

Chapter 1

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Chapter 1

THE SURVEY – OBJECTIVES, DESIGN AND PROCESS

The Western Australian Aboriginal Child Health Survey (WAACHS) was undertaken between 2000 and 2001 by the Telethon Institute for Child Health Research and is a project of the Kulunga Research Network. The survey data are the first of their kind to describe the health, wellbeing and educational outcomes of Aboriginal and Torres Strait Islander children. The findings reveal how many of these outcomes are associated with child rearing environments provided by families, communities and schools. The survey was designed in consultation with Aboriginal community leaders and organisations, government and other service providers to ensure that the findings can be used to inform the development of evidence-based policies and strategies to promote and maintain the healthy development of Aboriginal families, communities and the children and young people that they nurture.

This volume is the fourth in a series, and builds on findings from three previous volumes which examined the health, social and emotional wellbeing, and educational experiences of Aboriginal children and young people.

This chapter provides an overview of the conduct of the survey, introduces a classification specifically developed for the survey to measure geographic isolation from services, and describes the analytical techniques used in the analysis of WAACHS data presented in subsequent chapters.

SUMMARY

- ◆ The primary objective of the Western Australian Aboriginal Child Health Survey (WAACHS) was to identify the developmental and environmental factors that enable health, competency and resiliency in Aboriginal children and young people aged 0–17 years.
- ◆ The survey describes the population of families with Aboriginal children under the age of 18 years. Data were collected for 5,289 eligible children living in 1,999 households.
- ◆ A project Steering Committee comprising senior Aboriginal experts and representatives of community organisations has directed the planning, implementation and reporting of the survey. The survey content and processes were developed in consultation with Aboriginal leaders, key Aboriginal bodies, and through extensive consultations with Aboriginal community councils, parents, young people and key service providers throughout the state.
- ◆ The Telethon Institute for Child Health Research (the Institute) is home to the Kulunga Research Network — a formal collaboration between the Institute and the Western Australian Aboriginal community. The Kulunga Research Network is an advocate for the health of Aboriginal children and families in Western Australia and is working towards gaining recognition as a national centre of excellence for Aboriginal health research and the training of Aboriginal researchers.



SUMMARY *(continued)*

- ◆ A Level of Relative Isolation (LORI) classification was specifically developed for use in this survey. Existing remoteness classifications (e.g. ARIA) were not detailed enough to account for the broader geographic dispersion of Aboriginal people compared with the total population. LORI allows for greater discrimination of the circumstances of Aboriginal people with respect to their geographic isolation from population centres of various sizes. It also helps to better differentiate the unique characteristics of Aboriginal families living in communities located in areas of differing isolation. The classification categorises the survey population into five broadly homogenous levels of remoteness.
- ◆ LORI is based on a continuous scale of remoteness — the ARIA++ scale — which ranges from zero (representing the least remote locations — such as Perth) to 18 (representing the most remote locations — such as the discrete community of Balgo). This volume makes extensive use of both LORI and the 18 point ARIA++ scale to describe the relationship of geographical isolation to a range of variables of interest.
- ◆ A Family, Community and Housing Reference Group, comprising senior representatives from Aboriginal community organisations and State and Australian Government departments with responsibilities for Aboriginal families, communities and housing, provided advice on the analysis in this volume. The group also advised on the communicating of results to key stakeholders and helped facilitate the translation of survey findings into positive impacts on policy and practice.



THE TELETHON INSTITUTE FOR CHILD HEALTH RESEARCH

The Telethon Institute for Child Health Research (ICHR) is a centre of excellence for the conduct of research into child health. Founded in 1987, the Institute's research programmes include the study of asthma and allergic diseases, birth defects, child and adolescent social and emotional wellbeing, childhood death and disability, leukaemia and other cancers, as well as Aboriginal health and infectious disease.

The Institute's mission is to improve the health of children through the development and application of research into:

- ◆ causes of ill health
- ◆ the maintenance of good health
- ◆ prevention of ill health
- ◆ the treatment of conditions affecting children.

KULUNGA RESEARCH NETWORK

The Institute is home to the Kulunga Research Network (the Network) — a formal collaboration between the Institute and Western Australian Aboriginal Community Controlled Health organisations, now known as the Aboriginal Health Council of Western Australia. The Network is an advocate for the health of Aboriginal children and families in Western Australia and is working towards gaining recognition as a national centre of excellence for Aboriginal health research and the training of Aboriginal researchers. It seeks to ensure that community-based and culturally relevant research benefits Aboriginal people by influencing the policy and planning of government and other key agencies, and by involving Aboriginal people in all areas of research and implementation of outcomes. The Western Australian Aboriginal Child Health Survey (WAACHS) is a project of the Network.

The Network has been responsible for WAACHS project management, contractual arrangements with funders and the community, and community and stakeholder engagement processes to ensure the timely production of survey publications and the dissemination and uptake of findings from the WAACHS.

SURVEY OBJECTIVES

The survey's primary objective was to identify developmental and environmental factors that enable competency and resiliency in Aboriginal children and young people. There was emphasis on defining priority targets for existing and future health, education and social services. Building an epidemiological knowledge-base from which preventive strategies can be developed to facilitate the social, emotional, academic and vocational competency of young people was a notable feature of this survey.

The specific aims of the survey were to:

- ◆ describe and define the health and wellbeing of Western Australian Aboriginal and Torres Strait Islander children and young people aged 0–17 years
- ◆ estimate the prevalence and distribution of commonly occurring chronic medical conditions and disabilities (e.g. asthma, visual and hearing impairments, intellectual disability) and describe how they may affect a child's wellbeing and functioning



- ◆ estimate the prevalence, distribution and functional impact of common physical health, social and emotional problems in Aboriginal children and young people aged 0–17 years and their families
- ◆ estimate the prevalence and distribution of adverse health behaviours (e.g. smoking, alcohol, drug and volatile substance misuse)
- ◆ estimate the prevalence and distribution of other psychosocial problems, such as early school leaving, conduct problems, and juvenile offending
- ◆ describe Aboriginal and Torres Strait Islander children, young people and their families' access to, effective use of, and satisfaction with health care, education, juvenile justice, housing and social services
- ◆ identify factors resulting in protection from poor health and social and emotional wellbeing, adverse health behaviours and other psychosocial problems
- ◆ develop markers which identify children and young people at increased risk for various health, educational and vocational outcomes.

SURVEY CONCEPT AND DEVELOPMENT

The concept of gathering child health and wellbeing information from families with Aboriginal and Torres Strait Islander children was first proposed in 1991 during the development of the Western Australian Child Health Survey. However, for reasons of scale, cost and expertise, families with Aboriginal children were excluded from this earlier survey. The Telethon Institute for Child Health Research undertook to reassess the feasibility of conducting an Aboriginal child health survey following the conclusion of the original Western Australian Child Health Survey. The assessment of the feasibility, design and scope of the WAACHS was subsequently undertaken between 1996 and 1999.

Survey methodology and instrumentation were developed in consultation with Aboriginal leaders, key Aboriginal bodies (the Aboriginal and Torres Strait Islander Commission (ATSIC) Regional Councils, the Aboriginal Council of Elders, the Aboriginal Justice Council, and the Western Australian Aboriginal Community Controlled Health Sector), and through extensive community consultations throughout the state. A survey project team, reporting to an Aboriginal Steering Committee, had basic carriage of securing funding, developing the survey instruments, and implementing the fieldwork.

The Australian Bureau of Statistics (ABS) was a principal provider of consultancy services, expertise and support through all phases of survey development, implementation and analysis. Efforts were made to ensure that the data collected were both scientifically relevant and pertinent to current government information needs and policy initiatives. To do this, reference groups were convened during 1997–1998 with representation from the various government departments and community organisations that had an interest in the outcomes of the survey findings. This process involved senior policy input from: the Western Australian Government Departments of Health, Education and Training; Community Development and Police; the Alcohol and Drug Authority; the Disability Services Commission; the State Housing Commission; the Catholic Education Office of Western Australia; and the Association of Independent Schools of Western Australia. Australian Government departments were also consulted about policy information needs and to comment on the content and design of the survey.



ABORIGINAL LEADERSHIP

All phases of the survey and its development, design, and implementation were under the oversight of the Western Australian Aboriginal Child Health Survey Steering Committee. Established in 1997, the project Steering Committee has the responsibility to control and maintain:

- ◆ cultural integrity of survey methods and processes
- ◆ employment opportunities for Aboriginal people
- ◆ data access issues and communication of the findings to the Aboriginal, and general, community
- ◆ appropriate and respectful relations within the study team, with participants and communities, with stakeholders and funding agencies and with governments of the day.

COMMUNITY CONSULTATION AND APPROVAL

The survey was a large undertaking and involved extensive household sampling and voluntary participation in the survey by many Aboriginal and Torres Strait Islander people across Western Australia. Seeking support and approval for the survey required an extensive and ongoing consultation process. Consultations were undertaken during 1998 and 1999 with visits to Aboriginal communities in Albany, Bunbury, Broome, Carnarvon, Collie, Derby, Esperance, Fitzroy Crossing, Geraldton, Halls Creek, Kalgoorlie, Karratha, Katanning, Kwinana, Kununurra, Narrogin, Perth, Pinjarra, Port Hedland, and Roebourne. Every attempt was made to engage community leaders, community councils, administrative staff, service providers, and local residents to obtain their views about the requirements for the survey, and to secure their participation in the implementation of the survey. People were asked about survey methods and processes, their requirements with respect to specific survey content, their expectations about the use of the survey data, and intended outcomes.

The initial community consultations for the survey established that most participating family members and young people expressed a preference for the survey to be written and administered in plain English. The survey materials were assessed in the pilot test and dress rehearsal and found to yield reliable and valid information for all but the most isolated communities where there was a high level of traditional language use. In these communities, the majority of families chose to be interviewed with the assistance of an Aboriginal language translator employed through the local community council or Aboriginal Medical Service.

Approval for the survey was also obtained from the Western Australian Aboriginal Community Controlled Health Sector, the Western Australian Council of Elders, the Aboriginal Justice Advisory Committee and the Aboriginal and Torres Strait Islander Commission (ATSIC) State Council.



ETHICAL APPROVAL FOR THE SURVEY

The project met the requirements of, and was approved by, the Western Australian Department of Health's Aboriginal Health Information and Ethics Committee as well as the Ethics Committee of King Edward Memorial and Princess Margaret Hospitals. These clearances ensured that the survey process and procedures conformed with requirements and protocols for health research with Aboriginal people and adhered to National Health and Medical Research Council (NHMRC) ethical standards and guidelines for research with human subjects.

ABORIGINAL IDENTIFICATION AND THE SCOPE OF THE SURVEY

The survey was based on an area sample of dwellings (see *Glossary*). To determine whether a dwelling was eligible for inclusion in the survey, respondents were asked 'Are there any Aboriginal children or teenagers living at this address who are aged between 0 and 18 years?' Interviewers were instructed that Torres Strait Islander children were also in-scope. A 'Yes' response placed the household in-scope of the survey, and these households were asked to participate. All children in the household meeting the in-scope criteria were eligible to participate (see *Aboriginal status* in *Glossary*).

Children living within group homes, institutions and non-private dwellings were not in the scope of the survey. However, where a selected household had a child temporarily living away from home (e.g. in a boarding school or hostel), these children were included in the scope of the survey.

Once the authority for the survey and the nature of the survey was explained to a responsible adult (usually the carer(s) or head of the household), and consent to participate was obtained, Aboriginal status was determined for each person who was reported to usually live in the dwelling. This was done by asking 'Does (the person) consider him/herself to be of Aboriginal or Torres Strait Islander origin?' Data were collected on all Aboriginal and Torres Strait Islander children under the age of 18 years in each of the participating households.

TERMINOLOGY

Throughout this publication the term 'Aboriginal and Torres Strait Islander peoples' has been used as the most precise and inclusive reference for Aboriginal Australians. Where other group terms such as 'Aboriginal people' have been used, it should be noted that this is intended to refer to Aboriginal and Torres Strait Islander peoples.

SURVEY OUTPUTS AND COMMUNITY FEEDBACK

This is the fourth volume of results from the WAACHS. Volume One — *The Health of Aboriginal Children and Young People* was published in June 2004; Volume Two — *The Social and Emotional Wellbeing of Aboriginal Children and Young People* was published in April 2005; and Volume Three — *Improving the Educational Experiences of Aboriginal Children and Young People* was published in March 2006. These publications are available from the ICHR web site: www.ichr.uwa.edu.au. One further volume of results, which will focus on justice issues, is currently under consideration. A summary booklet for each volume will be produced. Summary booklets for the



first three volumes are already available. As well, a number of research papers and professional journal articles based on the findings of the survey are to be written.

A WAACHS communication and dissemination strategy has been designed to maximise knowledge and awareness of the findings in both the Aboriginal and wider communities. The strategy, driven by the Kulunga Research Network, aims to engage Aboriginal communities in committed action using the data as a catalyst for community action and desired change.

The communication and dissemination strategy is also complemented by work designed to link the findings of each volume into government policy and planning. For previous volumes, this work was led by the Government of Western Australia through the Human Services Senior Officers Group – Research and Evaluation. However, this work has now largely been subsumed as part of the role of the reference group for this volume.

For Volumes One, Two and Three, regional profiles have been produced for each of the former ATSIC regions in Western Australia. Regional profiles for this volume will continue to be produced for each ATSIC region. This decision recognises that, with the abolition of ATSIC Regional Councils, ATSIC regions have been replaced by Indigenous Coordination Centre (ICC) regions (see commentary box below entitled *ICC regions*). The decision means that users of WAACHS data will have access to consistency of regional information across the WAACHS volumes. The regional profiles have been disseminated throughout the state during consultation and feedback visits that have been conducted in every region. This process will continue for all volumes. The results published in each main volume will guide the production of community information resources which will be followed by meetings, workshops and seminars in each region to inform and educate survey participants and Aboriginal communities in general about the survey findings.

ICC REGIONS

With the abolition of ATSIC Regional Councils and the establishment by the Office of Indigenous Policy Coordination of regional Indigenous Coordination Centres (ICCs), changes have been made to the geographic regions used for producing statistics in relation to Aboriginal peoples. While it is recognised that ATSIC regions no longer exist, there is a need for continuity in the flow of information through all WAACHS volumes. Therefore, information in this volume is reported using the former ATSIC geographical boundaries.

In Western Australia, the nine ATSIC Regional Councils have been replaced by seven ICCs, resulting in two major boundary changes. Firstly, the former Perth Noongar and Noongar Country (Narrogin) ATSIC regions have been combined into the Perth ICC region. Secondly, the former Western Desert (Warburton) ATSIC region has been split, a small proportion being included in South Hedland ICC and the remaining area combined with the former Mulga Mallee (Kalgoorlie) ATSIC region to create the Kalgoorlie ICC region.



THE MAIN SURVEY

The main survey commenced in May 2000 and was completed in June 2002. Dwellings were selected for screening using an area-based clustered multi-stage sample design. From 166,290 dwellings in 761 census collection districts, 139,000 dwellings were approached to determine if residents were eligible to participate in the survey. Using this method, a random sample of 2,386 families with 6,209 eligible children was identified throughout metropolitan, rural and remote regions of Western Australia. A total of 1,999 of these families (84 per cent) with 5,513 eligible children consented to participate in the survey. Interviewers gathered useable data on 5,289 (96 per cent) of these participating children. In addition to the data gathered on children, data were also gathered on families from:

- ◆ 2,113 (95 per cent) participating carers identified as the persons who knew the most about the individual survey child (see *Primary carer* in *Glossary*)
- ◆ 1,040 (83 per cent) other participating carers of the survey children (see *Secondary carer* in *Glossary*) wherever this was possible and whenever they were present in the household
- ◆ 1,073 (73 per cent) participating young people aged 12–17 years.

TERMINOLOGY

Throughout this publication the terms ‘primary carer’ and ‘secondary carer’ have been used to describe the adults nominated to provide information about children selected in the survey. Primary and secondary carers were considered to be the people who spent most time with the children and who knew them best. In most cases, the primary carer was the mother of the child.

LEVEL OF RELATIVE ISOLATION (LORI)

MEASURING ISOLATION FROM SERVICES

A new classification of geographic remoteness from services — the Level of Relative Isolation (LORI) — has been used in the WAACHS. The LORI is based on an index of remoteness and accessibility developed by the National Key Centre for Social Application of Geographic Information Systems (GISCA) at Adelaide University, called ARIA++. The ARIA++ is an extension of ARIA (the Accessibility/Remoteness Index of Australia), which has been widely adopted as the standard classification of remoteness in Australia. The ARIA describes the entire population of Australia and was not specifically designed to describe the circumstances of Aboriginal people living in remote areas. The ARIA++, however, gives a more detailed description of the most remote areas of Australia by including more service centres, of smaller sizes, in calculating the remoteness scores.

Under the original ARIA, over two-thirds of the land mass of Western Australia, and over a quarter of Aboriginal people in Western Australia live in areas classified as ‘very remote’. However, WAACHS data have revealed that, within this group, there were marked differences in access to basic services, cultures, lifestyles and health outcomes. The greater detail of ARIA++ enables these differences to be more adequately described in the Aboriginal population.



ILLUSTRATING THE DIFFERENCE BETWEEN ARIA AND ARIA++

As an example of the difference between ARIA and ARIA++, the town of Halls Creek in the East Kimberley – population about 1,300 people – is classified as ‘very remote’ under ARIA. However, at the time of the survey, it had a 4-bed hospital facility providing health services to the town and communities throughout the surrounding region. One of those communities, Yiyili, about 120 kilometres east of Halls Creek, has a population of around 250 people. The Halls Creek Health Service provides a weekly community nursing clinic in the Yiyili community. Under ARIA’s 12 point remoteness scale, both Halls Creek and Yiyili receive the maximum score of 12 (‘very remote’).

Under ARIA++, which has an extended 18 point remoteness scale, Halls Creek receives a score of 12 and Yiyili receives a score of 18. Compared with major capital cities, both Halls Creek and Yiyili would be regarded as small places with limited access to services. However, analysis of WAACHS data has shown that the difference in isolation between Halls Creek and Yiyili is reflected not only in different access to basic services, but also in a different level of adherence to traditional cultures and languages, and different health outcomes.

FIVE LORI CATEGORIES

Based on the ARIA++ scores, five categories of isolation have been defined. To avoid confusion with the original ARIA, the five categories are referred to as Levels of Relative Isolation (LORI) and range from None (the Perth metropolitan area) to Low (e.g. Albany), Moderate (e.g. Broome), High (e.g. Kalumburu) and Extreme (e.g. Yiyili). These LORI categories are responsive to trends in accessibility to services and facilities (as defined by the distance by road to the nearest service centre); adherence to Aboriginal culture and language; and health outcomes for Aboriginal people, and therefore allow these trends to be more accurately determined and described. For more detailed information on how the LORI measure was constructed, see *Appendix C – Determination of Levels of Relative Isolation (LORI) based on ARIA++*.

The ability of LORI to better identify Aboriginal children in Western Australia in terms of their geographic isolation from services is seen when comparing the original ARIA ‘very remote’ category and the ‘extreme’ category under LORI. Under ARIA, one-quarter of Aboriginal children under 18 years of age were living in ‘very remote’ areas. Under LORI, these ‘very remote’ areas are further subdivided as either Moderate, High or Extreme isolation. Consequently, as shown in Figure 1.1, only one in ten (9.5 per cent; CI: 6.8%–12.7%) Aboriginal children are classified under LORI as living in extremely remote areas. This group was found to be more homogenous (in terms of characteristics likely to be associated with remoteness and isolation from services) than children classified as ‘very remote’ under ARIA.

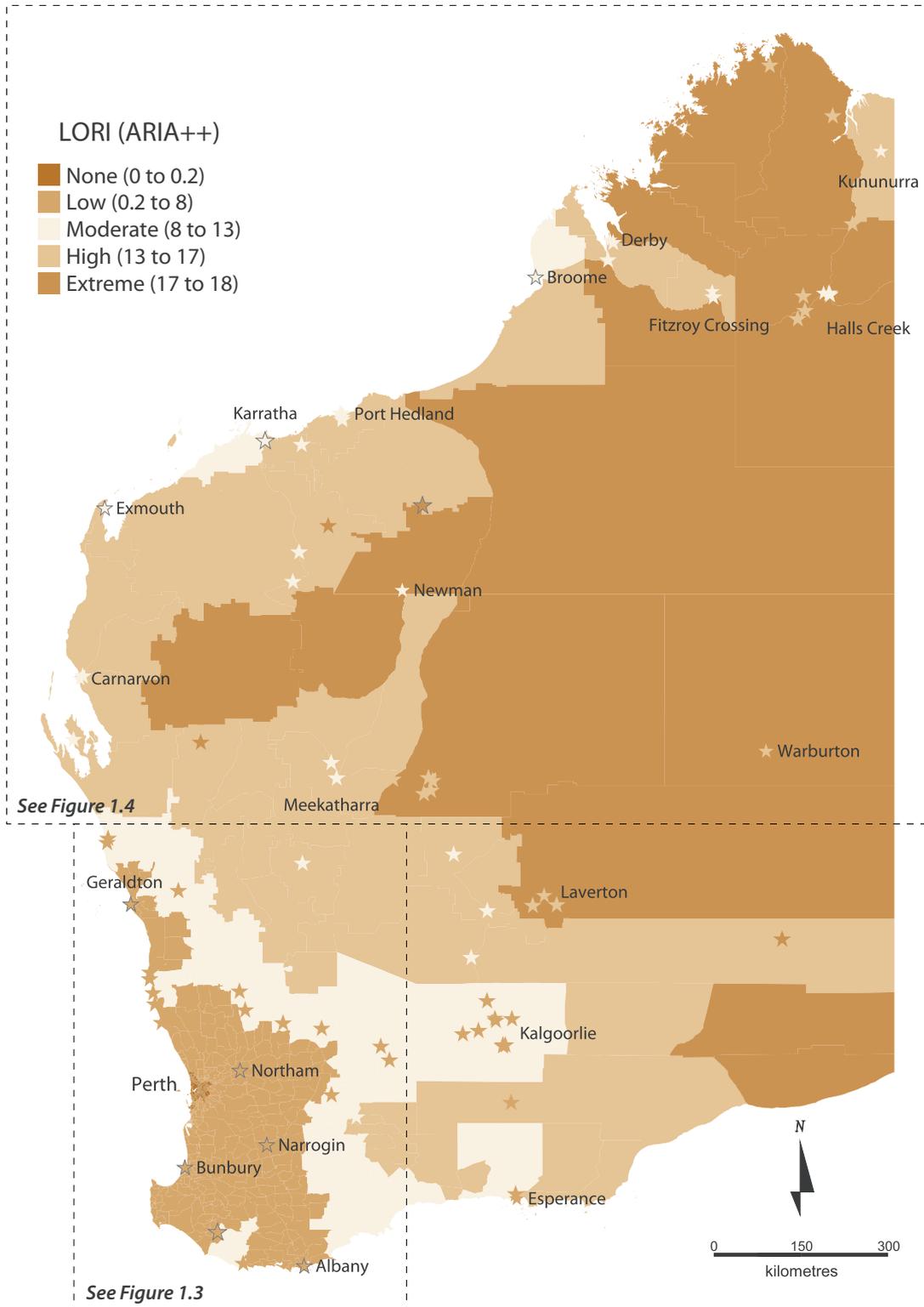
FIGURE 1.1: ABORIGINAL CHILDREN AGED 0–17 YEARS, BY LEVEL OF RELATIVE ISOLATION (LORI)

LORI	Area (sq km)	Number	95% CI	%	95% CI
None	1 413	10 200	(10 000 - 10 400)	34.1	(31.5 - 36.8)
Low	125 263	7 270	(6 640 - 7 930)	24.4	(21.8 - 27.0)
Moderate	226 975	6 390	(5 400 - 7 420)	21.4	(18.1 - 25.1)
High	839 057	3 170	(2 360 - 4 160)	10.6	(7.9 - 14.0)
Extreme	1 334 809	2 830	(2 040 - 3 800)	9.5	(6.8 - 12.7)
Total	2 527 517	29 800	(29 800 - 29 800)	100.0	

Figures 1.2–1.4 illustrate the five LORI categories for Western Australia. The maps are based on 1996 Census Collection districts, which were used as the sampling frame for the WAACHS.



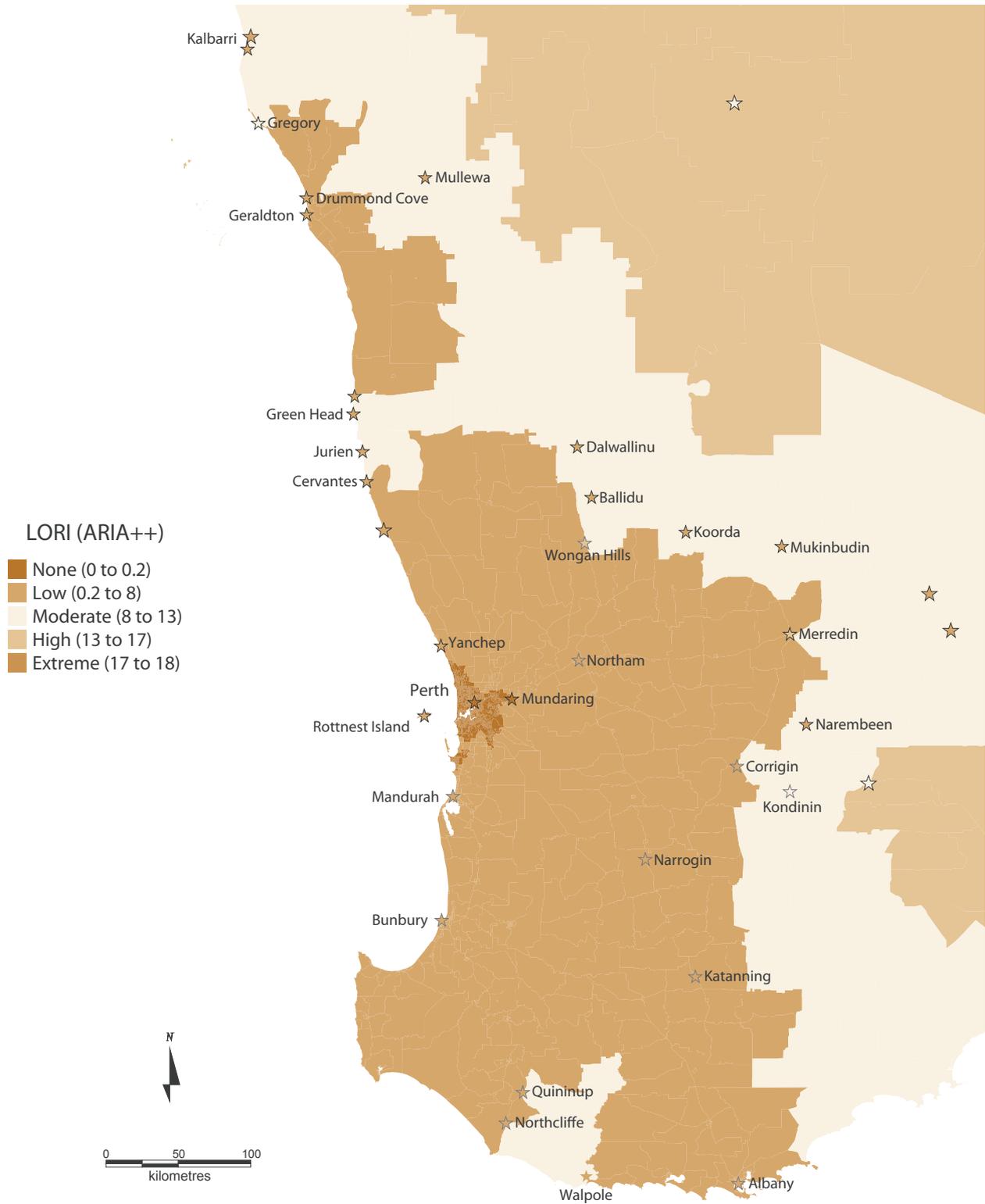
FIGURE 1.2: WESTERN AUSTRALIA — LEVEL OF RELATIVE ISOLATION (LORI) CATEGORIES BASED ON ARIA++ VALUES , WITH SELECTED LOCALITIES (a)



(a) Note that the level of relative isolation of localities marked on the map is represented by the colour of the star adjacent to the locality name. In many instances this will be a different colour to the surrounding area, as the localities may be service centres to more isolated regions.



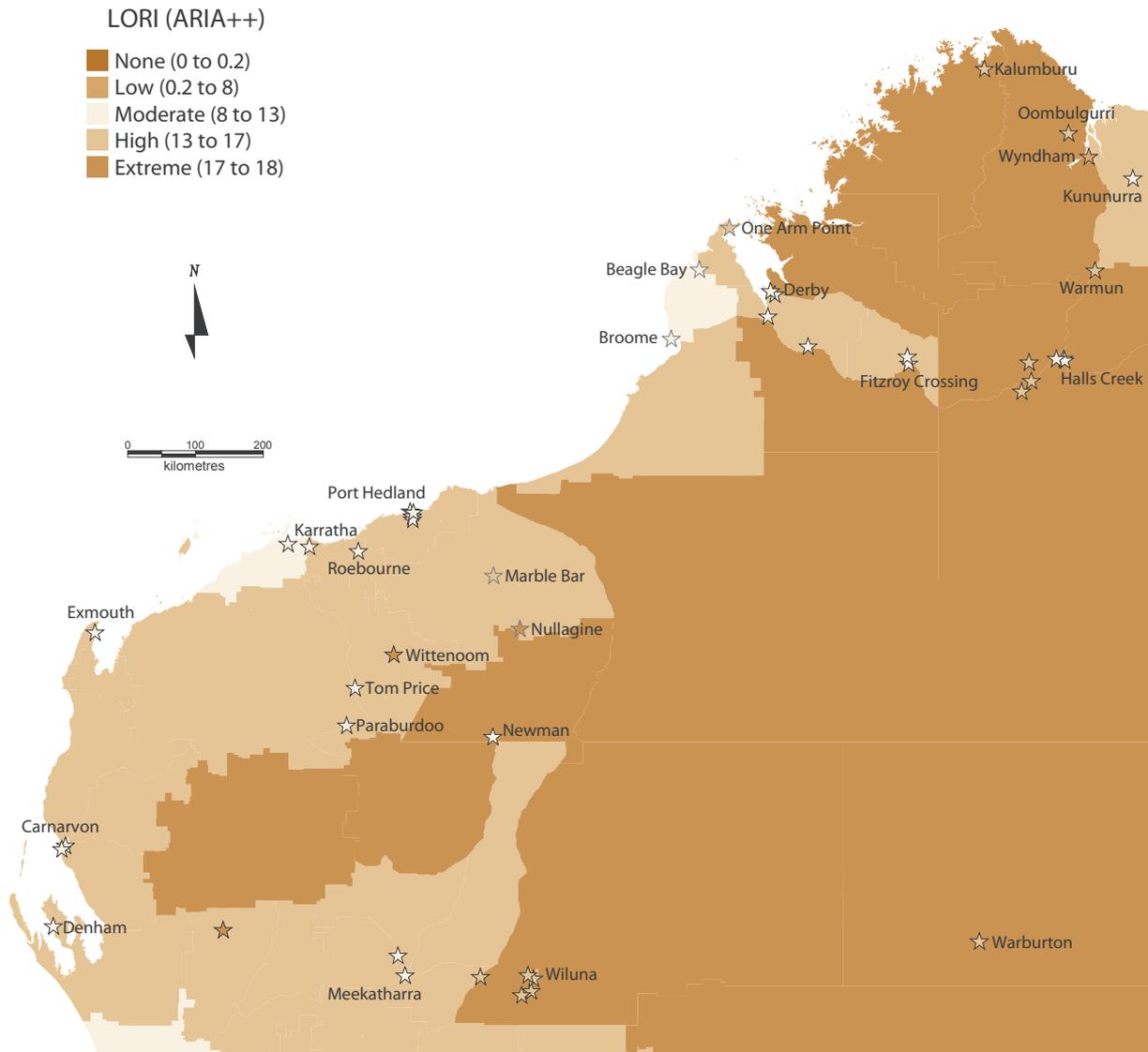
FIGURE 1.3: WESTERN AUSTRALIA (SOUTH) — LEVEL OF RELATIVE ISOLATION (LORI) CATEGORIES BASED ON ARIA++ VALUES , WITH SELECTED LOCALITIES (a)



(a) Note that the level of relative isolation of localities marked on the map is represented by the colour of the star adjacent to the locality name. In many instances this will be a different colour to the surrounding area, as the localities may be service centres to more isolated regions.



FIGURE 1.4: WESTERN AUSTRALIA (NORTH) — LEVEL OF RELATIVE ISOLATION (LORI) CATEGORIES BASED ON ARIA++ VALUES, WITH SELECTED LOCALITIES (a)



(a) Note that the level of relative isolation of localities marked on the map is represented by the colour of the star adjacent to the locality name. In many instances this will be a different colour to the surrounding area, as the localities may be service centres to more isolated regions.



INTERPRETING MEASURES OF GEOGRAPHICAL ISOLATION

This volume focuses on families and communities. Where a family or community is located can often be associated with social, cultural and service/infrastructure issues — hence the need for a tool that enables an analysis of the impact of location on family and community outcomes. The use of LORI as an interpretive tool is a major feature of the work in this volume. As such, LORI and ARIA++ have been used more extensively than in the three preceding volumes, with greater use of analytic techniques that were previously reserved only for specific key analyses.

ANALYSIS USING LORI CATEGORIES

LORI is used to categorise the survey population into five broadly homogenous levels of remoteness (see *Appendix C — Determination of Levels of Relative Isolation (LORI) based on ARIA++*). The five LORI categories — None, Low, Moderate, High, and Extreme, have been used in analyses that require an investigation into the relationship between a given outcome variable and remoteness. The full five categories are used in all cross-tabulations and multivariate logistic regression models where remoteness is used as a classification variable.

THE 18 POINT ARIA++ SCALE

The WAACHS can also examine remoteness via the continuous ARIA++ scale, which runs from zero to 18 points, where zero represents the least remote location (e.g. a capital city like Perth) and 18 the most remote (e.g. a remote community like Balgo). However, analysis of an outcome variable by the full 18 points is not undertaken in cross-tabulation or multilevel modelling analyses because the output would be impractically large, difficult to interpret, and result in confidence intervals too wide for meaningful use. The standard five categories generally provide enough discrimination between areas of differing remoteness for readers to obtain a clear picture of the relationship between remoteness and many key outcomes for Aboriginal children and their families.

SPLINE CHARTS AND REMOTENESS

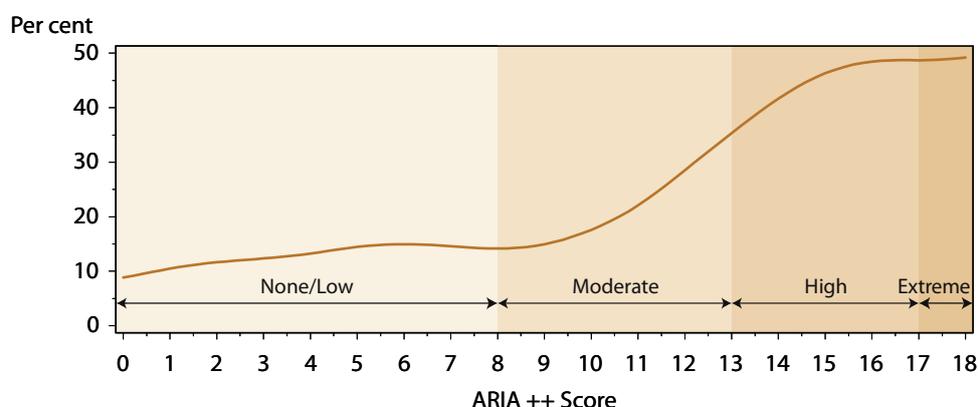
There is, however, another way to utilise the full 18 point ARIA++ to help describe a relationship between a given outcome variable and remoteness. The spline chart is a statistical procedure that results in a smoothed linear output of the probability of a particular outcome occurring. In this volume, spline output is plotted across all points of the ARIA++ scale so that readers can obtain an understanding of how a given outcome variable changes both within a LORI category and across the entire ARIA++ scale. Unlike a cross-tabulation or multivariate logistic regression model result, estimates and associated confidence intervals are not able to be provided with the spline. Rather, the spline is a compliment to an existing data table that uses the five point LORI categories, providing extra information about the within-category change. As a result of these differences in technique, the estimate from a cross-tabulation and that from any given point on the spline output will not necessarily align.



An example spline is provided below, taken from Chapter Six. We know from our cross-tabulation that 7.0 per cent (CI: 4.4%–10.4%) of dwellings in LORI—None have high household occupancy levels (overcrowded), rising to 17.1 per cent (CI: 13.6%–21.3%) in LORI—Moderate and 42.6 per cent (CI: 31.0%–54.6%) in LORI—High (Table 6.45). The spline highlights points within each LORI category where the most noticeable change occurs.

Note how in the LORI—Moderate category the proportion of dwellings with high household occupancy jumps steeply from around 15 per cent at ARIA++ = 8 points through to around 35 per cent at the end of the LORI—Moderate category, at ARIA++ = 13 points. This gives us more meaningful information than just the LORI category estimate from the cross-tabulation.

DWELLINGS — PROPORTION OF HOUSEHOLDS WITH HIGH OCCUPANCY, BY ARIA++ SCORE AND LEVEL OF RELATIVE ISOLATION



Note also that a high proportion of overcrowded dwellings in areas of extreme isolation may not equate to as many dwellings as a low proportion in areas with no/low isolation. This reflects the much higher Aboriginal population in less isolated areas.

Spline type presentation can be tremendously helpful for policy makers and analysts in general, as the points of change coincide with geographic locations that have a matching ARIA++ score. This means people can get a clear idea about what sort of towns or communities are likely to be home to people in particular situations suggested by the outcome variable being displayed, which in this case is high household occupancy levels (see Chapter Six for more discussion of housing-related topics such as this).

ARIA++ AND LORI FOR SELECTED LOCATIONS

The figure on the following page lists a selection of Western Australian locations and their corresponding ARIA++ score and LORI category. This list will provide readers with a greater understanding of how towns and localities fit within the ARIA++ measure of remoteness. This will aid the interpretation of spline output and results which provide a geographic comparison. Note that this chapter also provides a series of maps depicting the LORI boundaries, overlaid with selected towns and localities.



SELECTED LOCATIONS WITHIN WESTERN AUSTRALIA — COMPARISON OF ARIA++ VALUES AND LEVEL OF RELATIVE ISOLATION (LORI)

Locality	ARIA++ score	LORI	Locality	ARIA++ score	LORI
Perth	0.00	None	Fremantle	0.00	None
Kalamunda	0.00	None	Rockingham	0.04	None
Landsdale	0.08	None	Mundaring	0.18	None
Mandurah	0.21	Low	Leda	0.23	Low
Middle Swan	0.24	Low	Sawyers Valley	0.30	Low
Chidlow	0.55	Low	Pinjarra	0.61	Low
Two Rocks	0.77	Low	Northam	0.97	Low
Bunbury	0.94	Low	Collie	1.39	Low
Yarloop	1.87	Low	Gingin	2.37	Low
Albany	2.70	Low	Geraldton	2.70	Low
Goomalling	3.09	Low	Denmark	3.58	Low
Narrogin	3.60	Low	Cunderdin	3.73	Low
Kalgoorlie	3.97	Low	Manjimup	4.11	Low
Wagin	4.16	Low	Kojonup	4.21	Low
Kellerberrin	5.11	Low	Kambalda	5.20	Low
Kalbarri	6.61	Low	Southern Cross	6.86	Low
Esperance	7.51	Low	Mukinbudin	7.78	Low
Norseman	7.85	Low	Jurien	7.99	Low
Moulyinning	8.02	Moderate	Warrungup	8.05	Moderate
Carnamah	8.08	Moderate	Morawa	8.11	Moderate
Carnarvon	8.15	Moderate	Broome	9.00	Moderate
Karratha	9.00	Moderate	Port Hedland	9.00	Moderate
Dampier	9.16	Moderate	Emu Flat	9.21	Moderate
Roebourne	9.62	Moderate	Ravensthorpe	10.68	Moderate
Leinster	10.73	Moderate	Meekatharra	10.80	Moderate
Derby	11.10	Moderate	Newman	11.84	Moderate
Exmouth	12.00	Moderate	Fitzroy Crossing	12.00	Moderate
Halls Creek	12.00	Moderate	Kununurra	12.00	Moderate
Menzies	12.29	Moderate	Mount Magnet	12.35	Moderate
Boogardie	12.63	Moderate	Hyden	12.82	Moderate
Cue	13.04	High	Laverton	13.07	High
Cowerup	13.42	High	Yalgoo	13.49	High
Munglinup	13.56	High	Pannawonica	13.72	High
Mount Margaret	13.74	High	Wiluna	13.98	High
La Grange	14.12	High	Wyndham	14.23	High
Paynes Find	14.33	High	Coral Bay	14.44	High
Karalundi Community	14.63	High	Onslow	15.00	High
Warburton	15.00	High	Oombulgarri	15.08	High
Kalumburu	15.10	High	Lombadina	15.20	High
Murchison	15.41	High	Pago Mission	16.09	High
Nunngarra	16.12	High	Guda Guda	16.81	High
Den	17.07	Extreme	Wittenoom Gorge	17.09	Extreme
Shay Gap	17.10	Extreme	Christmas Creek	17.12	Extreme
Cosmo Newbery	17.24	Extreme	Grand Junction	17.63	Extreme
Eyre	17.68	Extreme	Jigalong	17.97	Extreme
Balgo	18.00	Extreme	Mulan	18.00	Extreme
Nullagine	18.00	Extreme	Punmu	18.00	Extreme
Ringers Soak	18.00	Extreme	Tjukurla	18.00	Extreme
Warakurna	18.00	Extreme	Yiyili	18.00	Extreme



ANALYSIS METHODS USED IN THIS VOLUME

Two main analytical techniques have been used to report the findings in this volume:

- ◆ Cross-tabulations
- ◆ Multivariate logistic regression modelling.

CROSS-TABULATIONS

What are cross-tabulations?

Cross-tabulations show how one analysis variable (e.g. household occupancy level) varies with reference to one or more classification variables (e.g. LORI). Results from this analysis technique are presented as proportions or percentages, based on weighted estimates (see *Appendix D — Reliability of estimates*). In discussing the survey findings, variables found to be associated in cross-tabulation analysis are described as being ‘related’ or ‘associated’ with another factor.

Interpreting cross-tabulation results

An example of WAACHS survey data analysed using this method is shown in Figure 1.3.

FIGURE 1.3: DWELLINGS — HOUSEHOLD OCCUPANCY LEVEL, BY LEVEL OF RELATIVE ISOLATION (LORI)

<i>Level of household occupancy</i>	<i>Number</i>	<i>95% CI</i>	<i>%</i>	<i>95% CI</i>
LORI — None				
Low	3 900	(3 760 - 4 050)	90.6	(87.2 - 93.3)
High	300	(190 - 450)	7.0	(4.4 - 10.4)
Not stated	100	(70 - 150)	2.4	(1.6 - 3.6)
Total	4 310	(4 230 - 4 390)	100.0	
LORI — Low				
Low	2 610	(2 380 - 2 840)	87.8	(84.9 - 90.3)
High	300	(230 - 380)	10.0	(7.7 - 12.7)
Not stated	70	(40 - 110)	2.3	(1.3 - 3.5)
Total	2 970	(2 730 - 3 220)	100.0	
LORI — Moderate				
Low	1 880	(1 600 - 2 180)	81.3	(77.1 - 85.2)
High	400	(300 - 510)	17.1	(13.6 - 21.3)
Not stated	40	(20 - 70)	1.6	(0.8 - 3.0)
Total	2 320	(1 990 - 2 680)	100.0	
LORI — High				
Low	480	(320 - 690)	55.2	(41.8 - 66.9)
High	370	(220 - 570)	42.6	(31.0 - 54.6)
Not stated	20	(0 - 180)	2.2	(0.1 - 19.6)
Total	860	(600 - 1 210)	100.0	
LORI — Extreme				
Low	510	(350 - 700)	56.6	(47.0 - 66.1)
High	360	(230 - 550)	39.7	(29.7 - 49.7)
Not stated	30	(10 - 70)	3.7	(1.4 - 8.0)
Total	900	(620 - 1 220)	100.0	
Western Australia				
Low	9 380	(9 130 - 9 620)	82.6	(80.4 - 84.7)
High	1 720	(1 500 - 1 960)	15.1	(13.2 - 17.3)
Not stated	260	(190 - 350)	2.3	(1.7 - 3.1)
Total	11 400	(11 300 - 11 400)	100.0	



This table shows the proportion of dwellings with a high household occupancy level in each LORI category. For example, it was observed that 7.0 per cent (CI: 4.4%–10.4%) of dwellings in the Perth metropolitan area (LORI—None) had high household occupancy. In areas of extreme isolation, the corresponding proportion was much higher — 39.7 per cent (CI: 29.7%–49.7%).

Assessing the significance of cross-tabulation results

When comparing survey estimates such as those in Figure 1.3, it is possible that differences in the proportions of dwellings with high household occupancy across the LORI categories could arise by chance alone, because the data is based on a random sample. Confidence intervals provide a means to assess the statistical significance of differences between estimates. The 95 per cent confidence interval (the ‘95% CI’ column in Figure 1.3) indicates that there is a 95 per cent chance that the true value lies between the lower and upper limits indicated by the confidence interval. For example, there is a 95 per cent chance that the true value of the proportion of dwellings with high household occupancy in the Perth metropolitan area (estimated at 7.0 per cent) lies between 4.4 per cent and 10.4 per cent. If two confidence intervals overlap, there is a possibility that the difference could be due to chance variation. When there is no overlap, it can be concluded that the difference is statistically significant at the 95 per cent level. In the example above, the respective confidence intervals for the estimates for LORI—None and LORI—Extreme categories are 4.4%–10.4% and 29.7%–49.7%. Because these confidence intervals do not overlap, it is likely that there is a real difference in levels of household occupancy between the two areas that can not be explained by chance alone. In contrast, when comparing the estimates of household occupancy between the LORI—None and LORI—Low categories, the two respective confidence intervals do overlap (4.4%–10.4% and 7.7%–12.7%, respectively). In this example, the difference between the two estimates would be regarded as not statistically significant. See *Assessing statistical significance* in *Appendix D* for more details.

MULTIVARIATE LOGISTIC REGRESSION MODELLING

The second analysis technique used throughout this volume is multivariate logistic regression modelling. Logistic regression is a statistical modelling technique that is used to investigate the relationship between the probability of a certain outcome (such as poor housing quality) and a set of explanatory factors. Logistic regression modelling is used in situations where multiple factors may all have an impact on an outcome of interest. If the factors themselves are related, cross-tabulations may not tell the full story. In some cases, only considering the cross-tabulation analysis results without also considering the logistic regression model results can be misleading. For further information see *Multivariate logistic regression modelling* in the *Glossary*.

Results from logistic regression modelling are presented as odds ratios (see *Glossary*). When discussing these results, the term ‘independently associated’ is used to refer to the effect of each factor on a key outcome variable, separate from the effect of all other factors represented in the model.

Logistic regression modelling complements the analysis of survey data using cross-tabulations. While percentages show the proportion of children or carers affected by each factor, they are unable to fully explain the relationships between all the factors that affect an outcome of interest. Many of the factors that are examined in this volume



are inter-related. For example, in Chapter Six, analysis of cross tabulated survey data illustrate that many factors were associated with poor housing quality, such as LORI, housing tenure and overuse of alcohol causing problems in the household. However, in addition to being related to poor housing quality, these factors can also be related to each other. For instance, housing tenure varies by LORI (as described in Chapter Six).

The use of logistic regression modelling can help tease out the relative importance of multiple factors by assessing the simultaneous impact of various factors and to determine the individual effects of each factor. The statistical model adjusts for the independent effects of the other variables in the model. Thus, for example, the association between poor housing quality and LORI can be separated from the association between poor housing quality and housing tenure.

It is possible that a factor can be ‘related’ or ‘associated’ to a key outcome variable, but not ‘independently associated’ with that outcome variable. That is, when other factors are controlled for in the statistical model, it is not associated with the outcome of interest.

For example, in the analysis of life stress events in Chapter Five, it was found that the primary carer’s labour force status was related to the experience of a high number of life stress events in the previous 12 months. This is an example of cross-tabulation analysis. However, after taking into account the effect of other factors using logistic regression modelling, labour force status was not found to be ‘independently associated’ with the number of life stress events in families with Aboriginal children.

An example of results from a multivariate logistic regression model is shown in Figure 1.4 below.

FIGURE 1.4: PRIMARY CARERS — LIKELIHOOD OF 7-14 LIFE STRESS EVENTS IN THE PREVIOUS 12 MONTHS, ASSOCIATED WITH CHILD, CARER, FAMILY AND HOUSEHOLD FACTORS

<i>Parameter</i>	<i>Odds Ratio</i>	<i>95% CI</i>
Level of Relative Isolation		
None	1.00	
Low	1.01	(0.74 - 1.38)
Moderate	0.95	(0.68 - 1.33)
High	0.89	(0.53 - 1.47)
Extreme	1.33	(0.80 - 2.20)
Does the carer speak an Aboriginal language?		
No	1.00	
A few words	1.18	(0.88 - 1.58)
A conversation	1.76	(1.18 - 2.61)
Attendance at an Aboriginal funeral?		
No	1.00	
Yes	1.55	(1.15 - 2.10)
Participation in an Aboriginal organisation?		
No	1.00	
Yes	1.42	(1.10 - 1.83)
Importance of Aboriginal ceremonial business		
Important	1.00	
Not important	0.60	(0.42 - 0.85)
Not relevant	0.72	(0.49 - 1.04)

Continued . . .



FIGURE 1.4 (continued): PRIMARY CARERS — LIKELIHOOD OF 7–14 LIFE STRESS EVENTS IN THE PREVIOUS 12 MONTHS, ASSOCIATED WITH CHILD, CARER, FAMILY AND HOUSEHOLD FACTORS

<i>Parameter</i>	<i>Odds Ratio</i>	<i>95% CI</i>
Family's money situation		
Spending more money than we get	3.58	(1.54 - 8.37)
Have just enough to get through to next pay	2.96	(1.33 - 6.59)
Some money left over each week but spend it	2.71	(1.17 - 6.31)
Can save a bit now and again	1.63	(0.72 - 3.70)
Can save a lot	1.00	
Primary carer limited in daily activities due to a medical condition?		
No	0.94	(0.69 - 1.29)
Yes	1.40	(1.01 - 1.93)
No medical condition	1.00	
Overuse of alcohol a cause of problems?		
No	1.00	
Yes	1.69	(1.23 - 2.31)
Primary carer ever arrested or charged with an offence?		
No	1.00	
Yes	1.79	(1.39 - 2.30)
Partner ever arrested or charged with an offence?		
No	1.00	
Yes	1.66	(1.15 - 2.39)
No partner/spouse	1.55	(1.09 - 2.22)
Housing tenure		
Owned	1.00	
Being paid off	0.51	(0.29 - 0.87)
Rented	0.64	(0.43 - 0.96)
None of these	1.37	(0.73 - 2.57)
Victims of crime in past three years?		
No	1.00	
Yes	1.51	(1.15 - 1.98)
Carer had contact with Mental Health Services?		
No	1.00	
Yes	1.32	(0.99 - 1.75)
Don't know	0.35	(0.14 - 0.87)
Neighbourhood problems quartile		
Lowest Quartile (0–1)	1.00	
Second Quartile (2–5)	1.97	(1.30 - 3.00)
Third Quartile (6–10)	3.11	(2.05 - 4.73)
Highest Quartile (11–18)	4.03	(2.69 - 6.03)
Does the carer have one or more children at high risk of clinically significant emotional or behavioural difficulties?		
No	1.00	
Yes	1.87	(1.45 - 2.43)
Does the carer have one or more children that have needed to stay away overnight with other family and friends?		
No	1.00	
Yes	1.42	(1.03 - 1.96)



Interpreting multivariate logistic regression results

The model results presented in Figure 1.4 (copied from Chapter Five) shows the likelihood of primary carers reporting 7–14 life stress events in the past 12 months with reference to a range of child, carer, family and household factors. The results of the model are expressed in terms of odds ratios. The odds ratios are calculated relative to an index category for each variable. As an example, for the variable describing the ‘Family’s money situation’, the category ‘can save a lot’ has been used as an index category (an odds ratio value of 1.00). When the primary carer said that they were ‘spending more than we get’, the odds ratio was 3.58 (CI: 1.54–8.37). This can be interpreted as saying that primary carers who said that their family typically spent more than they get were 3.58 times more likely to have 7–14 life stress events than families that could save a lot. The statistical significance of the odds ratio can be judged by whether the confidence interval includes the reference value of 1.00. For more information on the calculation and interpretation of odds ratios see *Glossary*.

Where an odds ratio is less than one, it indicates a reduced level of risk. For example, ‘important’ was chosen as the reference category for the variable ‘Importance of Aboriginal ceremonial business’ in the lives of the primary carer. For primary carers who stated that ceremonial business was ‘not important’ in their lives, the odds ratio was 0.60 (CI: 0.42–0.85), indicating that these carers were around half as likely to have 7–14 life stress events than primary carers who stated ceremonial business was important. Alternatively, it can be said that these primary carers were 1.67 times less likely to have 7–14 life stress events. The value of 1.67 is calculated by dividing the value of 0.60 into 1. As described above, this effect is after controlling for other possible confounding factors such as LORI.

It is also important to note that the factors identified in the statistical modelling do not necessarily cause life stress events in families with Aboriginal children. The reported results indicate an association between the factor tested and the modelled outcome. For example, while factors such as neighbourhood problems and family financial strain were found to be associated with an increased risk of life stress events, no causal relationship is inferred. The survey cannot identify which factor occurred first, or whether another factor (or multiple factors) not collected by the survey also had an influence on the increased risk of life stress events. Therefore we cannot infer the extent to which either factor might cause a life stress event, only that they are associated with an increased risk of life stress events.

Specification of the logistic models

The modelled results reported in this publication are the final model for each key outcome of interest. Each final model is developed through an iterative process. In order to determine the factors that are independently associated with each outcome of interest, a wide range of child, carer, family and household factors are tested for inclusion in the final model. Generally speaking, factors are chosen for consideration in each model based on:

- ◆ results from the cross-tabulation analysis reported in each chapter
- ◆ advice from the survey’s Aboriginal Steering Committee and expert reference group (see section *Consultation during analysis and publication* in this chapter)
- ◆ related literature and research that provide evidence of associations, predictors or causal links between factors.



In each chapter, factors that were tested but not retained in the final model are also generally listed.

In considering the significance of the results of these types of analyses, it is also worth noting the analysis of factors associated with each outcome variable is, by design, limited to the scope of the questions asked in the survey. Therefore, some explanations for the results may be outside the scope of the survey.

Presentation of analytical results

In presenting results throughout this volume, each chapter commences with a summary of the key associations. This provides an efficient overview, particularly for those readers most interested in the main findings rather than being interested in the full details for every factor and association.

These summaries are then followed by presentations of the detailed results. In each chapter section the cross-tabulation results are typically presented first, and then followed by the relevant multivariate model results. In this way the general pattern of findings leading to the final statistical model is shown. As noted above, in some analyses, some specific effects found to be statistically significant in cross-tabulations are subsequently not found to be significant (e.g. in the sense of being independently associated with the outcome of interest) when controlled for in a statistical model. Throughout each chapter, if a factor was found to be significantly associated with a key outcome variable in the cross-tabulation analysis but not independently associated when analysed in the statistical model, this has been noted when describing the relevant cross-tabulation result. Readers are encouraged to review the findings in each section to fully appreciate the pattern of significant and non significant results.

RECORD LINKAGE BETWEEN SURVEY DATA AND ADMINISTRATIVE DATA FOR DISCRETE ABORIGINAL COMMUNITIES

The use of record linkage adds considerable value to the survey data without burdening respondents with extra questions. It enables the study of a survey population across a range of topics such as health, education and community wellbeing utilising existing administrative data sources.

The scope for analysing WAACHS data has been further enhanced by linking data at the community level to two other data sets describing the characteristics of discrete Western Australian Aboriginal communities.

COMMUNITY HOUSING AND INFRASTRUCTURE NEEDS SURVEY

The Community Housing and Infrastructure Needs Survey (CHINS) was conducted in 1999 and 2001 by the Australian Bureau of Statistics on behalf of ATSIC. ATSIC kindly provided a copy of the 2001 CHINS data which has been linked to the WAACHS data set. Some 1,089 of the 5,289 survey children (20.6 per cent) were living in discrete Aboriginal communities covered by the CHINS. CHINS collects a large range of information about services in Aboriginal communities in addition to information about the quality of community infrastructure and housing stock. Access to the CHINS data for discrete Aboriginal communities has allowed the examination of the relationship between community characteristics and child health and wellbeing.



ENVIRONMENTAL HEALTH NEEDS SURVEY

The Environmental Health Needs Survey (EHNS) was conducted in 1997 and 2004 by the Indigenous Environmental Health Coordinating Committee (formerly the Environmental Health Needs Coordinating Committee), a whole-of-government coordinating body comprising relevant Australian, state and local government agencies. The 2004 EHNS surveyed 274 discrete Indigenous communities within Western Australia and covered such issues as water quality and supply, electricity supply, housing stocks and state of repair, solid waste disposal, sanitation, dust control, canine control, and emergency management.

Where CHINS was a national survey, EHNS was solely Western Australian-based and as such focused on issues specific to Western Australian Aboriginal communities. While there are areas of overlap between the two datasets, there are unique aspects to both which make them valuable tools for both validation and interrogation.

CONSULTATION DURING ANALYSIS AND PUBLICATION PRODUCTION

A Family, Community and Housing Reference Group was convened to advise on the analysis for, and production of, this volume. This group included senior representatives from Aboriginal community organisations and state and Australian government departments with responsibilities for Aboriginal families, communities and housing.

The reference group met regularly to review findings from the survey and offer feedback and guidance on the direction of the analysis. The reference group also advised on the communication of results with key stakeholders and helped facilitate a process of translation of findings into positive impacts on policy and practice.

As well as the reference group, each chapter was extensively peer reviewed by a panel of experts from key state and Australian Government agencies.

