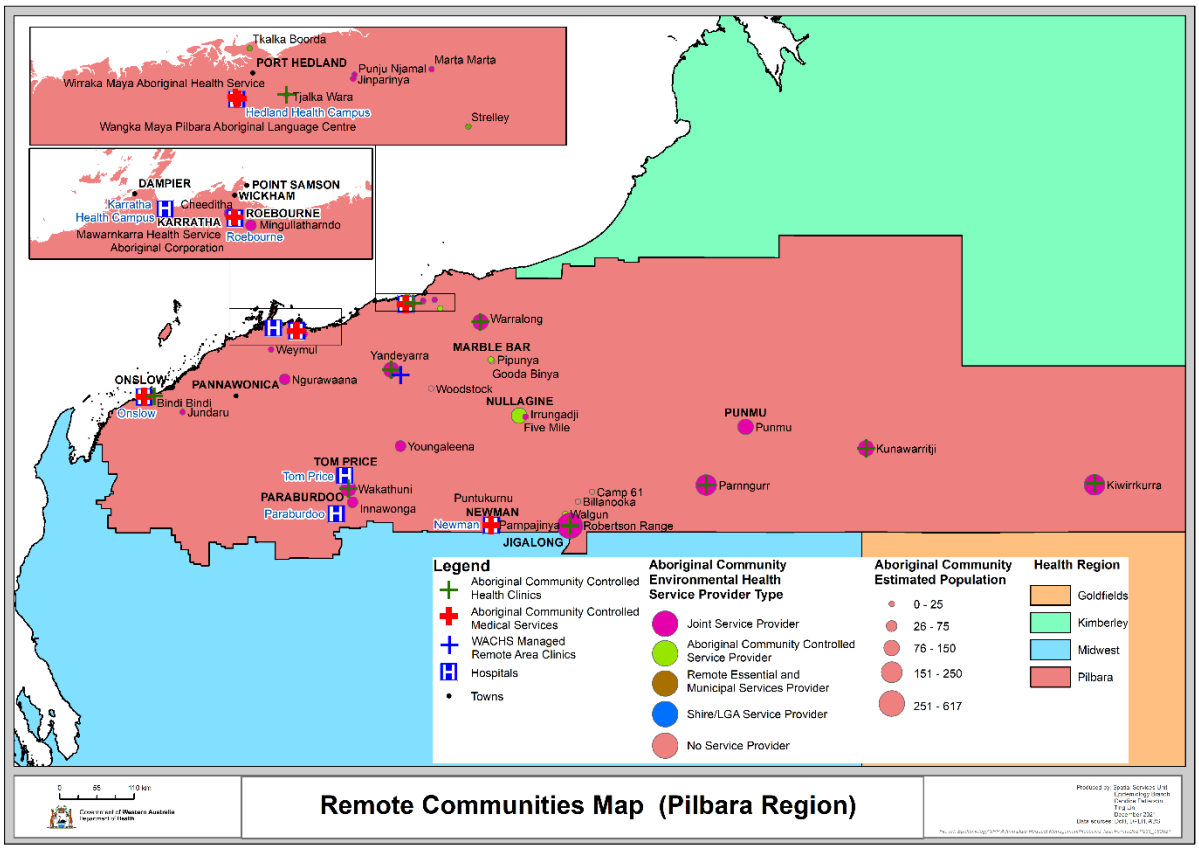
Appendix Table 9.4: Number of Aboriginal people living in WA, with a history of ARF and/or RHD, on the register as of 31 December 2020

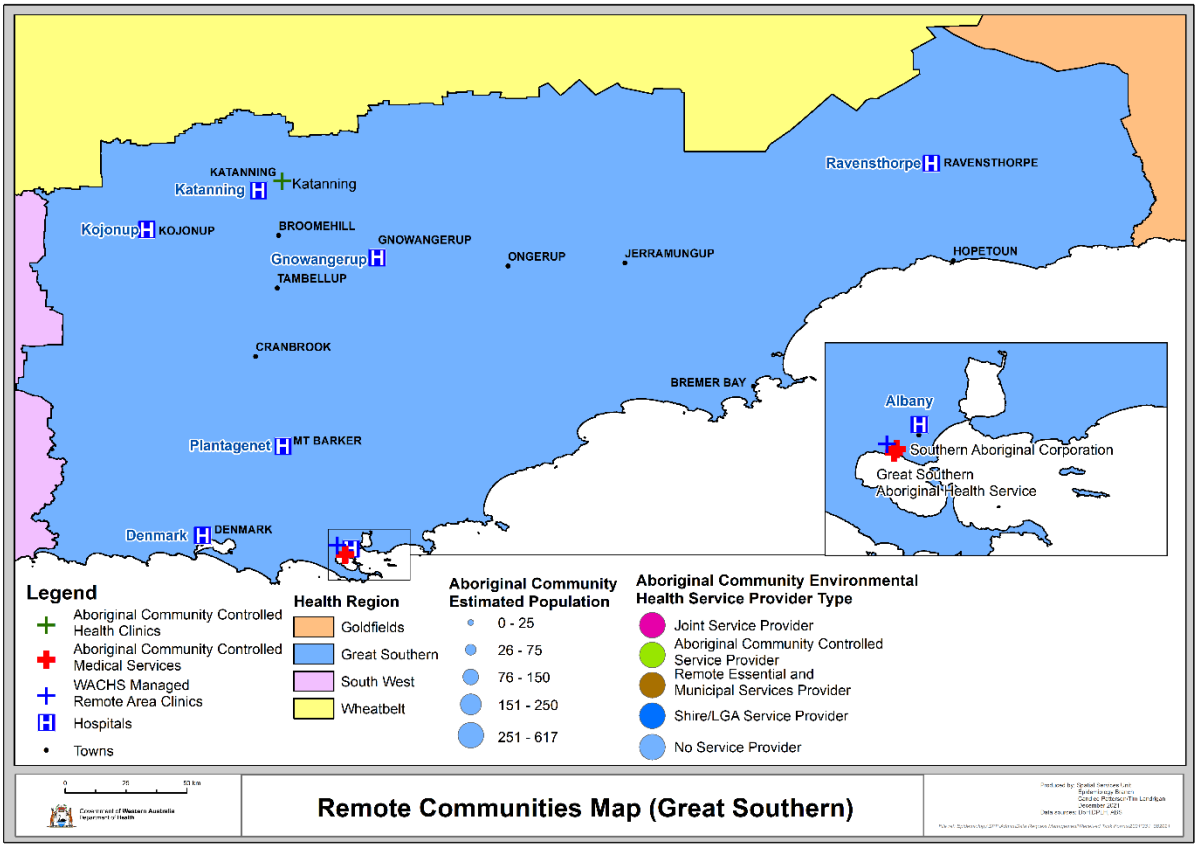
Age at 31/12/2020 (yrs)	0–14	15–24		25–44	45+	Grand Total
Region						
Goldfields	23	23		38	8	92
Great Southern	3	1		2		6
Kimberley	72	132		254	141	599
Mid West	22	24		23	10	79
Metro North	13	33		28	12	86
Pilbara	13	29		50	26	118
Metro South	13	11		12	7	43
South West	2	2		3		7
Wheatbelt	3	6		1	4	14
Grand total	**164**	**261**		**411**	**208**	**1044**

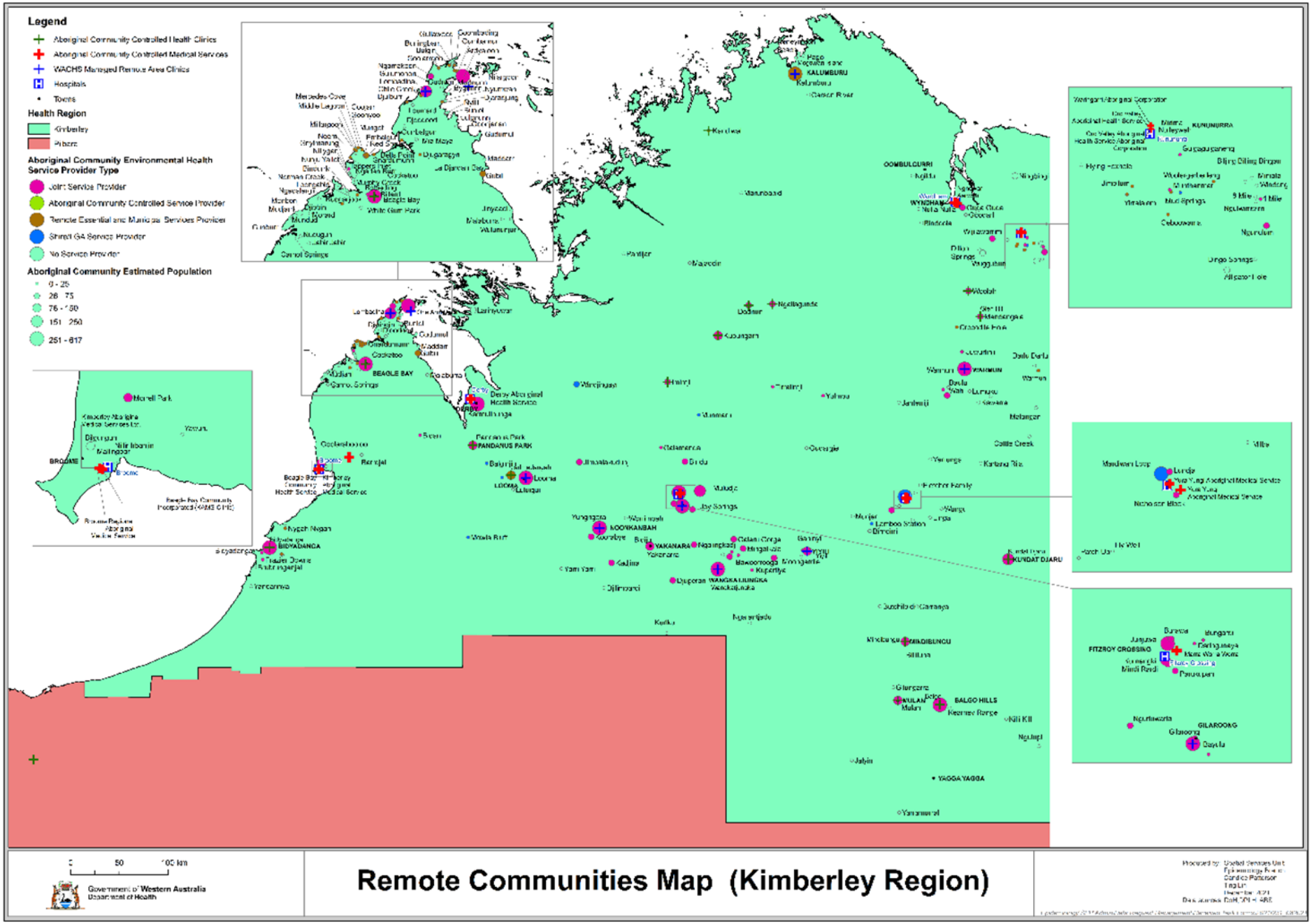
Appendix 5. Remote Communities Regional Maps

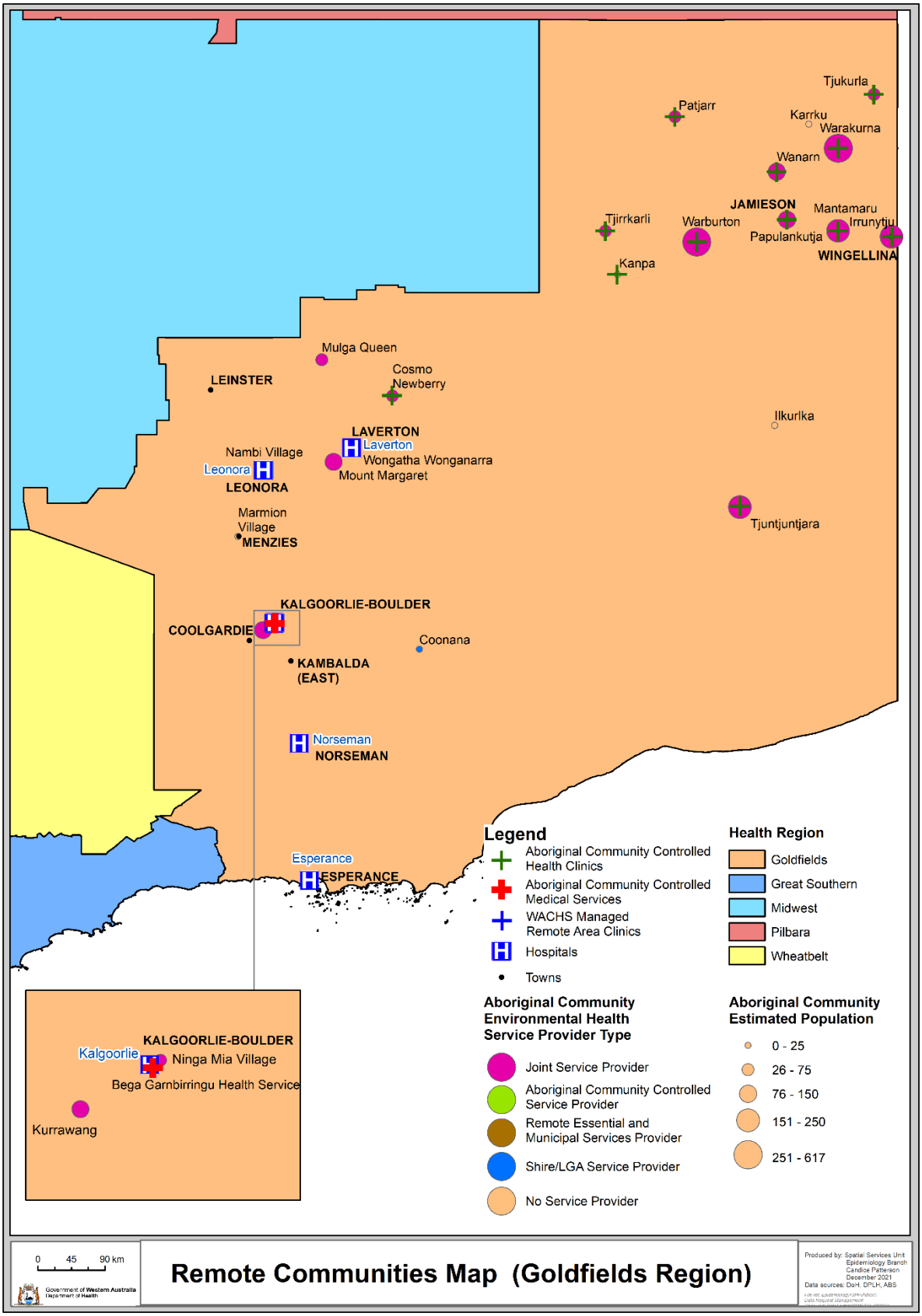



Legend
Aboriginal Community Controlled Health Clinics
Aboriginal Community Controlled Medical Services
WACHS Managed Remote Area Clinics
Hospitals
Towns
Aboriginal Community Environmental Health Service Provider Type
Joint Service Provider
Aboriginal Community Controlled Service Provider
Remote Essential and Municipal Services Provider
Shire/LGA Service Provider
No Service Provider
Aboriginal Community Estimated Population
0 - 25
26 - 75
76 - 150
151 - 250
251 - 617
Health Region
Goldfields
Midwest
Pilbara
Wheatbelt
Exmouth
EXMOUTH
MAUDS LANDING
Puntawari
Burringurrah
Samarvon
CARNARVON
Mungullah
Carnarvon Aboriginal Medical Service
Woodgamia
Yulga Jinna
DENHAM
Karalundi
Madunka
Ewurry
Meekatharra
Buttah
Windee
MEEKATHARRA
WILUNA
Kutkabubba
Desert Gold
Bondini
Nganggariawili Aboriginal Community Health Centre
Windidda
Pia Wadjari
CUE
Kalbarri Health Centre
KALBARRI
Barrel Well
MOUNT MAGNET
NORTHAMPTON
Northampton
Wandanooka
MULLEWA
Mullewa
GERALDTON
GERALDTON
Geraldton Regional Aboriginal Medical Service
Geraldton
St John of God Geraldton
DONGARA
Dongara Multi-Purpose Health Centre
MORAWA
Morawa
MINGENEW
PERENJORI
North Midlands
THREE SPRINGS
CARNAMAH
ENEABBA
COOROW
LEEMAN
GREEN HEAD
0
90
180 km
Remote Communities Map (Midwest Region)


Tkalka Boorda
PORT HEDLAND
Punju Njamal
Jinparinya
Marta Marta
Wirraka Maya Aboriginal Health Service
Tjalka Wara
Hedland Health Campus
Strelley
Wangka Maya Pilbara Aboriginal Language Centre
DAMPIER
POINT SAMSON
WICKHAM
Karratha
Cheeditha
Health Campus
ROEBOURNE
KARRATHA
Mingullatharndo
Mawarnkarra Health Service
Roebourne
Aboriginal Corporation
Warralong
Weymul
MARBLE BAR
Yandeyarra
Pipunya
Gooda Binya
ONSLOW
PANNAWONICA
Ngurawaana
Woodstock
Bindi Bindi
Onslow
Jundaru
NULLAGINE
Irrungadji
Five Mile
PUNMU
Punmu
Youngaleena
Kunawarritji
TOM PRICE
Tom Price
Wakathuni
Parnngurr
Kiwirrkurra
PARABURDOO
Paraburdoo
Innawonga
Puntukurnu
Camp 61
Billanooka
NEWMAN
Walgun
Newman
Pampajinya
Robertson Range
JIGALONG
Legend
Aboriginal Community Controlled Health Clinics
Aboriginal Community Controlled Medical Services
WACHS Managed Remote Area Clinics
Hospitals
Towns
Aboriginal Community Environmental Health Service Provider Type
Joint Service Provider
Aboriginal Community Controlled Service Provider
Remote Essential and Municipal Services Provider
Shire/LGA Service Provider
No Service Provider
Aboriginal Community Estimated Population
0 - 25
26 - 75
76 - 150
151 - 250
251 - 617
Health Region
Goldfields
Kimberley
Midwest
Pilbara
Remote Communities Map (Pilbara Region)


KATANNING
Katanning
Katanning
Kojonup
KOJONUP
BROOMEHILL
GNOWANGERUP
Gnowangerup
TAMBELLUP
ONGERUP
JERRAMUNGUP
Ravensthorpe
RAVENSTHORPE
HOPETOUN
CRANBROOK
BREMER BAY
Albany
Southern Aboriginal Corporation
Great Southern
Aboriginal Health Service
Plantagenet
MT BARKER
Denmark
DENMARK
Legend
Aboriginal Community Controlled Health Clinics
Aboriginal Community Controlled Medical Services
WACHS Managed Remote Area Clinics
Hospitals
Towns
Health Region
Goldfields
Great Southern
South West
Wheatbelt
Aboriginal Community Estimated Population
0 - 25
26 - 75
76 - 150
151 - 250
251 - 617
Aboriginal Community Environmental Health Service Provider Type
Joint Service Provider
Aboriginal Community Controlled Service Provider
Remote Essential and Municipal Services Provider
Shire/LGA Service Provider
No Service Provider
Remote Communities Map (Great Southern)


Legend
Aboriginal Community Controlled Health Clinics
Aboriginal Community Controlled Medical Services
WACHS Managed Remote Area Clinics
Hospitals
Towns
Health Region
Kimberley
Pilbara
Aboriginal Community Environmental Health Service Provider Type
Joint Service Provider
Aboriginal Community Controlled Service Provider
Remote Essential and Municipal Services Provider
Shired GA Service Provider
No Service Provider
Aboriginal Community Estimated Population
0 - 25
26 - 75
76 - 150
151 - 250
251 - 617
0
50
100 km
Government of Western Australia
Department of Health
Remote Communities Map (Kimberley Region)


Tjukurla
Patjarr
Karrku
Warakurna
Wanarn
JAMIESON
Mantamaru
Irrunytju
Tjirrkarli
Warburton
Papulankutja
WINGELLINA
Kanpa
Mulga Queen
Cosmo Newberry
LEINSTER
LAVERTON
Laverton
Wongatha Wonganarra
Mount Margaret
Nambi Village
Leonora
LEONORA
Marmion Village
MENZIES
Ilkurlka
Tjuntjuntjara
KALGOORLIE-BOULDER
COOLGARDIE
Coonana
KAMBALDA (EAST)
Norseman
NORSEMAN
Esperance
ESPERANCE
Legend
Aboriginal Community Controlled Health Clinics
Aboriginal Community Controlled Medical Services
WACHS Managed Remote Area Clinics
Hospitals
Towns
Health Region
Goldfields
Great Southern
Midwest
Pilbara
Wheatbelt
Aboriginal Community Environmental Health Service Provider Type
Joint Service Provider
Aboriginal Community Controlled Service Provider
Remote Essential and Municipal Services Provider
Shire/LGA Service Provider
No Service Provider
Aboriginal Community Estimated Population
0 - 25
26 - 75
76 - 150
151 - 250
251 - 617
KALGOORLIE-BOULDER
Kalgoorlie
Ninga Mia Village
Bega Garnbirringu Health Service
Kurrawang
0 45 90 km
Government of Western Australia Department of Health
Remote Communities Map (Goldfields Region)
Produced by: Spatial Services Unit Epidemiology Branch Candice Patterson December 2021
Data sources: DoH, DPLH, ABS

Appendix 6. Land Tenure and Aboriginal Lands Trust

Historical/Legal background

The continued impact of colonisation is reflected in the laws regarding Aboriginal land ownership and land rights. Under the policy of Terra Nullius (assumption was Australian land 'belonged to no-one' at the time of European arrival) meant that Aboriginal people had no legal access to ancestral land and were restricted by State governments in how they could move or where they could live, usually on Aboriginal reserves or mission stations. In the 1960s, before the 1967 Referendum granting Aboriginal people citizenship, a number of protests, petitions and strikes demanded return of their land.

The 1970s saw a strengthening of the Land Rights and the Outstation Movements, where Aboriginal people independently relocated to small kin-based communities on ancestral land. Starting with South Australia, state-based Aboriginal Lands Rights Acts were passed although with significant limitations. By 1976, half of land in the Northern Territory had been returned to Aboriginal peoples. The landmark Mabo case (1992) resulted in the Native Title Act (1993) recognising pre-existing Indigenous rights and interests according to traditional laws/customs. Land rights involves the return of some Crown lands to Aboriginal people as compensation for dispossession and disadvantage suffered.[191].

The Aboriginal Lands Trust (ALT) in WA, established in 1972, is responsible for the administration of Aboriginal lands covering 27 million hectares or 11% of the WA's land mass previously held by the Native Welfare Department and other State Government agencies. This land comprises different tenures including, reserves, leases, and freehold properties. The trustees can grant leases of up to 99-year terms for any purpose, including specific home ownership leases. A significant proportion of this land comprises reserves that have Management Orders with the ALT (generally having leasing powers), with their purposes mostly being for the use and benefit of Aboriginal inhabitants (see map below).

Affects on environmental services and health outcomes

While the outstation movement and the granting of land rights have been seen as a recovery of Aboriginal traditional culture, changes in policies and the removal of Commonwealth funding, ongoing contact with mainstream society, has continued to undermine Aboriginal laws, society, culture and religion[192]. Aboriginal people are still forced to make difficult choices about their lives and their ability to remain on their homelands or in their own communities.

Aboriginal social and emotional well-being is largely bound by their connection to songlines, the dreaming and stories and country. Integral to Aboriginal spirituality, songlines are deeply tied to the landscape and provide important knowledge, cultural values and wisdom to Indigenous people193. Evidence shows that Aboriginal people who regain ownership and control of their traditional lands enjoy improved health and wellbeing. However, amendments to the Aboriginal Lands Rights Act around township leasing schemes, undermine the authority of traditional owner groups with detrimental health impacts. There are reports of powerlessness created by the lack of consultation and the use of access to infrastructure as a means to normalise town-based communities or conversely refusal of rubbish removal resulting in poor environmental conditions. While these issues have been a cause for concern in the Northern Territory, similar issues have been echoed in WA[194].

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[191] https://www.creativespirits.info/aboriginalculture/land/land-rights-and-native-title-whats-the-difference#land-rights-and-native-title-comparison

[192]watoday.com.au/national/western-australia/wa-s-remote-communities-formed-in-hope-now-left-in-limbo-20181025-p50bvz.html

[193] https://www.abc.net.au/radionational/programs/allinthemind/songlines-indigenous-memory-code/7581788

[194] Watson NL. Implications of land rights reform for Indigenous health. Med J Aust. 2007;186(10):534-6.

Government classifications of community status as permanent/seasonal, large/small, family outstation, crown land, freehold, or having a housing management agreement or not, overlooks the importance many people attach to being able to remain in contact with their country either permanently or seasonally for land management and cultural obligations and celebrations. It allows policy decisions to be made that can be detrimental to Aboriginal health such as withdrawing services from small communities, and limiting infrastructure investment. Several of the consultations conducted for this review revealed the failure to acknowledge the importance of these deep cultural connections to land.

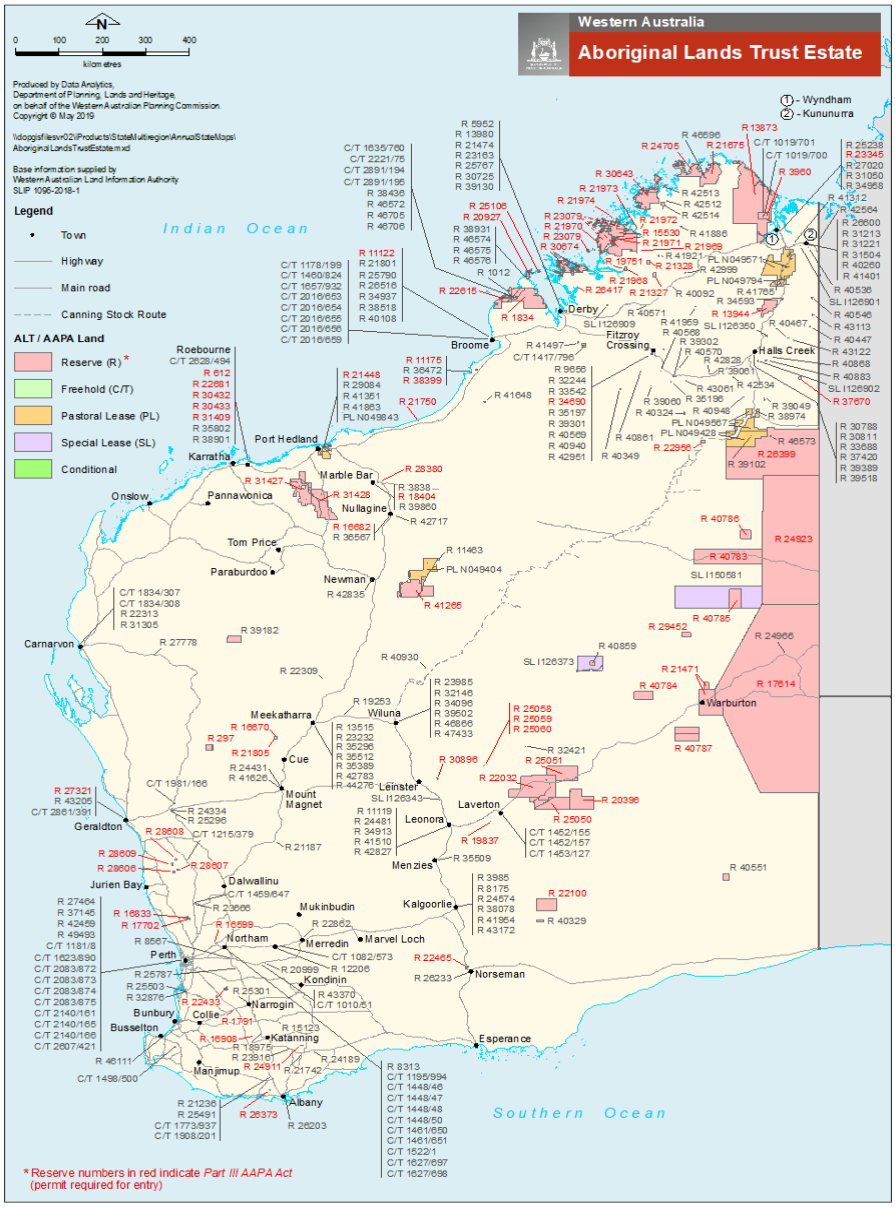

Figure 1. Map of Aboriginal Lands Trust Estates

Appendix 7. Aboriginal Environmental Health Service Provider Survey

1. Please select which Organisation you currently work for:
   Open text
2. Are you?
   a. Male
   b. Female
   c. Non-Binary
   d. Other (please specify)
3. Can you please select your age category:
   a. 18-24
   b. 25-34
   c. 35-44
   d. 45-54
   e. 55-64
   f. 65+
4. Do you identify as:
   a. Aboriginal
   b. Torres Strait Islander
   c. Aboriginal and Torres Strait Islander
   d. Culturally and Linguistically Diverse
   e. Non-Aboriginal
5. How long have you been in your current role:
   a. 1 year or less
   b. 2-4 years
   c. 5-7 years
   d. 7-10 years
   e. 10+ years
6. Which communities do you provide environmental health services to? Please list:
   Open text
7. Do you know what a Community Environmental Health Action Plan is?
   a. Yes
   b. No
8. Have you developed a Community Environmental Action Plan with each community?
   a. Yes
   b. No
9. If you have not developed a Community Environmental Health Action Plan for the Communities you work in, please explain why not?
   Open text

10. In your opinion how effective has the process of developing Community Environmental Health Action Plans been with your communities?
    a. Extremely effective
    b. Very effective
    c. Somewhat effective
    d. Not so effective
    e. Not at all effective
11. What would help in developing and implementing Community Environmental Health Action Plans with the communities you work with?

    Open text
12. Are you currently providing services that you are not funded to provide in relation to environmental health?
    a. Yes
    b. No
13. Referring to Q12, can you outline what those services are:

    Open text
14. Are there other services (related to environmental health) you think are needed by the communities you service that you are not funded to provide?
    a. Yes
    b. No
15. Referring to Q14, please list what those services are:

    Open text
16. Do you currently work with any of the following services in delivering environmental health services or programs (tick as many as apply)?
    a. Aboriginal Medical Service
    b. Local Clinic Community Health Nurse
    c. Visiting Clinician
    d. Housing
    e. Water Corporation
    f. Essential Services
    g. Other (please specify)
17. How many local people do you employ in the communities where the services are provided?
    a. None
    b. 1-2
    c. 3-4
    d. 5-7
    e. More than 7
    f. Other (please specify)
18. Are there any barriers to employing local community members?
    a. Yes
    b. No

19. Referring to Q18, please list the barriers:

    Open text

20. Referring to Q 19, please provide any suggestions or solutions to addressing these barriers:

    Open text

21. Please list training that you provide within your organisation related to the Environmental Health services you provide:

    Open text

22. Please list any training that you provide to the Communities you service related to the Environmental Health:

    Open text

23. Are you working with an external training provider to access training?
    a. Yes
    b. No

24. Referring to Q 19 please list the training provider/s you work with, as well as the training programs they deliver:

    Open text

25. Are there programs not currently offered that would assist in training community members to work in environmental health?
    a. Yes
    b. No

26. Referring to Q25 please list these programs:

    Open text

27. What are some of the considerations you need to work with, if any, in providing environmental health services? (tick as many as apply)
    a. Sorry business
    b. Weather
    c. Community understanding
    d. Inadequate funding
    e. Lack of training
    f. Workforce issues
    g. Resources
    h. Other (please specify)

28. If we asked the community about the environmental health services you provide for them, what do you think they would say?

    Open text

29. Are there any elements of your current contractual arrangements with the Department of Health that you consider problematic?
    a. Yes
    b. No

30. Referring to Q29 could you please outline the contractual elements you consider problematic?

    Open text

31. Referring to Q30 how could these contractual elements be improved?

    Open text

32. Is there anything else you would like to tell us in relation to the environmental health services you provide or the community needs in this area?

    Open text

33. Is there anyone you think we should speak to in relation to the review of the environmental health program? Please list them

    Open text

……..END OF SURVEY……..

Appendix 8. Community and Stakeholder Survey

1. Please name the main community you work with, or live in for the purposes of the Environmental Health Survey (noting the questions can only be answered with reference to one community):

   Open text

2. Please select the organisation type you currently work for:
   a. Aboriginal Community
   b. Aboriginal Community Controlled Organisation
   c. Aboriginal Medical Service
   d. Local Government
   e. Non-government
   f. State government
   g. Commonwealth government
   h. Other Relevant Community Stakeholder (please specify)
3. Please select your role:
   a. CEO
   b. Chairperson (Aboriginal Community)
   c. Manager
   d. Clinician
   e. None of the above
   f. Other (please specify)
4. Do you identify as:
   a. Aboriginal
   b. Torres Strait Islander
   c. Aboriginal and Torres Strait Islander
   d. Culturally and Linguistically Diverse
   e. Non-Aboriginal
5. How long have you been in your current role?
   a. 1 year or less
   b. 2-4 years
   c. 5-7 years
   d. 7-10 years
   e. 10+ years
6. Thinking about Healthy Homes and Housing; from the following list, which services are you aware of being delivered by your Aboriginal Environmental Health service provider? Tick all that apply
   a. Healthy Home and or safe bathroom assessments
   b. Dust minimisation
   c. Plumbing maintenance
   d. Washing Machine/Fridge
   e. Providing acrylic mirrors, stick on towel hooks, towels, Milk 6 step hygiene stickers
   f. Referrals to the Department of Communities - Housing for repair and maintenance issues
   g. Other (please specify)

7. Thinking about Community Maintenance; from the following list, which services are you aware of being delivered by your Aboriginal Environmental Health service provider? Tick all that apply
    a. Dust minimisation (e.g. greening, bitumenised roads)
    b. Dog Programs
    c. Rubbish Collection
    d. Fencing Maintenance
    e. Monitoring or clearing of vegetation around sewer ponds
    f. Other (please specify)
8. Thinking about Municipal and Essential Services; from the following list, which services are you aware of being delivered by your Aboriginal Environmental Health service provider? Tick all that apply
    a. Water supply/distribution
    b. Microbial water testing
    c. Chemical and physical water testing
    d. Wastewater management
    e. Power supply/distribution
    f. Municipal services, including roads, airstrips, rubbish tips, storm water drainage
    g. Slashing grass in shared areas
    h. Maintenance or supply (as required) of resources to sorry camps or Lore grounds
    i. Other (please specify)
9. Does your community require any additional environmental health services that are not currently provided?
    a. Yes (if so, please specific)
    b. No
    c. Don't know
10. Does your community have a Community Environmental Health Action Plan (CEHAP)?
    a. Yes
    b. No (move to question 16)
    c. Don't know
11. Were you, or your organisation, involved in the development of the CEHAP?
    a. Yes (if so, please specific who was involved)
    b. No
12. If no, why do you think a CEHAP has not been developed?

    Open text
13. If yes, in your opinion how effective was the process of developing a CEHAP in your community?
    a. Extremely effective
    b. Very effective
    c. Somewhat effective
    d. Not so effective
    e. Not at all effective

14. Based on your response to Q13, which of the following factors influenced the developed of the CEHAP?
    a. The Environmental Health Provider initiated the process and resultant Plan (CEHAP)
    b. Existing Community Strategic Plan
    c. Strong engagement by the Community Council in the process
    d. Strong leadership by the Chairperson
    e. Strong leadership by the CEO
    f. Regular meetings with the local community about the CEHAP
    g. Good communication between Council, Clinic and School about the CEHAP
    h. Wide understanding of link between health outcomes and environmental issues
    i. Strong engagement with relevant local stakeholders
    j. Recurrent Funding
    k. Local community employed as Environmental Health Workers
    l. Local community employed as Aboriginal Health Workers
15. Which of the following factors have influenced the implementation of the CEHAP? Tick all that apply
    a. Good relationship with the Environmental Health Provider
    b. Existing Community Strategic Plan
    c. Strong engagement by the Community Council in the process
    d. Strong leadership by the Chairperson
    e. Strong leadership by the CEO
    f. Regular meetings with local community about the CEHAP
    g. Good communication between Council, Clinic and School about the CEHAP
    h. Wide understanding of link between health outcomes and environmental issues
    i. Strong engagement with relevant local stakeholders
    j. Recurrent Funding
    k. Local community employed as Environmental Health Workers
    l. Local community employed as Aboriginal Health Workers
    m. Other (please specify)
16. Are you aware of other service providers visiting the community for Environmental Health related work?
    a. Yes
    b. No
    c. Don't know
17. What do you think are the biggest Environmental Health issues facing the community? Please specify:

    Open text
18. Have you been involved in or are you aware of any relevant environmental health audits/surveys/or data collection conducted in your community in the last 12 months? Please specify:

    Open text

19. Do any of the following services work closely with your community to help with the implementation of environmental health services or programs (tick as many as apply):
    a. Aboriginal Medical Service
    b. Local Clinic Community Health Nurse
    c. Visiting Clinician
    d. Department of Communities (Housing)
    e. Water Corporation
    f. Essential Services, including Municipal Services
    g. WA Country Health Services
    h. Horizon Power
    i. Synergy
20. How many Aboriginal people who live in, or are from the community, are employed in the delivery of environmental health services in your community?
    a. None
    b. 1-2
    c. 3-4
    d. 5-7
    e. More than 7
    f. Don't know
    g. Other (please specify)
21. Are there any barriers to employing local community members?
    a. Yes (please list)
    b. No
    c. Don't know
22. Does the Environmental Health Service provide training to local community members?
    a. Yes (please describe)
    b. No
    c. Don't know
23. Are there any Environmental Health training programs that you would like to see offered by Environmental Health Services?

    Open text
24. In your opinion, what are some of the issues, that may impact of effectiveness of environmental health service provision in your community? (tick as many as apply):
    a. Sorry business
    b. Lore business
    c. Weather
    d. Community understanding
    e. Inadequate funding
    f. Lack of training
    g. Workforce issues
    h. Resources
    i. Don't know
    j. Other (please specify)

25. Do you have any suggestions how any of the issues identified in Q24 could be improved?

    Open text

26. Overall, how would you rate the Environmental Health Service being provided in your community?
    a. Extremely effective
    b. Very effective
    c. Somewhat effective
    d. Not so effective
    e. Not at all effective
27. Overall, is the Environmental Health Service being provided in your community valued?
    a. A great deal
    b. A lot
    c. A moderate amount
    d. A little
    e. None at all
28. Is there anything else you would like to tell us about Environmental Health Services needed in your community?

    Open text

29. Is there anyone else that you think we should speak to in relation to environmental health services being delivered in your community? If yes, please provide contact details below

    Open text

……..END OF SURVEY……..

Appendix 9. Consultation Discussion Prompts

1. Can you describe your current role? How long have you been involved in AEH service delivery?

2. Program implementation prompts:

    a. What do you understand to be the purpose of the AEH Program?

    b. To what extent do you feel the program addresses environmental factors that impact on the health of communities where your organisation provides services?

c. What is working well in the delivery of your program?

3. Enablers and Barriers prompts:

    a. What do you think gets in the way of delivering an effective AEH Program?

    b. Gaps?

If we asked the community about the environmental health services you provide for them, what do you think they would say?

b. What do you think would help improve the delivery of the AEH Program?

i. Support for own organisation? Support for the community? Partner organisations?

4. Opportunities for the future prompts:

a. How do you think the AEH Program could be improved in the future?

5. Do you have anything more you would like to add?

Appendix 10. Additional Qualitative Data

<table>
<tr><th colspan="2">4.1 Issues impacting AEH outcomes outside of the EHD jurisdiction</th></tr>
<tr><td colspan="2">‘From my perspective the departmental team have always been fabulous.....when I do go to communities. Over the last, what, 15 years, I've gone to about a hundred of the communities … speaking about services and how they're provided... and, yeah, it's always been glowing reports about this program.’ (Stakeholder)

‘It’s always been that they're seen as an essential partner…trying to deliver culturally-appropriate service.’ (Stakeholder)</td></tr>
<tr><td>Understandings of Aboriginal Environmental Health service responsibilities</td><td>Environment health

‘would normally be done by local authorities in Aboriginal communities and elsewhere to address the environmental health needs of those communities … long term a lot of the functions which the team supports should be ones which local authorities cover anyway.’ (Stakeholder)

AEH Program involves

‘rubbish collection, cleaning, keeping the community tidy, tip maintenance, water, essential services.’ (Community)

They were going to [two close by communities]. This is what’s been happening in the past, right. I don’t know what they’re doing now…’ (Community)

‘Completely unaware of the program, while being very aware of community needs. Been in community for 10 years, never seen anything happen until 8 months ago a mobile service with washing machines came for a day or two…’ (Stakeholder)

‘in the past, we've seen them come out and check houses, and look after dogs and pets and stuff. I think it was good. I haven't seen them in [community] lately.’ (Community)

‘coupled with community uncertainty about who does what, and the extreme unmet need they have to live with, and the ongoing and rightful community expectations that something needs to be done, it is not surprising that they will feel disgruntled or dissatisfied with the level of environmental health service delivery they receive from us.’ (Service Provider)</td></tr>
<tr><td>Unsealed Roads</td><td>roads seen as being about systemic racism, discrimination or neglect.

‘I wish we had some leadership especially from the Shire (LGA), they should recognize these problems. You drive that road there. Look at the hole beside of the road coming down here. Shire don’t want to do that road because it’s a blackfellow road. And we pay Shire rates I live in town’. (Community/ Stakeholder)

‘And then what happens in wet season when… they’ve just got gravel roads it’s all unsealed just this town community. But all of these other ones, will get cut off in the wet. There’s about 19 communities in the 50K radius.’ (Community/ Stakeholder)

‘there is a road on both sides of the Playground. Both sides of the road have a big dip which fills up every Wet Season and kids swim in it and get sick with all the diseases in the sand. It is a big environmental health issue and no one will do anything about it. We had 2 meningitis deaths and lots of skin sores. It is very bad.’ (Service</td></tr>
</table>

	Provider) *'Dust and flies spread trachoma. You get all the ear, nose and throat complaints that come out of the dust.' (Service Provider)* *'…because like if a road or a crossing is down then that can affect access to a facility. One community, had the big floods and the stormwater drains got blocked up and the water … washed out the road …that meant the town was on one side and the tip was on the other side. So, rubbish started getting dumped on the town side. Well, that's an impact on a road that has an environmental health impact.'* (*Stakeholder*)
Rubbish Collection and Tip Maintenance	*'Rubbish is around the fact that we're not enforcing laws about how rubbish is disposed of in remote communities. We're not treating them [Aboriginal people] in the same way. It's all those sort of things where it comes out of the health sphere into the wider part. They're the canaries. Occasionally, we probably need to give them a louder microphone.' (Stakeholder)*
Housing Maintenance	*'Everything has been different in the last two years, to be quite honest, but from my experience over the last few years the response of the Department of Housing is very, very slow. Very slow.' (Community Member)* *'We got this … new system now, we got a housing number, so we call that number now.' (Stakeholder)* *'Housing providers are very difficult to get hold of. Residents have to contact the housing provider to get Aboriginal Environmental Health [ie mainly plumbing and bathroom and kitchen hardware] help, but they need to have a phone, know the number, have credit and be prepared to wait hours to get through…' (Stakeholder)* *'My son he rang me and said mum the workman left a hole in our wall where they were supposed to fix that thing and there is a snake came into our house and we got that little baby there.' (Community)*
Changes in Government Policies and Programs	*'So everybody in the valley at the moment is not how it used to be, so Marra Worra...It used be strong…Got to get their self back on their feet as well, and with all the communities in the valley it's going to be a big job…'* (Stakeholder) *'There are so many people got Cert 11 but there are no jobs… so they give up hope.' (Service Provider)* *'We've got CDP participants, there was quite a few of them here in the community. They're such a large team, so when we got community meetings or events, CDP participants would engage in that and support it, do the setups, cooking. If it hasn't shown a big impact, it will.' (Stakeholder)* *'I remember a long time, when we were partners with Nindilingarri, the AEHWs used to go out and work with the communities, and some of them were based in the community. But funding maybe failed or they had to cut that off… bring back what Nindilingarri used to do, getting men and women from the community, training them up to do these simple and odd jobs that can be done there and then. And there were many of them in all the communities, there was always somebody…you have to go tell them.' (Community)* *'Yeah, the community felt pride. …. That all stopped. There was a business in town, they used to have all the plumbing, even simple ones.' (Community)* *'We used to have an army of AEHWs.' (Service Provider)* *'I can say it requires the Commonwealth to come on board. It's not one thing. It's a suite, isn't it? It has to be. If I say, 'I would like to see the ability for us to be able to engage people on CDP and talk about if needed.' …It's a Commonwealth thing. We*

	got to get the Commonwealth on board as well as state on board to actually tweak some of these concerns and issues that we see off the rails. This is what this national peak could do…' (Service Provider) *'we get left out, the smaller communities. They mainly focus on the larger communities.' (Community)* *'Pressure to normalise town-based communities… it's been adapted into the town.' (Community)* *'We were offered five million in houses but the thing was they said we had to leave our community, our country and come in and be like white fellas in town…We told them no …we've got plans for our community future' (Community)* rubbish removal for a town camp stated: *'Not totally. That's sort of part of what we need to sort out. I think it's more of state government managed....because it was part of ALT land or something…I don't know all the history but I think it is, ... I think the government ..they've been potentially removing more houses ... trying to relocate those people in town or back out to community…' (Stakeholder)* *'I don't know officially … We're trying to work it out. Potentially even some of the more outlying communities, …I don't know if some have been shut down or reduced facilities or whatever, that may have resulted in more people coming into [town] So, potentially, that could be the plan with [town camp], … I think that's been a bit more of a trend' (Stakeholder)*
Filling the gaps for ALT communities	*'Another issue with some of the communities is the housing agreement. I think they found that issue with some of the other communities … they're not under a housing agreement, so they administer themselves, so we do the best we can'. (Service Provider)*
The role of Local Government Authorities in AEH	*'… from a local government point of view if you get a complaint one of the first things is —are we responsible for it? Because if we're not responsible, then we're not responsible… I think it's probably working out - for it to be clear - who is actually responsible for what? If we, if local government, if the shire says we're responsible for responding to the septic tanks or whatever, then it's something we would do...but that hasn't happened' (Stakeholder)* *'I don't know exactly if the [Service Provider] meets with [stakeholders]. … but that's potentially a role that the shire could fulfil. …we don't have to be responsible for everything but we could perhaps play a bit more that neutral role and then out of those discussions, identify issues but also who's maybe responsible.' (Stakeholder)*
The influence of social issues on AEH outcomes	*'and we've got a lot of young people out there that they does nothing. They just live on CDP or Centrelink and go to Job Pathway. I don't know what they do there. And they go to the yard and then some of them are good at making a lot of things, like tables, and chair And then the rest, what do they do? They can be the same for 20 years. Never move forward.' (Community)s* *'… there be little kids down there as well and they're getting sick. Yeah, all that happens. People drinking there, do their smoking, …, nobody's really looking out for cutting the grass. The grass that high and the kids playing everywhere, you know. They're like dirty. All those children. There's about 10 or 15 houses down there. It's got a lot of people there…' (Community)* *'Even for the kids they're out of control. The environment here is not good. It's bad influence on the children.' (Community)*

	'I think Thrive is something that many families would welcome, and it would be good to run through the AEH service providers. It could employ local people, and provide good role models.' (Stakeholder) *'NIAA could be involved in setting up parenting programs for the families who are struggling and living in overcrowded houses, if they could get them into their own place.' (Stakeholder)*
Breakdown in Community Governance	*'The Prescribed Body Corporate. The governing institute for this area…. They're working together with the local governing entity...trying to form some kind of partnership or an agreement so that the environment could be sustained.' (Community)* *'There's overcrowding - yet there are vacant houses because people can keep their house but move into town, if somebody moves out for so many years, then the house should go to somebody in the community, it's a community governance issue.' (Community)* *'[Community] has got a corporation, has deeds and control over the land but there's not much land allocation and one family has the decision-making, no proper governance. …we don't get our rubbish collected anymore because the Chair won't pay rates…it piles up everywhere. not everyone has a trailer to remove it… that's where [Service Provider] help out they come around sometimes.' (Community)*

4.2 Specific areas of AEH responsibility	
	'For us, the funding remit is for the program to actually work to address issues and conditions associated with preventable diseases in community. … We're basically looking at, what are some of the barriers, and addressing some of the barriers, that prevent people from being able to understand, act, or feel confident to do things, for those in remote communities to actually prevent the spread of communicable diseases, things that should not exist here. And then, what sorts of advocacy are needed, because advocacy and support can be done at the ground level, and some basic repairs that are within remit to support people on the ground practically.' (Service Provider) *'Yeah, it's about paying for what you say you want. For example, what percentage is education and promotion and awareness, and what percentage is going on checking bathrooms, fixing...because you can't just check and then leave. … And then, that's just in the home, so we start to go out to the wider community, there's dogs and there's sewage and access to water and all these other things…' (Service Provider)*
Safe Bathroom Assessments	*'There's always safe bathroom stuff that needs more forethought in how to resource and how to actually not just knock on a door but to help out community members. From when we first started with this current project, it's come a long way.' (Stakeholder)* *'You know it's hard to go in and try and do a bathroom audit and then you're walking out and you can't do anything. So that's I suppose our issues… they didn't have hot water, they didn't even have a working tap, they didn't have… and sometimes it's really old plumbing that breaks…and we can't do anything.' (Stakeholder)*
Emergency Plumbing Repairs	*'We have two households that have adults, elderly and small children that are not able to fully utilise the houses e.g. shower, bath or wash clothes and use the toilets and clean. Which … heightens the level of health risk to the residents in both households.' (Service Provider)* *'And then you've got to wait. I'm lucky, my partner was working for [Service Provider] and he can do all that, and he used to do it anyway. But other families, you know, they're less fortunate, they don't have that. They struggle and have to wait for months to get a blocked toiled fixed.' (Community)* *'… whenever they come in for sewage …any jobs, any house job, you have to wait three or four months just for someone to come up.' (Stakeholder)* *'… the local town plumbing went out of business because they're [Dept of Housing] getting contractors from Broome and they lost their contract to outside contractors... They had to all close down because no work here… That's so wrong... I used to like the plumber brothers coming out. They understand us, what we are telling them. Locals, they understand our language, the lingo we speak. And now the contractors that come out, they're not Aboriginal…' (Community)* *Even though we're not paid to go to these communities you can't just go out there and see this Elder without her toilet cistern connected to the sewage and all that waste under the house... it's a human rights issue…. Technically the CEO of the community is supposed to use the rent to cover these repairs. But some CEOs are not that great, and money doesn't get put aside and people can't pay the rent, these are disadvantaged communities... so you can't just walk away… someone has a moral responsibility to do something.' (Service Provider)*

Dog Health Programs	*'… it's hard to get rid of the dogs they give them $20-$30 for a dog, they need dog beds, they've got ticks and all sorts of things, and sometimes manage this causes a lot of issues, skin infections and all this other things.' (Community member)* *'There's also a lack of fences to keep dogs out. There's stray dogs everywhere. The Shire [Service Provider] come up. The rangers come up quite regular...well, don't want to say quite regularly, but few times, they come up to do the ticks.' (Stakeholder)* *'Yeah. environmental health service provider) did do that, but it's been some time since they've had that funding. Desexing dogs, spraying them, and microchipping, but that was years ago.' (Community member)* *'… out here in the community, we have like, 'How many dogs do you want to have? How many cats?' It becomes a problem in the house. Just try to keep them in the yard, so they're not biting anybody. [AEH service provider] can't really do nothing about it unless you're the owner of that dog and give your permission to take that animal. They can't just grab any dog off the street unless they know who the owner is. A lot of them are just strays, anyways.' (Stakeholder)* *'Oh, people want them to be collected. There's a pack of dogs here of four or five of them and they just kill everyone's animals anyways and chase kids.' (Stakeholder)*
Pest Control	*'We had that pest person here a couple of weeks ago for cockroaches and ants. …..… The problem is that if your neighbours have it and they don't keep up with it, you're going to end up getting it eventually. It's the same with mice, rats.' (Community)*
Mosquitoes	*'Mosquitoes can be an issue. Shire does mosquitoes.' (Community)* *'We used to know a little bit about it [Ross River virus] …. I remember that they was going around town with mosquito, and spraying some sort of smoke thing … and the small communities close to town. That was...a couple of years ago.' (Community)* *'… we've planned for that, but we just use it naturally when mosquito biting, we use it. But we don't really know that we have to do it every time you go camping. We've got mosquitoes everywhere when we go camping. … we plan for that, use Huckleberry Tree and we use the bull poo as well when we go camping, because that helps… if people knew that this [Murray Valley Encephalitis] was around, they'll do that more. They won't muck around. they'll spray and stuff, they'll go for a good plan to have at home and fires burning if they're sitting outside.' (Community)* *'You could ask [AEHW] but nothing that I've heard of.'* *'Yeah, make sure it goes out. Make sure... at the hospital and at Nindilingarri together with locals, I don't know if that part...that communication need to be better there, if they got that partnership.' (Community).* *'No one does that [fogging or spraying for mosquitoes]. You do it yourself. We just light fires and smoke the place up.' (Community).* *'there should be more notice. If the hospitals are getting people with this disease, they should be telling Nindilingarri, this is what we've found … and then it should be Nindilingarri's job to go around to every community and let people know.' (Community)* *'The problem I see is if you don't know about it or the symptoms as a doctor then you don't know what you should be testing for.' (Stakeholder)*

Prevention, Health Promotion and Education	*'I would say that doing health promotion, as an opportunity to bring about change in people's behaviors, is what's it says on paper, but that's not what's funded. For what's funded, you can't do all that.' (Service Provider)* *'I live an extended family system. And going to funerals every month or whatever and burying kids and other people that's younger than me or little older than I am is not right… And a lot of that comes back to links to environmental health and understanding and education. …' (Community)* *'Everything just really starts from home. …The home environment is key to the success of everyone … The parent, the child, and the community at large.' (Community)* *'Environmental health issues, housing, connection to the clinic, education all have an important part to play to the wellbeing of our kids but everything starts from home. …if you don't have a healthy environment in your home, then everything else is working to the causes rather than having a prevention thing going. So it's starting in the home with some of the young mums and dads having understandings of how providing a role model is important.' (Stakeholder)* *'… give a bit of parental education, looking after children, play house with them, role modelling that you don't drop rubbish, you make your bed, you sweep the floor, you wash the dishes from early childhood the whole education, just to get right back to basics.' (Stakeholder)* *'In Beagle Bay the old people used to say, 'Well, back in my day, when you had a baby, you went home. We used to have the child health nurse come to your house and show you how to look after the baby and make sure your house is clean,' and all that stuff.' (Stakeholder)* *'[Service Provider] would give me cleaning products and do home demos. So, we'd do the bathroom and kitchen. How to keep the kitchen basically clean using whatever products you can get. '[Service Provider] was actually giving household packs with just your basic items like your Chucks, liquid detergents, things that you could make yourself using bicarb soda or something for blocked drains. They'd give out homemade recipes and tips that you can just keep your house clean, buy cheap thing or things you might already have in your cupboard.' (Community)*
Referral and Follow-up	*'… we do bathroom checks and hardware. ..we get referrals from clinical staff. … Let's say someone has scabies…we get approval, we go to the house, we sort out the practical ways to fix that problem. .Do they have hot water? Do they have soap and a washing machine? And if they don't have a clothesline, we'll weld up a clothesline and concrete it in and stuff like that.' (Stakeholder)* *'This organization knows who we go to with all different things (referrals, etc. for house)… We're very much involved with Nirrumbuk if anything needs to be done, because we've got nurses out there, health workers. So they're on the ground there... They're observing, assessing clients and the environment as well. So if there's things that need to be done out there, they will get in touch with us here.....then we get in touch with them with a referral. We do referral to the [Service Provider] and Department of Communities.' (Stakeholder).* *'Because we do rheumatic heart fever. Scabies and the boys are in Bidgy doing trachoma….We get referrals from the clinics to do home checks... So, once we get referrals from the clinic…Yeah. We work pretty well.' (Service Provider speaking as a Community person).* *'The hospital Child Health Nurses are pretty good at reporting, when they go to communities they report to the Shire [Service Provider], and they actually went out*

	and addressed situations and the clinic actually does report stuff, and follow up on certain things'. (Stakeholder) *'Yeah, overcrowding is a big thing.... They come to their health checks and if it's reoccurring then we're going to have to look further and ask those hard questions. Especially with ... recurring sores. ..because if you keep getting sores, leads to rheumatic heart … we ask them, about overcrowding, where does your dog sleep?, if they've got running water and hot water and...So if they came up as issues, that's when you would then give a referral… to the Environmental health worker…' (Clinic Stakeholder)* *'We don't actually see them (EH workers) in the clinic unless I specifically ask them to come and have a meeting with us. If I've brought up concerns, whether a huge tick infestation, scabies, fleas, or something that's really impacting the health of their people, then I would say, 'The place needs fogging,' or, 'We need to do this,' or 'We need to start this treatment,' or, 'You guys need to come in and clean up the soils,' and things like that.' (Senior Clinic Nurse)* *'People need training in closing off referrals. That's pretty important. It is hard to close off a referral it might take a family 6 months to get rid of scabies. It might take 3, 4, 10 trailer loads of rubbish, and there's social problems, drinking all that sort of stuff. So, it is hard to close off referrals because they're an ongoing thing on our radar all the time. I still go back to some houses, and it's two years on.' (Stakeholder)* *'I'm lucky being at the hospital, I work with the drug and alcohol team and community health, so I can refer on. For [Service Provider], I don't know if they have those connections.' (Stakeholder)* *'[the AEHW] didn't like the way the form tells them what to do… they would rather know what the health condition is and make their own choices around what needs addressing in the home'* (Service Provider)
Developing and Implementing Community Environmental Health Action Plans (CEHAP)	*'And Aboriginal people everybody need to be involved and a lot of our mobs can't read and write properly and understand English properly, we seem to be dropping them off the bandwagon, you know.' (Community)* *'The community wasn't consulted for the CEHAP' (stakeholder)* *'Well, I think whoever's going to deliver the program they need to do a bit of homework and actually try to tailor… Because each community's different, and obviously people are going to be wanting different things as well. But, yeah, look, do the homework, see what the people in the community see as things to address in regards to environmental health. ..that's the main thing … not just come into the office but talk to the actual people in the community.' (Stakeholder)* *'I know they've come up with action plans …. We've never actually been that involved in this…Well, I consult the community a bit about what we do and what they would like to see … So, it's like a co-design thing this is just how I work… But that doesn't translate into a big overall plan that everyone sees. Yeah Community Environment Health Action Plans. I have been involved in the past but not in the last few years.' (Stakeholder)*
Challenges, Gaps and Duplications	*'How we improve a better outcome can't just be the interrelation of health. It has to be how you tie it into all your services… housing … the commission of road services. All those other services. It's that part.' (Stakeholder)* *'seeing it as a criticism of them or the communities .. that we're saying that these people are living badly.' … It's that challenge. Culturally, you get into a question about whether or not that's culturally appropriate for them to actually be talking to*

	us … we need to know that house is in such a bad state .. to be able to spend some of our limited money on addressing that particular problem. Some providers have the distance to be able to do that and go, 'Emergency work needs to be done on it.' Others don't like …relating straight to state government.' (Stakeholder) *'The primary measure should be at the end of the program are people healthier than they would be if the program wasn't actually there? I think the answer is, absolutely the program makes a difference in terms of that. … Judging it on its own merits….' (Stakeholder)*

4.3 Systems perspective	
Aboriginal leadership	*'What is required here is for government to commit to the national agreement to Closing the Gap priority reforms, this is a real opportunity for change - to give over decision-making to Aboriginal people. We all know, the government knows, that the unacceptable conditions in Aboriginal remote communities, do not meet fundamental human rights, it's a disgrace. Aboriginal people are being neglected, and it's this what drives the current high rates of disease that should not occur in a rich country like ours. We need to establish an Aboriginal environmental health council working in partnership with AHCWA, and national peaks.' (Service Provider/Community)* *'Aboriginal Community Control… Developing the strengthening structures in terms of people sharing decision-making with governments closing the gap. ….. We need to control the sector to deliver services and programs important to closing the gap. …. systemic and structural transformation …, ensuring Aboriginal communities and the people have access to and can use local government and information to monitor implementation of the priority reforms, closing the gaps…'. (Service Provider)*
AEH Program accountability and management structure	*'They do some good work, they are willing to come out and talk with workers on the ground, they have a good understanding of the challenges we face.' (Service Provider)* *'They attend the health planning forums and make a good contribution and keep up with all the environmental health issues and the difficulties that we are confronted with in the different regions, everything from STIs, to scabies to trachoma and rheumatic heart disease, they do training too.' (Service Provider)* *'From my perspective the departmental team have always been fabulous....' (Stakeholder)* *'We haven't found them responsive to new ideas, or to working as partners. I know they like to get out on the ground and handout the towels – but we can do that- just give the resources to us to do that.' (Service Provider)* *'I would like to see more transparency in decision-making, at present, there are people being funded that we don't believe deliver the goods, which seems like they have favourites.' (Service Provider)* *'From our perspective it seems like the goal posts shift…' (Service Provider)* *'I guess from the contractor's point of view it can be a bit tricky when he's there in the field, but you've also got to report to him.' (Stakeholder).* *'In any government organization, any program is going to be more effective when there's alignment and support from the top levels of the organizations to support what stops being pilot projects and becomes part of strategy and the support and budget to deliver on agreed outcomes.'* *'I'm not saying it doesn't happen at the moment but that would be something if we're looking to polish the way this kind of work is delivered, then it's worth starting at a strategic level. (Stakeholder)'*
Community partnerships	*'When I first started working in Environmental Health in 2000 … there were a lot of issues, there were a lot of things needed changing. When we joined up with Nirrumbuk in 2003, a lot of things changed. We got more bigger and better than what we was before…' (Community).* *'Our plan was to put it all together in one and make it get bigger and better like*

	now. We in the process now of Nirrumbuk becoming partners with Beagle Bay Futures. We're going to be like coordinating in this community and whatever they need help with…' (Community)
Coordination, integration and communication	*'In terms of more networking and relationship-building, that hasn't really happened. It's something normally I would like to rush in and do it straight away…. But… I was also by myself for a while. Well, we're short-staffed beyond health as well. So, just get a feel for it and then I knew this process had to be done as well and then we'll start and network more in an official sort of capacity.' (Stakeholder)* *'There's potential for getting all of the areas where there's good expertise, and infrastructure, and getting them all linked up, and then getting rid of the overlaps and filling in the gaps.' (Service Provider)* *'It's difficult because the environmental health side is literally one side of the coin. If you've got a building which is falling down… or there are poor infrastructure, having people come out and do environmental health work and, say, unblock the drain helps but doesn't actually resolve that problem. Certainly …., in places where they've been able to do work and build relationships, we've seen the number of call outs for other kind of services involved where they are successful at actually intervening.' (Senior Government Stakeholder)*
Accountability and transparency	*'The community they don't really know what we do...they think we just drive around to communities dropping off soap and things like that …and talking to kids about washing their hands. They don't understand the range of issues we are dealing with. We are everywhere doing everything from blocked toilets to fixing the lights on the airstrip so some very sick person can be flown out to Broome or Perth…' (Service Provider)* *'The reality is in lots of Aboriginal communities, the level of service in terms of things like the roads, the rubbish, everything else is not up to the standard that would be acceptable outside in any regional town. Having that information fed back into the loop in terms of policy making and particularly if we're moving into closing the gap targets, which are including some elements of community infrastructure, is going to be vital in terms of being able to say what improvements have happened. It is the ability of them to actually deliver change.' (Senior Government Stakeholder)* *The problem is systemic and it is based on the lack of funding and coordination and integrated policy and programs in this space… it's also because government are not willing to hand over control to us… the people who know how to fix this.' (Service Provider)* *'It would be good to know how often are they supposed to visit? What are they supposed to be doing?' (Community)* *'We want to know what they [Service Providers] are supposed to be doing, if its rubbish collection every few weeks they could give the money to us to collect our own rubbish.' (Community)* *'Yeah, that transparency and accountability and… But, if you got the funding allocations right for… And you said, all right, we've got these five programs, they're going to have these outcomes. So, the pump-out truck would have an outcome, which would be clean sewers in town…' (Stakeholder)* *'We just see their cars driving around town we don't know what they are up to… I know they go out to the communities… but they rock up to a meeting for COVID in different cars… it's not a good look we need to know what they do for their money ...other than take soap out to the schools…' (Community/Stakeholder)*

	'even a poster or something we could put around' (Service Provider) *'A greater transparency and accountability. That whole thing that the national partnership agreement reflects, or it's signed off on. That's going to be hard. Otherwise, we're just talking sh-t. I'm tired of talking. I'm tired of waiting for change. I'm tired of having to fight for any little ground.' (Service Provider)* *'We need to be able to invest time in communities, calling into different agencies, visiting the school, the council,…explain what we do and network… things come out of those yarns, you hear about what's happening for different families and what the issues are and you can sort of start to plan more strategies for the community…' (Service Provider)* *'… they think we go off for a sleep in the afternoon, they don't know we are out checking the sewerage ponds … and we spend a lot of time just getting onside with the women.. so they will let us into their houses now …or they tell us we need to go help their Aunty or their daughter .. we fix them straight away... so they are starting to trust us.' (Service Provider)*
Aboriginal health workforce	*'we'd love to see, obviously, stakeholders utilising locals – creating more local employment.' (Stakeholder)* *'Yeah, more AEH workers more in the communities.' (Community)* *'I think it comes down to who those workers are, if they're local people, they're more likely to be successful. Local committed people… You can still have local people who are not doing their job, but then it's dependent on your management and other things.' (Community/Stakeholder)* *'Then the other thing …is the training and keeping the Aboriginal Environmental Health workers on the ground local. Keeping things local, yeah?' (Service Provider)* *'So, we have an EHO over at the Shire … 7 years ago we used to have three, and now we only have one, she's flat out. They do all the regulatory stuff, like, plumbing inspections for brand-new septics and drains, how many toilets they need, evacuation plans, all of that sort of stuff they do. We don't touch any of that, but we work closely. So, if the Shire has a problem with a house in town or they use us for local knowledge.' (Stakeholder)* issues training, and staff retention and recruitment were raised. *'the delivery of the program, has been seen not to be doing what they should be doing…you always hear constant complaints or questioning, 'What are they supposed to be doing…where are they? All we see them doing is taking care of their dogs. What about us?' sort of thing. So, up until maybe 10, 15 months ago they had two AEH workers and none since'(Community/Stakeholder)* *'When they're [Service Provider] questioned about what's happening,…their response is that they can't find qualified people to step into the roles. ... we're trying to give them so many suggestions around what they could be doing or how they could be doing it, and they just don't seem to take it on board.' (Community/Stakeholder)*
Training	*'We need to provide training and development of local staff in communities to build capacity so that they can make sure AEH Program keeps going and everyone knows about it.' (Service Provider)* *'There is a big thing on how to approach a door. How to talk to the community members. How to get into those homes. How to resource yourself to say, 'We're here. We can help you. We have direct contacts with housing.'*

	(Stakeholder) *We need local people employed in every community and they might need funding to have a house so that they will live there. That's important for the future to support local AMS's to have that funding and to employ and train up AEHWs in every community.' (Service Provider)*
Staff turnover and retention	*'Yeah [staff turnover] is a challenge, so there's no continuity of services every time the new person starts it starts, from scratch. They've been unable to refill that role of both for some time now.' (Stakeholder)* *'We had a lack of a handover, the AHW left before me so it's been very much a learning process and continues to be a learning process…' (Stakeholder)* *'… there were two environmental health workers… the offer was made to them every time we met, we're there for you, we can help you.. .and sometimes go out to the communities with you... they were doing good work but both of them have moved on. …it sort of comes in cycles. But at times there can be a high staff turnover.' (Service Provider)* *'So obviously the staff turnover is a problem and if staff is unsure about how programs are run, they won't be able to transfer or translate the same message... So once you've tried someone and they leave within six months, then you've got to start the process from scratch. …so it's that expertise, that experience and stuff that you lose all the time. Which is really sad.' (Stakeholder)* *'We work very closely with [AEH Service Provider] and get support from them as the Shire don't know what they're doing as there are so many staff changes.' (Stakeholder)* *'We [Pop Health Unit] get a lot of new staff all the time, and they don't know about the referrals.' (Stakeholder)* *'There is a shortage of staff across the State – this impacts service delivery…and our ability to work in with AEHWs.' (Stakeholder)* *'Department of Housing comes to [community] consistently: She is very strong in supporting families with environmental health but there are limited services so she is limited in what she can do. But she will refer for support through Housing for clean-up.' (Stakeholder)* *'where you have service providers who are highly engaged, and you can actually make a difference in terms of the day to day living of people.… it isn't necessarily that they're Aboriginal Controlled …Some of the shires who provide the service who are funded by the guys provide a fantastic service. Some of the other service providers struggle ... It depends on how many people they have and what the skills on the team is' (Stakeholder)*
Culturally safe service delivery	*'I think COVID has somehow, in a positive, taken that into the right direction. It's brought in some (cultural respect) processes or protocols that will probably be ongoing. And this was talked about at the forum, beyond COVID. This requesting to visit and asking permission and engaging council.' (Stakeholder)* *'We do cultural awareness training for all staff about Aboriginal people. But the problem is, Aboriginal people are completely different. Our community is completely different to Fitzroy, which is about 270 Kms away.' (Service Provider)* *'The government they still don't understand why we have our small communities out of town on our own country, they don't want to come out and fix our communities because they can't see that our very being is tied to that country, Many families around here might live in town, but they still got their cultural responsibility to take*

	their young men and women back on country for culture and to learn about looking after country…this is part of their identity and what we gotta do to stop suicide and drinking and violence, all those things… the government they don't see that and that's why things have got worse.' (Community) *'Look the truth is staff often come up here for an adventure but most of the time they aren't here long enough to get to understand that all the squalor and poverty and overwhelming social issues they have to try to work with are tied into our historical legacy, taking away their lands and their families. They get culture shock quite honestly, they can't see the cultural strengths to work with, and by the time they finally do they are worn-out and they leave…It would be good to invest all the costs of relocation on training and supporting local Aboriginal people, cadetships, scholarships, on the job training that sort of thing.' (Stakeholder).*
Health prevention and health promotion	*'We have a local radio station here. They should be on it every week……talking about all sorts of problems. They should be putting a lot of experts on there talking about diabetes and sugar, alcohol and drugs, all sorts of health issues. And they should be on there once a week. They get funding for promoting, you know.' (Community member)* *'I think the important thing is we need a greater emphasis on holding community events with health messages, but we need to understand that people speak in language and they have different concepts and meanings so health messages need to be in language… so it's important to be able to work with linguists and local Aboriginal groups to get the messages right and that can be a real challenge and it requires extra resources.' (Service Provider)*
Strengthening community capacity	*'We would like to see more focus on how the Directorate, how Matt and Rob can support Aboriginal organisations with training, with information, with funding and yeah with respectful conversations, consulting with us as they are formulating priorities for our communities… Not just telling what they think needs to happen. They need to be funding us to employ more Aboriginal local people to build local community capacity down the line…So we can have more AEH workers to do referrals and that will be supporting our local clinics too, build their capacity too.' (Service Providers)* *'As a part of our role is to try to build capacity and bring that up to a certain level, working pretty closely with the contractors and also the Directorate to make sure we're all streamlining in the same direction.' (Service Providers)*
Local advocacy, community empowerment and capacity building	*'I don't want to blame people. I wouldn't say they don't care. People have mortgages. People have families. Some people aren't willing to rock the boat. Some people aren't willing to lose their jobs. …Too afraid to make a noise... You can't make a noise in government if you work for government, which is why I tell them to tell me. I'll make a noise because I work for community control. That's why I stay in community control because I can question every one of them.' (Service Provider)* *'Yeah. That's the big sort of the philosophical stuff …. it's two quite different cultures. How do you sort of bridge the gap? We just come across that governments have their ideas of what should happen but that doesn't necessarily mean that's what the Aboriginal communities want. I'm a bit more like, 'Well, what do you want or what's the empowerment?' (Stakeholder)* *'Some of the positive stuff could be good. Empowerment, with potentially creating employment or whatever through bush foods or something that is important, tourism. I think those positive sort of bridging the gap between the cultural life and economic life as opposed to just saying, 'Just get a job,'… you need a lot more of*

	that positivity [in town] because there's a lot of disconnect between the white community and the Indigenous community and a lot of the time, we only see the negative side. So, if there's programs like that, funding could be put into those.' (Stakeholder) *'…so here at school, our water quality was often unsafe to drink and play in and we were on public water. ...well, as deputy that was always a problem, and then I just thought, I'm going to give this a bit of a push with our department. It was towards the end when I had conservations with Patrick Davies from Nindilingarri. We now have an upgraded water treatment, and I think Patrick was probably part of that solution there, and we're now on that same automated system. It's read remotely …every month, a person actually comes out and just has a look at it…' (Stakeholder)*
Community ownership	
Data, evidence and research	*'Having access to up-to-date, accurate environmental health data which tells you the conditions on the ground is essential to actually delivering that role, so being able to know what the condition of places are. I suppose one of my criticisms, and it's not a criticism of the team. I think the team do fantastic work. It's that that information is not shared across the government.' (Senior Government Stakeholder)* *'Monitoring something and changing something are two different things. ..how does that information get out to them into a form that actually drives policy change? For me, it's that area…They do great work on the ground. My number one criticism,… is that for far too long their information stays within health.' (Stakeholder* *'What we need is current information which tells you what the conditions in places and what's the highest risk. Getting that information is difficult. Not all the service providers provide that information back to the team because they don't necessarily want to and because there's confidentiality issues. Finding out whether or not those communities which are more high risk, like the ones which have trachoma, is difficult.' (Stakeholder))* *'I know that the Directorate is missing out on a lot of data because the workforce can't complete the form correctly.' (Stakeholder)*
Financing and procurement	*'And they [Government and Industry] started what is now is the engine room economy of the nation with the mining. We are smack right in the middle of it. Not one of our persons got a job. If they gave us all employment and training and all of that, if they had the view, right, that there's nothing wrong with black folk…' (Stakeholder/Community)*