



FILLING THE GAP DISPARITIES IN ORAL HEALTH ACCESS AND OUTCOMES IN REMOTE AND RURAL AUSTRALIA

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Acknowledgements

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Commitment to Indigenous Reconciliation

The Royal Flying Doctor Service is developing a Reconciliation Action Plan (Carapetis, Brown, Wilson, & Edwards) to commence in 2016. The Reconciliation Action Plan proposes, among other things, to “use research and policy to improve Indigenous health outcomes” by “research and policy papers including a specific Indigenous focus” as part of a broader effort to “improve health outcomes and access to health services for Indigenous Australians as a contribution to the ‘Close the Gap’ campaign.” This research and policy report contributes to these aims.

Royal Flying Doctor Service Research and Policy Unit

In mid-2015, the Royal Flying Doctor Service established a new Research and Policy Unit, located in Canberra. The Unit’s role is to gather evidence about, and recommend solutions to, overcoming barriers to poor health outcomes and limited health service access for patients and communities cared for by Royal Flying Doctor Service programs. The Research and Policy Unit can be contacted by phone on 02 6269 5500 or by email at enquiries@rfd sno.com

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Abbreviations

ABC	Aboriginal Birth Cohort
ABS	Australian Bureau of Statistics
ACCHO	Aboriginal Community Controlled Health Organisation
ACT	Australian Capital Territory
ACVD	Atherosclerotic cardiovascular disease
ADA	Australian Dental Association
AIHW	Australian Institute of Health and Welfare
AMS	Aboriginal Medical Service
ARF	Acute rheumatic fever
ASGC	Australian Standard Geographical Classification
ASGC RA	Australian Standard Geographical Classification Remoteness Areas
ASGS	Australian Statistical Geography Standard
ASGS RA	Australian Statistical Geography Standard Remoteness Areas
CDBS	Child Dental Benefit Schedule
CDC	Centers for Disease Control
CDHS	Child Dental Health Survey
CHD	Chronic Heart Disease
CKD	Chronic kidney disease
COPD	Chronic obstructive pulmonary disease
CVD	Cardiovascular disease
dmft	Decayed, missing (due to decay), filled (deciduous) teeth
DMFT	Decayed, missing (due to decay), filled (permanent) teeth
DRISS	Dental Relocation and Infrastructure Support Scheme
ERP	Estimated resident population
GP	General practitioner
IHT	Inter hospital transfer
MBS	Medical Benefits Schedule
NGO	Non Government Organisation
NSW	New South Wales
NATSIHMS	National Aboriginal and Torres Strait Islander Health Measures Survey
NDTIS	National Dental Telephone Interview Survey
NSAOH	National Survey of Adult Oral Health
NICE	National Institute for Health and Care Excellence
NT	Northern Territory
OECD	Organisation for Economic Co-operation and Development
PE	Primary evacuation
PHCAG	Primary Health Care Advisory Group
PPH	Potentially preventable hospitalisation
QLD	Queensland
RAP	Reconciliation Action Plan
RFDS	Royal Flying Doctor Service
RHD	Rheumatic heart disease
SA	South Australia
SEIFA	Socio-Economic Indexes for Areas
SES	Socioeconomic status
TAS	Tasmania
VIC	Victoria
WA	Western Australia
WHO	World Health Organization

Foreword

Brent Finlay



You won't be surprised to hear I'm not an expert on dental health services. I was curious as to why I was approached by the Royal Flying Doctor Service to help out with their research into ways in which the dental health of rural residents could be improved.

The logic is obvious. Thousands of farmer families like mine live and work in rural Australia. We sacrifice and miss out on comforts that people in the city take for granted. We also accept at times, that because we live great distances from city centres, we also miss out on some services. There are a few services that country residents can't do without. Access to schooling is one. Access to health care is another. Again, with both schooling and health care, country people are willing to wait and travel, and we're lucky the Royal Flying Doctor Service, in many parts, brings health care to us.

Dental care in rural Australia is another service country residents can't do without. It's also a service not often available. Yet it's rare to hear of an uproar when a country resident has to drive for hours to see a dentist, most often in an emergency. It happens. It happens regularly.

The Australian political process and media does not often consider the shortage of dental services and oral health prevention programs in country Australia. I'm therefore proud to lend the support of the National Farmers' Federation to Royal Flying Doctor Service efforts to make the case for better dental care in the country.

This Royal Flying Doctor Service research and policy paper shows country residents have higher rates of tooth decay, higher rates of gum disease, and greater risk of having teeth extracted than people who live in cities.

The paper outlines the many reasons for this, a key reason being few opportunities to see a dentist.

The research and policy paper also makes recommendations about actions governments and communities can take to provide better dental care. Action is urgent, as the paper shows poor oral health is associated with some illnesses, and that poor oral health impacts work and productivity.

The Royal Flying Doctor Service is so important to country communities. It's a key part of the social infrastructure of many towns. It's a credible national charity with eight decades of experience in providing health services over vast distances that are part of living and working in country Australia.

The National Farmers' Federation stands with the Royal Flying Doctor Service in wanting to improve the dental health of country Australians as a means of improving the overall health and sustainability of country communities.

A stylized, handwritten signature in black ink, appearing to read 'Brent Finlay'.

Brent Finlay

President, National Farmers' Federation



Executive summary

Residents of remote and rural Australia have poorer oral health than residents of major cities in Australia. While approximately one quarter (23%) of adults living in major cities have untreated tooth decay, prevalence increases as distance from a capital city rises, with more than one third (37%) of remote area residents living with untreated decay. Untreated tooth decay for Indigenous Australians is even higher, with more than half (57%) of Indigenous Australians having one or more teeth affected by decay.

A similar measure, the prevalence of gum disease, also proves the existence of a disparity in oral health between remote and rural and major city residents. One in five (22%) major city adults have gum disease, with this prevalence again rising to more than one in three (36%) in remote Australia.

Assessment of child oral health outcomes between city and country presents similar findings. Dental decay can be half (55%) more likely again for remote area children than children in major cities, and the number of filled teeth can be more than double (117%) for remote area children than children of major cities.

The disparity in oral health outcomes between city and country is directly related to disparities in dental care availability and access. On average, more than six in ten (63%) major city adults visited a dentist in a year, compared to little more than four in ten (45%) in remote areas. When dental visits occurred, people from remote areas required more acute interventions; one in three (33%) remote area residents had a tooth extraction in a year compared to a little more than one in ten (12%) people from major cities. Access is limited by the availability of dental professionals in remote areas; major cities have been found to have 72.3 dentists per 100,000 people compared to 22.7 per 100,000 people in remote areas.

This disparity in oral health outcomes between city and country is also influenced by a greater prevalence of oral health risk factors and barriers to access and availability in country Australia. Risk factors and barriers relating to diet, tobacco use, harmful alcohol use, stress, dental hygiene, health literacy, access to fluoridated water, dental product cost, and fruit and vegetable access are more acute in country areas than in major cities. For example, a basket of healthy food has been found to cost \$24 more per fortnight in rural areas than in a major city. The impact of social determinants of health is also felt more acutely in country areas.

The Royal Flying Doctor Service (RFDS) has, over 85 years, been a provider of emergency aeromedical and primary health care services to remote and rural Australia. Cardiovascular disease (CVD) and respiratory illness are two of the three most common reasons for tasking of an RFDS emergency evacuation of a patient from remote Australia by air (the other being trauma). Oral disease, particularly when left untreated, is associated with certain cardiovascular diseases, respiratory illnesses, and other chronic diseases. Other diseases that trigger RFDS emergency evacuation of patients, including endocarditis, (inflammation of the lining of the heart) stroke, aspiration pneumonia, diabetes, kidney disease, and some adverse pregnancy outcomes, are also associated with poor oral health.

Recognising this link between oral health and illness, and having witnessed dental service shortages in parts of remote and rural Australia, the RFDS commenced delivery of new dental and oral health care and prevention programs, and expanded delivery of older established programs. In the 2012-2013 financial year, the RFDS operated 11 separate oral health programs in all states and territories except the Australian Capital Territory (ACT). These programs were accessed by 11,519 people, an increase in activity of 9% on the previous year when 10,113 people were seen.

Adverse impacts of oral conditions have been estimated to be greater over a twelve month period than the effect of all infectious diseases combined. One in ten adults (9%) missed half a day of paid work due to a dental problem.

Whereas long term improvements in oral health indicators were achieved in Australia during the 1970s and early 2000s, recent evidence indicates these positive trends have plateaued or started to go backwards; 31% of the adult population reported an oral health impact in 1994 compared to 39% in 2008. To halt a further national decline in oral health, and to address the disparity in city and country oral health outcomes and access, evidence supports the need for a new commitment to dental health public policy reform.

Government responsibility for oral health funding in Australia is contentious. More than half (58%) of the cost of dental services have been met by individuals, 18% by the Commonwealth, and 8% by State and Territory Governments. The *Commonwealth of Australia Constitution Act 1900* s51 (xxiiiA) empowers the Commonwealth to provide for dental services.

Within this context of the Commonwealth having constitutional responsibility, evidence suggests – and the recommendations of this report are – that dental health public policy reform should consider whole of population, targeted, and individual approaches to improve oral health outcomes for remote and rural Australians, and indeed all Australians.

A draft *National Oral Health Plan 2015-2024* has been developed, but has not yet been finalised for release. Slated as a blue print for united action by states, territories and the Commonwealth, it identifies rural and remote residents as a priority group who display higher rates of poor oral health, face significant challenges in accessing oral health services, and need targeted additional strategies to overcome these inequalities. The national plan should be finalised and implemented, and given the resources it needs to succeed.

In finalising the *National Oral Health Plan 2015-2024* to ensure it sufficiently allows for prevention of poor oral health, this report presents evidence that supports recommendations to address continued gaps in water fluoridation, regulation of television advertisements promoting unhealthy food and drinks, legislation on food labelling and nutritional claims, taxation and legislation around harmful products such as tobacco, implementing strategies to reduce costs of healthy food outside of major cities, integrating oral health programs into primary care, and lessening of taxes around oral health hygiene products in remote and rural areas. Oral health prevention messages should also be included in general health promotion programs.

In finalising the *National Oral Health Plan 2015-2024* to ensure it sufficiently allows access to oral health services in remote and rural areas, this report presents evidence that supports recommendations to expand incentives for oral health professionals to work in remote and rural areas, and oral health students to train in, and experience, working in country Australia. Dental outreach programs should be provided where, for reasons of market failure, dental practices are not sustainable.

Finally, given the links between chronic disease and oral health status, this report presents evidence that supports recommendations to expand oral health service access as part of chronic disease management. The Primary Health Care Advisory Group (PHCAG) should consider the role of oral health services as part of specific chronic disease management.

1.0 Purpose statement

Poor oral health is one of the most common health problems affecting remote and rural Australians, who experience poor oral health at significantly higher rates than people living in major cities (Oral Health Monitoring Group, 2014). Provision of timely and accessible dental services is recognised as fundamental to improving oral health outcomes in remote and rural Australia. Unfortunately, residents living in these areas often experience an irregular presence of oral health professionals and sporadic provision of dental services.

As the primary, and often only, healthcare provider in some parts of remote and rural Australia, the RFDS has first-hand experience of the impacts of poor oral health on remote and rural Australians. The RFDS has responded by establishing a range of state-based remote and rural outreach, fly-in, fly-out and mobile oral health services. However, the demand for these oral health services in remote and rural Australia far outweighs the supply, and significant service gaps remain.

Consequently, the RFDS produced this discussion paper to highlight the poor oral health of remote and rural Australians, the lack of timely and accessible dental services, and to identify ways to improve oral health for remote and rural Australians. It was developed to highlight the oral health disparities between remote and rural Australians and those living in major cities. It gives voice to remote and rural Australians and champions a solution-focused framework for improving oral health. It considers appropriate, cost effective, and policy relevant solutions. Furthermore, it provides the platform for discussions between service delivery organisations, researchers, policy makers, corporate and private sectors, and philanthropic organisations to identify collaborative and innovative approaches to improving remote and rural oral health status.

To achieve this, the discussion paper comprises eight sections. Section one describes the purpose of the report. Section two provides the background for the discussion paper. Section three defines remote and rural Australia. Section four considers the general health status of remote and rural Australians and describes the role of the RFDS in providing primary health care and other services in remote and rural regions. Section five describes the oral health of Australians and includes discussion on dental health indicators, general oral health in Australia, oral health of remote and rural Australians, social determinants of health, an integrated risk factor approach to oral health, the links between oral health, overall health and diseases, risk factors for poor oral health in remote and rural areas, and barriers to accessing oral health services in remote and rural areas. Section six describes the role of the RFDS in provision of remote and rural oral health services and includes specific information about the oral health programs delivered by the RFDS and the usage and uptake of these services. Section seven presents examples of potential evidence-based solutions and discusses innovative approaches to improving oral health for rural and remote Australians. Section eight concludes the report.

2.0 Background

Oral Health is fundamental to overall health, wellbeing and quality of life (Australian Institute of Health and Welfare, 2014d). The World Health Organization (WHO) defines oral health as “a state of being free from mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal (gum) disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual’s capacity in biting, chewing, smiling, speaking, and psychosocial wellbeing” (World Health Organization, 2012).

Good oral health contributes positively to physical, mental and social wellbeing and enables people to speak, eat and socialise unhindered by active disease, pain, discomfort or embarrassment (Canadian Dental Association, 2015; National Advisory Committee on Oral Health, 2004; United Kingdom Department of Health, 1994). Conversely, poor oral health can have deleterious impacts on speech, sleep, productivity, self-esteem, psychological and social wellbeing, relationships and general quality of life (Oral Health Monitoring Group, 2014). Poor oral health is more likely to be present in individuals with poor general health and vice versa (Australian Institute of Health and Welfare, 2014d).

The burden of disease associated with oral health in Australia is large (Russell, 2014). Tooth decay is Australia’s most prevalent health problem, even though it is largely preventable through population level interventions and individual practices (NSW Health, 2013). Around 25% of adults have untreated tooth decay (Roberts-Thomson & Do, 2007) and tooth decay is five times more prevalent than asthma among children (Rogers, 2011). Other oral health conditions impacting Australians include periodontal (gum) disease, edentulism (loss of all natural teeth), oral cancer and oral trauma (Crocombe, Slack-Smith, Bell, & Barnett, 2014; Richardson & Richardson, 2011; Roberts-Thomson & Do, 2007; Rogers, 2011). When considering quality of life, “the impact of oral conditions is estimated to be greater over a 12-month period than the effect of all infectious diseases combined or of either breast cancer or lung cancer” (Richardson & Richardson, 2011, p. 2; Russell, 2014, p. 641).

In addition to impacting on health and quality of life, oral health imposes a financial burden on individuals, governments and health funds. In 2012-2013, just over \$8.7 billion was spent on dental services in Australia. Of this expenditure, \$5.07 billion (58.2%) was contributed through individual out-of-pocket expenses (Australian Institute of Health and Welfare, 2014, p. 65). The Commonwealth provided \$1.55 billion, which represented 6.8% of its primary health care expenditure (extrapolated from Australian Institute of Health and Welfare, 2014, p. 65). The remaining expenditure was contributed by state and territory governments, private health insurance funds and other sources.

Oral health, therefore, is a significant issue for all Australians. However, there are marked inequalities in oral health in Australia (Rogers, 2011). Some groups of Australians experience poor oral health at significantly higher rates than the general population (Oral Health Monitoring Group, 2014). These populations include people living in remote and regional areas (Oral Health Monitoring Group, 2014), people who are socially disadvantaged or on low incomes (Oral Health Monitoring Group, 2014), Aboriginal and Torres Strait Islander people (Oral Health Monitoring Group, 2014), people with additional and/or specialised health care needs (Oral Health Monitoring Group, 2014), dependant older people (National Advisory Committee on Oral Health, 2004; Rogers, 2011), and some immigrant groups from culturally and linguistically diverse backgrounds (National Advisory Committee on Oral Health, 2004; Rogers, 2011).

As previously outlined, the current discussion paper specifically explores the oral health of remote and rural Australians¹. This group has been chosen because they are the main recipients of primary healthcare, including oral health services, provided by the RFDS, who developed this paper.

¹ People living in remote and rural areas may also be socially disadvantaged, on low incomes, or Indigenous (or a combination of all of these). Indigenous oral health is a complex issue, and although it is discussed in the context of remote and rural Australia in the current paper, the authors recognise that separate Indigenous focused oral health research and reform must continue.

3.0 Defining remote and rural Australia

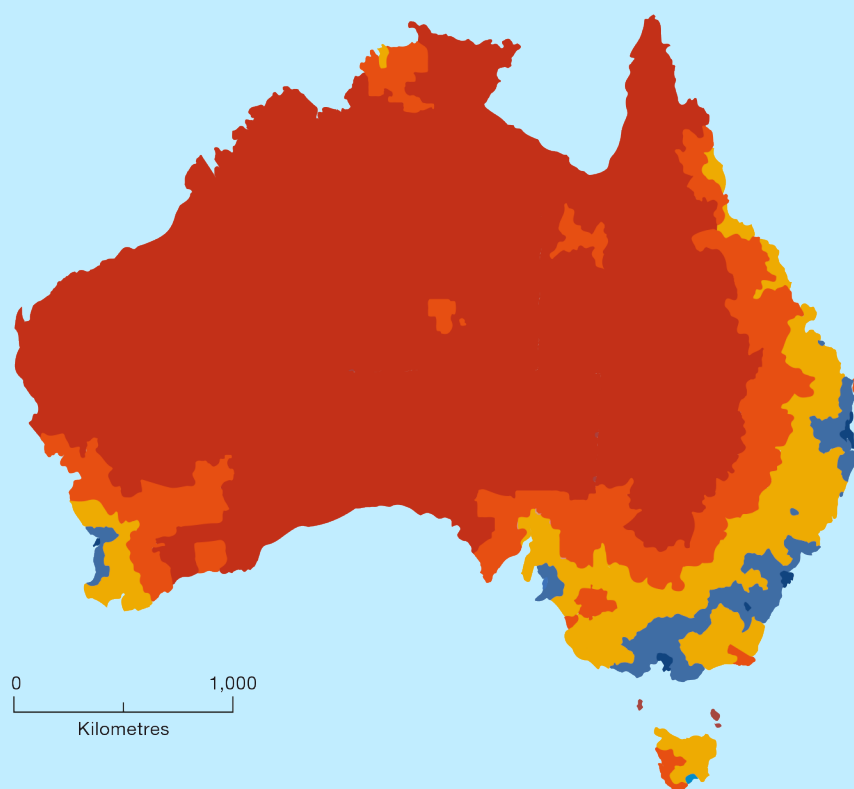
For the purpose of this paper, the term ‘remote and rural’ is used to encompass all areas outside Australia’s major cities.

This includes areas that are classified as inner and outer regional (RA2 and RA3 respectively) and remote or very remote (RA4 and RA5 respectively) under the Australian Standard Geographical Classification System Remoteness Areas (ASGC RA)². The ASGC RA allocates one of five remoteness categories to an area (major cities, inner regional, outer regional, remote and very remote), based on its distance from a range of five types of population centres. Each of these remoteness categories are also defined by population characteristics.

The remoteness areas of Australia are represented in Figure 1 and the proportion of the Australian land mass in each ASGC RA classification, and the proportion of the population residing in each ASGC RA area, is represented in Table 1.

Figure 1. Remoteness areas of Australia

■ Major Cities ■ Inner Regional ■ Outer Regional ■ Remote ■ Very Remote



Map produced by Australian Bureau of Statistics
2006 ASGC Remoteness Structure: Remoteness Area Boundaries
© Commonwealth of Australia, 2007

Source: National Rural and Remote Support Service (2015)

² The ASGC RA has been replaced by the Australian Statistical Geography Standard (ASGS) Remoteness Areas (RA), a new geographical framework that was introduced in July 2011. However, due to the lag time between data collection and production of statistics, there are few current publications that report ASGS RA data. The majority of data used in this report were collected using the ASGC RA, therefore this classification is used. Note that the new ASGS RA categories are very similar to those used in the ASGC RA.

Table 1. Area (and proportion) of Australian land mass, and population (and proportion), by ASGC RA Classification

ASGC RA Classification	Examples of locality	Area (sq. km)	Area (%)	Population (N)	Population (%)
Major cities (RA1)	Most capital cities, major urban areas such as Newcastle, Geelong, the Gold Coast	23,076	0.3	16,490,471	70.2
Inner regional (RA2)	Cities and towns such as Hobart, Launceston, Mackay, Tamworth, Yass, Capertee, Canowindra, Dalby, Taillem Bend, Ararat, Dunsborough	246,145	3.2	4,322,289	18.4
Outer regional (RA3)	Cities and towns such as Darwin, Whyalla, Cairns, Gunnedah, Ross, Biloela, Wialda, Nhill	830,739	10.8	2,137,654	9.1
Remote (RA4)	Cities and towns such as Alice Springs, Mount Isa, Esperance	1,015,347	13.2	328,870	1.4
Very remote (RA5)	Towns such as Tennant Creek, Longreach, Coober Pedy	5,576,717	72.5	211,416	0.9
Total		7,692,024	100	23,490,700	100

Source: Data extrapolated from Australian Bureau of Statistics (2013a), Garvan Research Foundation (2015), Geoscience Australia (2015).

Major cities comprise only 0.3% of Australia's land mass (Garvan Research Foundation, 2015), yet the majority (70.2%) of Australians live in these areas (Australian Bureau of Statistics, 2013a). The remaining population is not evenly distributed throughout the country – 18.4% live in inner regional areas, 9.1% in outer regional areas, 1.4% in remote areas and 0.9% in very remote areas (Australian Institute of Health and Welfare, 2014b).

Australia's estimated resident population (ERP) was 23,490,700 in June 2014 (Garvan Research Foundation, 2015). Table 1 shows that 29.8% of the population live outside Australia's major cities (Australian Institute of Health and Welfare, 2014b). This equates to around seven million Australians who reside in remote and rural areas. Over half a million (540,286) people live in either remote, or very remote, areas of Australia.

4.0 General health status of remote and rural Australians

Australia's remote and rural areas differ significantly in their location, economic activities, climate and demography (Australian Institute of Health and Welfare, 2010). Consequently, health status may vary within each of the broad remoteness categories (Australian Institute of Health and Welfare, 2010). However, the evidence indicates that as a whole, remote and rural Australians generally experience poorer health than people living in major cities, including higher levels of mortality, morbidity and health and disease risk factors (Australian Institute of Health and Welfare, 2008, 2014b).

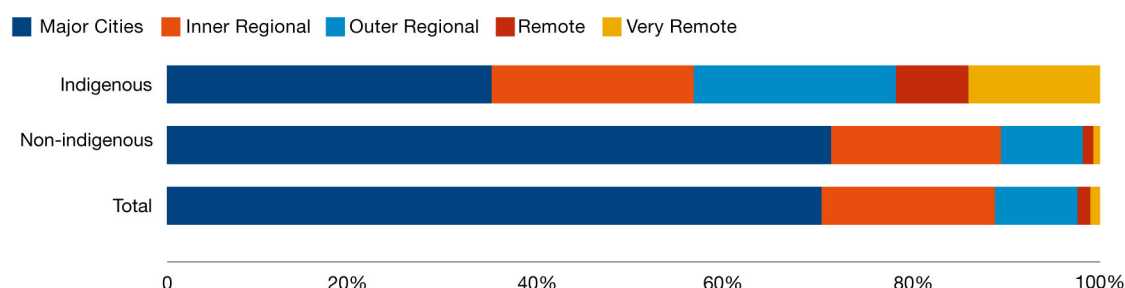
For example, In 2009-2010, death rates from CHD in men living in remote/very remote areas were 1.3 times higher than for men in major cities, and 1.2 times higher for women (The Centre for International Economics, 2015). In 2008-2009 prevalence of diabetes in remote/very remote areas was 4.9%, compared with 3.9% for people living in major cities (Australian Institute of Health and Welfare, 2014b; The Centre for International Economics, 2015). Rates of cancer between geographic localities varied by type of cancer. For example, people living in remote and very remote areas had 1.3-1.4 times higher incidence rates of cervical cancer, cancer of unknown primary site and lung cancer than people living in major cities, but 0.8-0.9 times lower rates of prostate cancer, breast cancer in females and non-Hodgkin lymphoma (Australian Institute of Health and Welfare & Australasian Association of Cancer Registries, 2012, p. 51). However, the five-year survival rate from all cancers was higher for people living in major cities (67%) compared to people who live in remote/very remote (63%) areas (Australian Institute of Health and Welfare & Australasian Association of Cancer Registries, 2012).

When the composition of remote and rural residents is considered, it is clear that a disproportionately large proportion of remote and rural residents are Indigenous Australians (Australian Institute of Health and Welfare, 2014b). Almost half (45%) of all people in very remote areas and 16% in remote areas comprise Indigenous Australians, compared with a 3% Indigenous representation in the total population (Australian Institute of Health and Welfare, 2014b). Most Indigenous Australians live in non-remote areas (79% in 2011) rather than remote areas (21%). By comparison, 98% of non-Indigenous Australians live in non-remote areas, while 2% live in remote areas (Australian Institute of Health and Welfare, 2014b). Figure 2 shows Indigenous, non-Indigenous and total population, by remoteness.

Across all remoteness areas, Indigenous Australians generally experience poorer health than non-Indigenous Australians (Australian Institute of Health and Welfare, 2014b). Life expectancy for Indigenous Australians is up to ten years less than for their non-Indigenous counterparts and Indigenous Australians are five times more likely to die from endocrine, nutritional and metabolic conditions, such as diabetes, than non-Indigenous Australians (The Centre for International Economics, 2015).

Indigenous Australians are more than twice as likely as non-Indigenous Australians to experience chronic kidney disease (CKD) (Australian Bureau of Statistics, 2014). The incidence of end stage kidney disease is 18-20 times higher amongst remote and very remote Indigenous Australians compared with a comparable sample of non-Indigenous Australians (Stumpers & Thomson, 2013).

Figure 2. Indigenous, non-Indigenous and total population, by remoteness, 30 June 2011



Source: Data extrapolated from Australian Bureau of Statistics (2013a).

Compared with non-Indigenous Australians, and after adjusting for age composition, Indigenous Australians are 3.3 times more likely to have diabetes than non-Indigenous Australians (Australian Institute of Health and Welfare, 2014b).

Biomedical data collected between 2011-2013, through the National Aboriginal and Torres Strait Islander Health Measures Survey (NATSIHMS), found that when compared with Indigenous Australian adults in major cities, Indigenous Australian adults in remote areas were:

- > Two and a half times as likely to have signs of CKD (33.6% compared with 13.1%);
- > Around twice as likely to have diabetes (20.8% compared with 9.4%);
- > Five times as likely to have newly diagnosed diabetes (4.8% compared with 0.9%); and
- > Less likely to be effectively managing their diabetes (25.1% compared with 43.5%) (Australian Bureau of Statistics, 2014).

Although Indigenous Australians make up a higher proportion of residents residing in remote areas, this does not completely account for the generally poorer health of people living in remote areas (Australian Institute of Health and Welfare, 2014b).

High levels of social disadvantage (The Centre for International Economics, 2015) and income inequality are evident in many remote and rural areas. The Socio-Economic Indexes for Areas (SEIFA), which uses census data, ranks areas in Australia according to relative socioeconomic advantage and disadvantage, by considering people's access to material and social resources and their ability to participate in society (Australian Bureau of Statistics, 2013b). Comprising four subscales, variables considered in the index include income, education, employment, occupation, housing, and other miscellaneous indicators of relative advantage or disadvantage (Australian Bureau of Statistics, 2013b). A large proportion of remote areas have a low SEIFA ranking (The Centre for International Economics, 2015). The lower the score, the higher the disadvantage. More recent research has confirmed that people residing in capital cities are more likely to be in the top 20% of income earners, while those outside capital cities are more likely to be in the bottom 20% of income earners (Australian Council of Social Service, 2015). Around 39% of people living in remote areas have low socioeconomic status, compared to 24% in regional areas and 17% in major cities (Garvan Research Foundation, 2015). This means that in addition to the practical difficulties associated with living in remote and rural locations, a large proportion of clients serviced by the RFDS are also some of Australia's most socioeconomically disadvantaged.

Understanding the impact of socioeconomic factors is crucial in light of recent research claiming that socioeconomic factors account for 40% of all influences on health, rather than clinical care (20%) (The British Academy, 2014), which has traditionally been identified as the major influence on health. Other factors, including health behaviours (30%) and the physical environment (10%) also, impact on health (The British Academy, 2014).

In summary, there are several factors that contribute to poor outcomes for remote and rural Australians. In addition to the difficulties associated with availability and access to health services for people living in the most inaccessible regions of Australia, these groups are further disadvantaged in terms of educational and employment opportunities, income, access to goods and services, and access to clean water and fresh food (Australian Institute of Health and Welfare, 2008). Higher levels of socioeconomic disadvantage and a higher proportion of Indigenous Australians in remote and rural areas contributes to the generally poorer health of people living in these areas.

4.1 Role of the RFDS in primary healthcare provision in remote and rural Australia

Although unable to modify the socioeconomic factors influencing health, service providers such as the RFDS can provide clinical care to remote and rural Australians, where low population densities make it unviable to support locally operating health services.

By providing services to people who, because of geographic factors, are unable to access services under the Medical Benefits Schedule (MBS), the RFDS plays a pivotal role in the provision of universal access to primary healthcare. The RFDS is often the only organisation fulfilling the Commonwealth's obligation of delivering universal services, in an environment where market failure means it is unviable for permanent services to operate.

The RFDS is a federated health charity. Services are delivered through RFDS Sections and Operations, comprising RFDS Central Operations (includes South Australia (SA) and Northern Territory (NT)), RFDS Queensland (QLD) Section, RFDS South Eastern Section (includes New South Wales (NSW)), RFDS Tasmania (TAS), RFDS Victorian (VIC) Section and RFDS Western Operations (includes Western Australia (WA)). Each of the RFDS sections have responsibility for the delivery of health services to the communities they serve through the establishment of effective systems and maintenance of efficient operations. The sections are supported at a national level by the RFDS of Australia (Federation Office, Canberra).

In 2013-2014, the RFDS delivered health services to 282,000 remote and rural Australians. With a fleet of 63 aircraft, operating from 22 aviation bases spread across all Australian states and territories, the RFDS serviced 7,150,000 square kilometres of Australia. The RFDS operates a 24 hour, seven day a week, aeromedical evacuation service to patients experiencing a medical emergency who live, work or travel in remote and rural Australia and who are unable to access normal medical services.

CVD and respiratory illness are two of the three most common reasons for tasking of an RFDS aeromedical evacuation of a patient from remote Australia by air (the other being trauma). Oral disease, particularly when left untreated, is associated with certain CVDs and respiratory illnesses. Other diseases that trigger RFDS emergency evacuation of patients include endocarditis, stroke, aspiration pneumonia, kidney disease, diabetes and some adverse pregnancy outcomes. These are also associated with poor oral health (ORH, 2014).

The RFDS also provides inter hospital transfers (IHTs), medical and nursing clinics, remote telehealth consultations, medical chest supplies, outreach programs, health promotion and education activities, clinic charter services, evacuations by charter aircraft from tour vessels, and assistance with staffing other aeromedical services that provide rescue activities.

Activity levels for 2013-2014 are shown in Table 2.

Table 2. 2013-2014 RFDS activity levels

	Daily	Annually
Total patients attended	773	282,000
Aeromedical evacuations	149	54,705
Medical and nursing clinics	44	16,096
Remote telephone consultations	225	82,305
Aircraft landings	206	75,314
Distance flown (km)	72,358	26,410,611

Source: Data extrapolated from Royal Flying Doctor Service (2014)

In the last five years, the RFDS has also implemented a range of oral health programs using a variety of service delivery models. These are explored in section five.

5.0 Oral health in Australia

The oral health of Australians varies throughout the country. In order to demonstrate that remote and rural Australians have significantly poorer oral health than those who live in major cities, it is necessary to first explore overall national oral health status.

5.1 Dental health indicators

An understanding of the dental health indicators commonly used to measure oral health status in Australia is required if we are to draw meaningful conclusions from the data.

Dental caries experience (tooth decay) is a key indicator of oral health status (NSW Health, 2013). In deciduous (or baby) teeth (t), this is recorded as the number that are decayed (d), missing (m) due to decay, or filled (f) because of decay (dmft). Permanent caries experience (DMFT) describes the number of permanent teeth (T) that are decayed (D), missing (M) due to decay, or filled (F) because of decay (NSW Health, 2013). The sum of the three figures forms the dmft/DMFT value. Higher values correspond to a higher number of teeth affected by decay (Ha, Amarasena, & Crocombe, 2013).

Other factors that alert us to poor oral health include the presence of gum disease and oral cancer, and high numbers of potentially preventable hospitalisations (PPHs) for dental conditions.

In Australia, several population-based surveys have been undertaken with adults and children, many of which include dental examinations. Telephone surveys and other state and national data collection methods have also been used in Australia and these improve our knowledge of the dental health of Australians. Results from these surveys are incorporated into this discussion paper. (Tennant & Kruger, 2013). It should be noted that each survey employed different population sampling methodologies and each has methodological limitations. However, these surveys have generated valuable Australian data that are included in this discussion paper.

5.2 National oral health status

Long term improvements in the major measures of oral health were observed in Australia between the late 1970s and early 2000s (Australian Institute of Health and Welfare, 2014d). However, recent evidence indicates these positive trends have now plateaued or started to head in a negative direction (Australian Institute of Health and Welfare, 2014d). For example, from 1977 to 1995, data from school dental services revealed a decrease in the average number of baby teeth affected by decay, and between 1987-1988 and 2004-2006, national adult surveys indicated a reduction in the number of teeth affected by decay (Australian Institute of Health and Welfare, 2014d). Since 1996 Australia has recorded an increase in the number of children's baby teeth affected by decay, and from 1994 to 2009 (except for 2002), there was an increase in the proportion of people aged 15 years or older who reported any adverse oral health impact (Australian Institute of Health and Welfare, 2014d). The proportion reporting any oral health impact ranged from 31.4% in 1994 to 39.9% in 2008 (Australian Institute of Health and Welfare, 2014d).

Indigenous Australians traditionally displayed good oral health, but changes in lifestyle, including dependence on new introduced foods, have resulted in a significant decline in their oral health status over time (National Advisory Committee on Oral Health, 2004). Tooth decay and periodontal diseases were uncommon in rural and remote Indigenous communities up until the late twentieth century, when they became much more prevalent (Williams, Jamieson, MacRae, & Gray, 2011). Indigenous Australians now experience more decay, gum disease and tooth loss than non-Indigenous Australians (Williams et al., 2011).

5.2.1 Adults

Data from the 2010 National Dental Telephone Interview Survey (NDTIS) of 7,869 Australians, demonstrated that over one-third (37.5%) of adults had experienced a dental issue in the previous 12 months, such as a toothache, feeling uncomfortable with their dental appearance or having to avoid certain foods (Australian Institute of Health and Welfare, Harford, & Islam, 2013). Six in 10 (60%) adults visited a dentist in 2010 and of these visits, 60% were for a check-up (Australian Institute of Health and Welfare et al., 2013).

Earlier data from the 2004-2006 National Survey of Adult Oral Health (NSAOH), revealed that around 30% of adults had untreated tooth decay and around 40% had favourable dental visiting patterns (that is, they had a usual dental provider and visited a dentist once a year for a check-up, rather than visiting with a problem) (Australian Institute of Health and Welfare, 2014d; Oral Health Monitoring Group, 2014).

When compared with non-Indigenous Australian adults of a similar age, Indigenous Australian adults fare especially poorly – they have higher rates of dental decay, more missing teeth and worse gum disease (National Advisory Committee on Oral Health, 2004). Data from the 2004-2006 NSAOH found that the rate of untreated caries was 2.3 times higher in Indigenous Australians – 57% of Indigenous adults had one or more teeth affected by decay compared with 25% of non-Indigenous adults (Williams et al., 2011). Comparison of outcomes between the dental component of the 2006-2007 Wave-3 Aboriginal Birth Cohort (ABC) study of 442 16-20 year old Indigenous Australians, with 202 NSAOH (2004-2006) age-matched and nationally representative counterparts, demonstrated that the number of decayed teeth amongst the ABC Indigenous Australians was 8.0 times higher than for NSAOH participants (Jamieson, Sayers, & Roberts-Thomson, 2010). ABC participants had 10.8 times the prevalence of moderate to severe periodontal disease as the NSAOH participants (Jamieson et al., 2010). Indigenous Australians, therefore, have significantly poorer oral health than non-Indigenous Australians.

As well as physical consequences, dental problems also have economic consequences. In 2010, 9% of Australian adults missed half a day or more from paid work or study because of a dental problem and 4.6% had at least one episode of up to half a day of reduced activity (Harford & Chrisopoulos, 2012). It was estimated that this resulted in a cost to the economy of approximately \$103 million (Harford & Chrisopoulos, 2012).

5.2.2 Children

Understanding the oral health status of children is particularly important as dental caries often starts early in life may be predictive of later dental disease (Australian Research Centre for Population Oral Health, 2014).

Data from the 2009 Australian Child Dental Survey (CDS), which reported the state of dental health of 87,269 children examined through school dental services (SDSs), aged 5-14 years, from most Australian states and territories, except NSW and Victoria, demonstrated that dental decay was relatively common among Australian children, a minority of children experienced a greater amount of dental decay, and that dental decay varied across regions (Ha et al., 2013). Specifically, more than half (51%) of all 6 year olds had a history of decay in their deciduous (baby) teeth, with one or more decayed, missing, or filled because of dental caries (Ha et al., 2013). However, the limitations of the CDS should be acknowledged. Specifically, by excluding NSW and Victorian children, the CDS only measured a subset of Australian children, leaving the reader to extrapolate the results to the wider community (Tennant & Kruger, 2013).

In 2010, the proportion of children visiting a school dental service that had decayed, missing or filled teeth varied from 48% for 5 year olds to 63% for 9 year olds (Australian Institute of Health and Welfare, 2014d). On average, children aged 5 years had 2.32 decayed missing or filled baby teeth, those aged 8 years had 2.63 and those aged 10 years had 1.78 (this lower figure was related to them having fewer baby teeth) (Australian Institute of Health and Welfare, 2014d). Of children aged 12 years, almost half had experienced decay in their permanent teeth, and this figure was higher in older children (Australian Institute of Health and Welfare, 2014d).

Indigenous children demonstrate significantly poorer oral health than non-Indigenous children. As part of the 2007 NSW Child Dental Health Survey, 7,975 children, aged 5-12 years, from 107 primary schools in NSW, underwent a dental examination (Centre for Oral Health Strategy NSW, 2009). When compared to non-Indigenous children, Indigenous children, aged 5-12 years, experienced a significantly higher burden of dental decay in both deciduous and permanent teeth (Centre for Oral Health Strategy NSW, 2009). In WA, a study of 253 children aged between 2-4 years demonstrated that Indigenous children had more decay (69%) than non-Indigenous children (25%), and were also less likely to brush their teeth on a daily basis (50%) compared with non-Indigenous children (85%) (Dogar, Kruger, Dyson, & Tennant, 2011).

5.3 Oral health status of remote and rural Australians

Australians living in remote and rural areas have poorer oral health than people living in major cities, including more dental decay, higher rates of edentulism, higher rates of gum disease, less favourable dental visiting patterns (in that they were more likely to visit in response to a dental problem, visited a dentist irregularly and did not have a regular dentist) and higher rates of PPH admissions for dental problems. These patterns are observed in the dental health of both adults and children.

Data from multiple sources were extrapolated to provide a comprehensive picture of the oral health of remote and rural Australians. Comparable data are provided regarding the oral health status of Australians living in major cities. This facilitates a direct comparison of Australian's oral health status by remoteness.

5.3.1 Adults in remote and rural areas

Table 3 compares the oral health status of Australian adults between ASGC-RAs based on data extrapolated from the 2010 NDTIS (Australian Institute of Health and Welfare et al., 2013).

Table 3. A comparison of adult oral health status between ASGC remoteness areas in 2010

Dental indicator	Major cities	Inner regional	Outer regional	Remote/very remote
Mean number of missing teeth**	5.20	5.98	6.60	7.50
Visited a dental practitioner in the previous 12 months*	63.1%	55.7%	54.1%	45.8%
Reason for last dental visit – check-up*	62.0%	55.0%	50.7%	59.3%
Reason for last dental visit – problem*	38.0%	45.0%	49.3%	40.7%
Received tooth extraction in previous 12 months*	12.1%	17.3%	15.5%	33.0%
Dental visiting pattern – favourable*	52.7%	44.4%	35.2%	34.1%
Difficulty paying \$150 dental bill*	18.7%	20.7%	17.4%	8.3%

*Dentate respondents aged 18 years and over who made a dental visit in the previous 12 months

**Adults aged 18 years and over

Note: Data reported to one decimal place where available, remote/very remote responses combined in publication

Source: Australian Institute of Health and Welfare et al. (2013), Chrisopoulos and Harford (2013)

The data demonstrated that people living outside of major cities had significantly poorer oral health than those living in major cities, across multiple oral health domains. Specifically, the data demonstrated that:

- > Adults living outside major cities had more missing teeth (5.98-7.50) than those living in major cities (5.20), and the number of missing teeth increased with increasing remoteness;
- > Adults in major cities (63.1%) were more likely to have visited a dentist in the previous 12 months than those living outside of capital cities (45.8%-55.7%). The percentage of people who had visited a dentist decreased with increasing remoteness;
- > Across all remoteness categories, adults were more likely to have visited a dentist for a check-up rather than a problem, in the previous 12 months;
- > Significantly more adults living in remote/very remote areas (33.0%) had received a tooth extraction in the previous 12 months, compared with adults living in major cities (12.1%);
- > Adults who lived in remote/very remote areas were less likely to report difficulty paying a \$150 dental bill than those residing in other areas (8.3% compared with 17.4% or more); and
- > Adults in major cities had higher rates of favourable attendance (52.7%) than those in remote/very remote areas (34.1%). The percentage of favourable attendance decreased with increasing remoteness.

Data captured in earlier dental surveys are represented in Table 4.

Table 4. A comparison of adult oral health status between ASGC remoteness areas, various years

Dental indicator	Major cities	Inner regional	Outer regional	Remote/very remote
DMFT ^a	12.31	14.75	13.08	11.07
Untreated decay ^a	23.5%	29.8%	30.4%	37.6%
Gum disease ^a	22.1%	23.0%	28.5%	36.3%
Type of practice visited at last dental visit – private ^b	90.8%	83.8%	80.0%	71.4%
Type of practice visited at last dental visit – public ^b	5.1%	8.3%	8.6%	6.3%
Type of practice visited at last dental visit – School Dental Service (SDS) ^b	3.3%	6.7%	10.3%	21.2%
PPH separation rates for dental conditions ^c	2.6 per 1,000 population	3.1 per 1,000 population	3.1 per 1,000 population	3.7 (remote) and 4.1 (very remote) per 1,000 population

Source: Chrisopoulos and Harford (2013), Australian Institute of Health and Welfare (2014d) – this reference consolidates data from multiple sources, including: the National Dental Telephone Interview Survey 1994-2010; National Oral Health Survey, Australia, 1987-1988; National Survey of Adult Oral Health, 2004-2006

Note: Data reported to one decimal place where available, separation rates describe completed episodes of care, PPHs are hospital separations where the principal diagnosis of the hospitalisation is thought to be avoidable.

^adentate people aged 15 and over, 2004-2006, ^bdentate people aged 5 and over who visited in last 12 months, 2010, ^cAll ages, from newborn, 2010-2011

These data also support the argument that people living outside of major cities have significantly poorer oral health across a number of oral health domains, than those living in major cities. The data in Table 4 demonstrated that in 2004-2006:

- > DMFT was highest among dentate (having one or more natural teeth) people aged over 15 living in inner regional areas;
- > Remote and rural dentate Australians aged 15 and over had higher rates of untreated decay and gum disease than people living in major cities, and that rates of both increased with increasing remoteness;
- > Of people aged over 5 years who sought dental care in 2010, the majority attended a private dental practice. However, significantly more people attended a private dental practice in major cities (90.8%) compared with remote/very remote (71.4%) residents; and
- > People living outside major cities were more likely to attend public dental clinics and use school dental services. Around one in five people (21.2%) attended a school dental service in remote/very remote areas compared to 3.3% in major cities. Use of school dental services increased with increasing remoteness.

In 2004-2006, people residing in remote and rural areas were more likely to suffer complete tooth loss, wear dentures, and have a higher mean DMFT than people living in capital cities (Roberts-Thomson & Do, 2007). Additionally, they were more likely to have an inadequate dentition (less than 21 teeth), 10.0% in capital cities, compared with 14.0% outside capital cities (Roberts-Thomson & Do, 2007).

5.3.2 Children in remote and rural areas

In 2009, data were collected on 74,467 children aged 5-12 years, who attended a school dental service (SDS), as part of the Child Dental Health Survey (CDHS) (Ha, Crocombe, & C Mejia, 2014). Routine dental examinations of the children, from Australian states and territories except NSW and VIC, provided the data for the 2009 CDHS (Ha et al., 2014).

Table 5 provides a comparison of child oral health status between remoteness areas in 2009 derived from bivariate analysis. The data demonstrated that children living outside of major cities had significantly poorer oral health than those living in major cities, across multiple oral health domains. Specifically, the data demonstrated that:

- > Mean DMFT of 8-12 year olds living outside major cities (0.65-1.12) was higher than for children who live in major cities (0.61), and highest in remote/very remote areas (1.12);
- > Mean dmft in 5-10 year olds was highest for children living in outer regional (2.69) and remote/very remote areas (2.69) compared with children living in major cities (1.91)
- > Deciduous teeth caries experience among children 5-10 years, and permanent teeth caries experience of 8-12 year old children, were significantly higher outside the major cities;

Using multivariate modelling, the researchers found that differences in child oral health status were not explained by being Indigenous, living in an area without water fluoridation or being of low SES (Ha et al., 2014). The researchers suggested that these findings may be explained in terms of the higher amount of disease in children that present to the clinic, the very limited access to dental care, or a different treatment philosophy in remote/very remote areas, compared with other regions for children (Ha et al., 2014).

Table 5. A comparison of child oral health status between ASGC remoteness areas in 2009, significant findings

Dental indicator	Major cities	Inner regional	Outer regional	Remote/very remote
DMFT(mean) ^a	0.61	0.80	0.65	1.12
Untreated caries(mean number) ^a	0.29	0.36	0.28	0.45
Filled teeth (mean number) ^a	0.29	0.37	0.34	0.63
dmft(mean) ^b	1.91	2.38	2.69	2.69
Untreated caries(mean number) ^b	0.89	1.20	1.16	1.37

^a 8-12 year olds, permanent teeth, ^b 5-10 year olds, deciduous teeth

Source: Ha et al. (2014)

Data from other surveys have yielded similar findings. For example, data from the 2007 NSW CDHS found that children aged 5-6 years, living in remote and very remote areas of NSW, had more than twice the number of decayed, missing and filled teeth than those living in major cities (Centre for Oral Health Strategy NSW, 2009). Of those 5-6 year olds with the poorest dental health, five teeth were affected by decay, which was three times the average for the age group as a whole (Centre for Oral Health Strategy NSW, 2009). Children aged 11-12 years, with the poorest dental health, had an average of 2.42 teeth affected by decay, more than three times the average for the age group (Centre for Oral Health Strategy NSW, 2009).

Other data from WA, demonstrated that rural preschool children were 1.3 times more likely than metropolitan children to be hospitalised for decay, providing additional evidence for poorer oral health in children from remote and rural areas (Dogar et al., 2011).

More recently, Australian researchers conducted a Monte Carlo simulation for 273,000 Australian 12-year-old children (Tennant & Kruger, 2014) which demonstrated localisation of dental disease burden away from the cores of major cities and towns, and focused on remote and rural Australia (Tennant & Kruger, 2014).

5.3.3 Child Dental Benefit Schedule

The Child Dental Benefits Schedule (CDBS) commenced on 1 January 2014 (Department of Health, 2014). It is a means tested payment providing \$1,000 per child, over two calendar years, to those in receipt of Family Tax Benefit Part A or a relevant Australian Government payment (Department of Health, 2014). It was initiated to provide access to benefits for basic dental services including examinations, x-rays, cleaning, fissure sealing, fillings, root canals and extractions for families requiring additional financial support (Department of Health, 2014). Benefits are not available for orthodontic or cosmetic dental work and cannot be paid for any services provided in a hospital (Department of Health, 2014).

One of the strategies outlined in the Draft National Oral Health Plan is to promote the use of CDBS for children in priority areas (Oral Health Monitoring Group, 2014), which includes remote and rural Australia. However, the CDBS can only be accessed in areas where a dental service is operating. For people living in remote and rural areas that are not serviced by a dentist, the CDBS is unavailable. In order to ensure equitable access to the CDBS, monitoring of uptake is needed in remote and rural Australia. Funds should be set aside for a children's outreach service, to enable children's dental services to be delivered in remote and rural areas, where there is no regular access to dental services.

"It is always sad to see kids with a mouthful of cavities, but unfortunately in rural and remote areas this seems to be more common than not. Lack of access to dental services, lack of fluoride, and lack of oral health education all contribute to the higher rate of decayed and missing teeth in the kids in these areas. Unfortunately the neediest kids need the most treatment – this could not be more true than in remote areas of Australia."

Dr Lyn Mayne, RFDS dentist, South Eastern Section

5.3.4 Summary of oral health status of adults and children in remote and rural Australia

The data clearly demonstrate that adults and children living in areas outside of major cities have poorer oral health than people who live in major cities. Furthermore, one study found that differences in oral health still exist between adults and children residing in remote/rural areas, compared to those in major cities, even after controlling for SES, Indigenous status and water fluoridation (Ha et al., 2014). This indicates that there may be other factors influencing the oral health status of remote and rural Australians.

In summary, people in remote and rural areas have:

- > Higher DMFT/dmft rates;
- > More decay;
- > More filled teeth;
- > Higher rates of gum disease;
- > Higher rates of edentualism;
- > Higher rates of missing teeth;
- > More potentially preventable hospitalisations from oral disease; and
- > Lower rates of favourable dental visiting patterns and higher rates of unfavourable visiting patterns.

As a general rule, oral health status declines with increasing remoteness, meaning that people who live in the most remote areas of Australia have the worst oral health of all Australians.



Patient with decay attending an RFDS dental clinic

5.4 Social determinants of health and an integrated risk factor approach to oral health

The disparities in oral health between remote and rural Australians and those living in major cities can be explored by considering the social determinants of health and risk factors that impact them.

“The social determinants of health are the conditions in which people are born, grow, live, work and age,” and these “are shaped by the distribution of money, power and resources at global, national and local levels” (World Health Organization, 2015a). There are many social determinants that influence oral health including social, economic, environmental, political, behavioural and biological factors, and cultural perceptions (Victorian Department of Health, 2013). Examples of these social determinants include access to education, access to healthcare, employment status, income, access to affordable housing, stress, age, race, transport, disability (World Health Organization, 2015a). These social determinants impact on oral health knowledge and behaviour (oral health literacy) (Victorian Department of Health, 2013) as well as access to, and availability of, health services and interventions (Smith, Kruger, Dyson, & Tennant, 2007).

In addition to the broader social determinants of health, there are several common risk factors that are implicated in a variety of diseases, including oral disease and poor oral health. An integrated risk factor approach recognises that oral diseases share common risk factors with many chronic diseases, as well as other health conditions such as overweight and obesity, heart disease, stroke, cancer, and diabetes (NSW Health, 2013). Key risk factors in many of these conditions include diet, tobacco use and alcohol consumption (Australian Research Centre for Population Oral Health at The University of Adelaide South Australia, 2011; Sheiham & Watt, 2000).

Figure 3 shows the common risk factor approach to oral health and other chronic conditions. It also shows the broader social determinants of health that can influence oral health knowledge and behaviour.

Figure 3. Common risk factor and social determinants of health approach to oral health and other chronic conditions



Figure 3 demonstrates that there are seven major risk factors for chronic diseases, including smoking, alcohol consumption, exercise, diet, stress and control, environmental hygiene and injuries. In terms of oral health, the major risk factors contributing to poor oral health include poor diet and smoking (Oral Health Monitoring Group, 2014). Explicit links between poor diet and tooth decay, and tobacco use and gum disease are observed.

5.5 Oral health, overall health, and diseases

The previous section proposed that many diseases share common risk factors. Recent research has established associations between oral diseases and specific health conditions and chronic diseases (Australian Research Centre for Population Oral Health at The University of Adelaide South Australia, 2011).

Oral disease, especially if untreated or poorly managed, is associated with systemic diseases, including CVD (Mattila, Pussinen, & Paju, 2005; Petersen & Yamamoto, 2005; Shanker & Kakkar, 2009; Sheiham & Watt, 2000) and respiratory diseases (Petersen & Yamamoto, 2005).

Diseases such as infective endocarditis, stroke, aspiration pneumonia and adverse pregnancy outcomes may also be associated with poor oral health (Rogers, 2011; Russell, 2014).

Similarly, chronic conditions, such as some types of cancer (Bui, Markham, Ross, & Mullen, 2013), CHD, diabetes, osteoporosis, obesity and malnutrition are also associated with poor oral health (Oral Health Monitoring Group, 2014).

Chronic gum infections, such as periodontitis, can adversely affect blood sugar control and the incidence of diabetes complications (Taylor & Borgnakke, 2008). Given that people with diabetes are estimated to experience periodontitis at more than double the rate of people without diabetes (Taylor & Borgnakke, 2008), and people in remote and rural areas of Australia have higher rates of diabetes than people living in major cities, this association is significant. Importantly, timely periodontal treatment has been linked to improvement of glycaemic control in type 2 diabetic patients and this improvement is maintained for at least three months (Teeuw, Gerdes, & Loos, 2010). Other research has suggested a bidirectional relationship between diabetes and periodontitis including a direct and dose-dependent relationship between periodontitis severity and diabetes complications and an increased risk for diabetes onset in patients with severe periodontitis (Chapple & Genco, 2013).

Periodontitis has also been associated with atherosclerotic cardiovascular disease (ACVD) (Tonetti & Van Dyke, 2013). There is consistent and strong epidemiological evidence that periodontitis is a risk factor for future cardiovascular disease, after controlling for other risk factors, and moderate evidence that treatment of periodontitis reduces systemic inflammation (Tonetti & Van Dyke, 2013).

Acute rheumatic fever (ARF) and rheumatic heart disease (RHD) are examples of illnesses that can be impacted by poor oral health (Carapetis et al., 2007). ARF is an autoimmune response to bacterial infection with Group A streptococcus that can result in RHD (damage to the heart, specifically the mitral and/or the aortic valves, that can occur secondary to rheumatic fever) (Carapetis et al., 2007). Compared with other countries around the world, Australia has the highest documented rates of ARF and RHD in Indigenous communities (Carapetis et al., 2007). ARF and RHD are almost exclusively restricted to Indigenous Australians living in regional and remote areas of central and northern Australia (Australian Institute of Health and Welfare, 2004) and are most common amongst children between 5 and 15 years of age (State Government of Victoria, 2014). Ongoing dental care amongst people with ARF and RHD is indicated in order to reduce the risk of endocarditis (Carapetis et al., 2007). Good dental hygiene is even more important for people prone to RHD, since oral bacteria entering the bloodstream can increase the risk of heart complications such as endocarditis (State Government of Victoria, 2014).

Associations between oral health and kidney disease have also been suggested. Recent research demonstrated that “periodontitis and other manifestations of poor oral health, are common in patients with CKD and may contribute to increased morbidity and mortality because of systemic consequences such as inflammation, infections, protein-energy wasting, and atherosclerotic complications” (Akar, Akar, Carrero, Stenvinkel, & Lindholm, 2011, p. 218)

In summary, there is emerging evidence of association between oral health, overall health, and some diseases. However, more research is needed to quantify the strength of these associations. This is especially relevant in remote and rural areas where poorer outcomes across a range of health conditions occur. Coupled with poorer oral health in remote and rural areas, actions to reduce inequalities in oral health between remote and rural residents and people who reside in major cities are urgently required.

5.6 Risk factors for poor oral health in remote and rural areas

The broad integrated risk factor approach recognises that many factors that cause or increase the development of poor general health also impact on oral health (Victorian Department of Health, 2013). In addition to the broader risk factors, there are multiple additional risk factors that contribute to the markedly poorer oral health experienced by people residing in remote and rural communities. Some of these are specific to oral health and some are relevant to both oral health and other chronic diseases.

There are several risk factors implicated in the development of poor oral health in remote and rural communities, including individual risk factors and systemic risk factors. Individual risk factors are within the control of individuals and can be modified by the individual. Systemic risk factors are outside of the control of individuals, and cannot be modified by the individual. Table 6 outlines the individual and systemic risk factors for poor oral health.

“More and more, oral health is being linked to general health, and good oral health can have a positive influence on systemic diseases such as cardiovascular disease, stroke, diabetes and low birth weight in babies. By providing oral health clinics alongside general practitioners, and other allied health staff, such as mental health workers and child and family care nurses, there are greater opportunities to provide integrated chronic disease care to our patients.”

Dr Lyn Mayne, RFDS dentist, South Eastern Section

Table 6. Individual and systemic risk factors for poor oral health in remote and rural communities

Risk factor	Description of impact
Individual	
Poor diet	Consumption of carbonated soft drinks, juices, and foods high in sodium, fat, and sugar, and low intake of fruit and vegetables, leads to increased risk of dental caries
Tobacco use	Tobacco use is associated with oral mucosal lesions, oral cancer, temporomandibular joint dysfunction and pain, and periodontal disease
Harmful alcohol use	High levels of alcohol consumption are linked with cancers of the mouth, pharynx and oesophagus, and increased dental caries
High stress and low control	Stressful life events affect physiological processes and increase risk behaviours such as smoking and oral hygiene which increase susceptibility to periodontal diseases
Poor dental hygiene	Low toothbrush ownership in some areas, sporadic teeth brushing, fluoridated toothpaste not used, results in excessive plaque build-up, increased dental caries and periodontitis
Poor oral health literacy*	Poor knowledge, attitudes and beliefs around maintaining good oral health practices. Unaware of importance of brushing, toothpaste use, good diet etc. This impacts on dental hygiene and overall oral health. May have poor clinical oral health but believe their oral health is good, leading to unfavourable visiting patterns and resulting in worse oral health
Systemic	
Reduced access to fluoridated water	Lack of access to fluoridated water is linked to increased dental decay
Limited access to fruit and vegetables	Can be a result of high costs associated with transporting fruit and vegetables to remote areas, resulting in high costs to consumer. Can result in increased consumption of cheaper foods with higher sugar and fat content resulting in increased risk of dental caries
High cost of dental products	Can be a result of high costs associated with transporting dental products such as toothbrushes, toothpaste, dental floss etc. to remote areas, resulting in high costs to consumer. Can result in poor dental hygiene and poor overall oral health
Poor oral health literacy*	Poor knowledge, attitudes and beliefs around maintaining good oral health practices. Unaware of importance of brushing, toothpaste use, good diet etc. This impacts on dental hygiene and overall oral health

Source: Australian Research Centre for Population Oral Health (2006), Crocombe et al. (2010), Do, Slade, Roberts-Thomson, & Sanders (2008), First Nations Health Authority (2014), Oral Health Monitoring Group (2014), Parker et al. (2012), Pavia, Pileggi, Nobile, & Angellillo (2006), Rogers (2011), Russell (2014), Sheiham & Watt (2000), Smith et al. (2007), Victorian Department of Health (2013)

* Is both an individual and systemic risk factor.

5.6.1 Poor diet

Poor diet is a risk factor for increased dental caries (Sheiham & Watt, 2000). Consumption of carbonated soft drinks and excess foods high in sodium and fat is linked to an increased risk of dental caries (Sheiham & Watt, 2000). Sugar consumption, especially consumption of non-milk extrinsic sugars, such as those added to food and drinks during processing and manufacturing, is also linked to increased risk of dental caries (Rogers, 2011; Sheiham & Watt, 2000). The consumption of fruit and vegetables is associated with a reduced risk of oral cancer (Pavia et al., 2006).

5.6.2 Tobacco use

Tobacco use is a risk factor for poor oral health (Sheiham & Watt, 2000). Smoking and the use of smokeless tobacco (e.g. chewing tobacco) contribute to poor oral health (Public Health England, 2014). In 2011-2012, 22% of Australians living in outer regional and remote areas were daily smokers, compared with 15% in major cities (Garvan Research Foundation, 2015).

Smoking is associated with oral mucosal lesions, oral cancer, temporomandibular joint dysfunction and pain, and periodontal disease (Sheiham & Watt, 2000; Tonetti & Van Dyke, 2013). Analysis of data from the 2004-2006 NSAOH demonstrated that former- and current-smokers had significantly higher periodontitis prevalence than never-smokers (Do et al., 2008). Furthermore, it was estimated that around 32% of Australia's two million cases of moderate-severe periodontal gum disease could be prevented by not smoking (Do et al., 2008).

5.6.3 Harmful alcohol use

Consumption of alcohol that places a person at risk of harm during their lifetime (risky alcohol drinking (lifetime)), is linked to poor oral health outcomes (Do et al., 2008). Lifetime risky drinkers are defined as people who consume more than two standard drinks per day (on average over a 12 month period) (National Health and Medical Research Council, 2015). Lifetime risky drinking is highest amongst Australians living in outer regional and remote areas (24%) compared with Australians living in major cities (19%) (Garvan Research Foundation, 2015). This is important, since harmful alcohol use is linked to a variety of oral cancers (National Health and Medical Research Council, 2015; Sheiham & Watt, 2000; Victorian Department of Health, 2013) and increased risk of dental caries (Do et al., 2008). Consequently, remote and rural Australians are at greater risk of poor oral health due to their higher lifetime risky alcohol consumption.

5.6.4 High stress and low control

Increased stress and perceived low control over one's life are linked to periodontal diseases (Sheiham & Watt, 2000). Stressful life events can adversely impact health outcomes by affecting physiological processes and increasing risk behaviours, such as harmful alcohol use and smoking (Sheiham & Watt, 2000). The two main risk behaviours – higher rates of harmful alcohol use and smoking – have already been established as having negative impacts on the oral health of people living in remote and rural communities.

Previous research has also found that farmers, farm workers and their respective families in rural Australia experience a range of stressors related to the physical environment, structure of farming families and the economic difficulties and uncertainties associated with farming (Fraser et al., 2005). These, and other stressors related to remoteness, such as social isolation and the need for long distance travel to reach services and potentially higher occupational risks associated with activities such as farming and mining (Garvan Research Foundation, 2015) potentially impact on levels of stress and feelings of control leading to poorer health outcomes, including poorer dental outcomes (Sheiham & Watt, 2000).

5.6.5 Poor dental hygiene

Because there are few dental services in remote areas, people living in these areas receive less education about good dental hygiene than people living in major cities (Royal Flying Doctor Service, 2015). They might not be aware of things that people in cities take for granted, such as the importance of regular tooth brushing, and using fluoride toothpaste (Royal Flying Doctor Service, 2015).

Adults who visit the dentist every year for a check-up are more likely to receive regular professional advice on oral hygiene (Harford, Ellershaw, & Spencer, 2011), suggesting that preventative dental checks play an important role in improving oral hygiene.

Consequences of poor oral hygiene include increased dental plaque, which is the main cause of gum inflammation and gum disease, and increased dental caries (Sheiham & Watt, 2000).

5.6.6 Poor oral health literacy

Oral health literacy is defined as “the degree to which individuals have the capacity to obtain, process, and understand basic oral health information and services needed to make appropriate health decisions and act on them” (National Institute of Dental and Craniofacial Research, National Institutes of Health, US Public Health Service, & US Dept of Health and Human Services, 2005, p. 176). Factors associated with poor oral health literacy include poorer health knowledge and health status, unhealthy behaviours, less utilisation of preventive services, higher rates of hospitalisations, increased health care costs, and poorer health outcomes (Lee, Divaris, Baker, Rozier, & Vann, 2012).

Research regarding disparities in oral health literacy between remote and rural Australians and those in major cities is sparse. One of the few studies undertaken in Australia assessed the oral health literacy of Indigenous rural dwelling Australians (Parker et al., 2012). The researchers found that people with lower oral health literacy employed greater problem-based dental service utilisation, had poorer oral health knowledge and displayed sub-optimal oral self-care behaviour than people with better oral health literacy (Parker et al., 2012). For example, prevalence of having had a tooth removed was higher among older people (38+ years), those with low oral health literacy scores, those who usually visited a dentist because of a problem, and those who believed cordial was good for teeth (Parker et al., 2012).

The evidence indicates that regardless of where a person lives, having a good knowledge about oral health is important in ensuring good oral health outcomes (Oral Health Monitoring Group, 2014; Rogers, 2011).

5.6.7 Reduced access to fluoridated water

“Water fluoridation is the topping up of the levels of naturally occurring fluoride in the water to strengthen teeth against tooth decay” (Australian Dental Association, 2015). It has been described as a socially equitable, efficient and effective health measure for reducing dental caries in the population (Australian Research Centre for Population Oral Health, 2006), although it is not mandatory in all states of Australia (Sivaneswaran, Chong, & Blinkhorn, 2010). Community water fluoridation was first introduced to Australia in 1953 in Beaconsfield, Tasmania and since that time, has been extended to many other areas of Australia (Al-Bloushi, Trolio, Kruger, & Tennant, 2012).

There is good evidence that water fluoridation improves population level outcomes (Cobiac & Vos, 2012), with the greatest health benefits accruing to those who are most disadvantaged” (National Advisory Committee on Oral Health, 2004, p. vi).

Presently, around 90% of Australians have access to fluoridated water (Australian Dental Association, 2015). Those areas without fluoridation are predominantly located in remote and rural areas (National Advisory Committee on Oral Health, 2004).

Evidence from Western Australia demonstrated that those with a highest burden of dental disease mostly resided in rural and remote areas where water is either not fluoridated, nor regulated, or low in fluoride, whilst those with low levels of dental disease (urban, high socioeconomic areas) had access to regulated fluoridated water (Al-Bloushi et al., 2012). Furthermore, a review of 59 worldwide studies that measured the effects of water fluoridation, found that substantial reductions in dental decay (20%-60%) occurred in populations with access to fluoridated water (Rugg-Gunn & Do, 2012).

5.6.8 Limited access to fruit and vegetables

Australians living in some remote and rural areas have limited access to fresh fruit and vegetables (Crocombe, Stewart, Brennan, Slade, & Spencer, 2013). In some remote communities, where access to fruit and vegetables are available, the high cost of these products is prohibitive (Ward, Coveney, Verity, Carter, & Schilling, 2012). Research undertaken in 2010 revealed that a typical family (comprising a 44 year old male and female, 18 year old female, 8 year old male) in rural South Australia would need to spend approximately \$24 per fortnight more than a family in a major city in order to buy a basket of healthy food (Ward et al., 2012). The researchers also demonstrated that the cost of buying healthy food increased with increasing remoteness (Ward et al., 2012).

With limited access to fresh fruit and vegetables, and the high cost of purchasing these products in some remote and rural areas, people do not always include them in their diet, even if they want to (Royal Flying Doctor Service Queensland Section, 2012). The result can be a poorer diet and an increased risk of dental caries (Sheiham & Watt, 2000).

High cost of fruit and vegetables in remote Australia

"...fruit and vegetables have to be brought in from the coast. If you buy a loaf of bread and a bottle of milk, you don't get much change out of \$10, and a single lettuce can cost between \$5 and \$10 and is usually a bit wilted by the time it gets to us."

Mr John Ferguson, Mayor of Bulloo Shire Council (QLD)

Source: Royal Flying Doctor Service Queensland Section (2012)

5.6.9 High cost of dental products

Basic dental hygiene products, such as toothpaste and toothbrushes, can be more expensive in remote areas (Royal Flying Doctor Service, 2015). With a greater proportion of rural and remote residents on low incomes, they are more likely to experience difficulty affording these products (Royal Flying Doctor Service, 2015). People who do not regularly use dental products demonstrate poorer overall oral health and increased dental caries.

5.7 Barriers to accessing oral health services in remote and rural areas

All of the factors described in section 5.6 influence oral health for people in remote and rural areas. However, people living in these areas also face a number of additional barriers related to accessing oral health services. Table 7 describes these barriers, their impact, and the resulting outcome for people living in remote and rural areas.

Table 7. Summary of barriers to accessing oral health services, their impact and result in remote and rural areas

Barrier	Impact	Result
Service availability /provision	Few permanent services, sporadic provision of temporary services, specialist services unavailable	People unable to access services even if they want/need to; have to travel further distances to larger towns to see dentists; difficulty getting dental appointments; more reliance on GPs and other health staff for emergency treatment, leading to greater use of antibiotics
Service access	Lack of transport, long travel distance	Unable to attend appointments because no available transport; long travel time to nearest service potentially prohibitive
Cost of dental treatment	High individual out of pocket expenses	Pattern of dental visiting for problems/crisis; less visits for preventative services
Workforce maldistribution	Few dental services available, where services exist, difficult to retain staff	Private dental practice models may not be viable, lack of personnel willing/able to work in remote area even if some infrastructure exists; where personnel other than dentists are willing/able to work, can be limitations to scope of practice therefore not all services available to population
Appropriateness of service	Person unlikely to visit service if not culturally appropriate	Higher rates of poor oral health amongst Indigenous Australians where culturally appropriate services unavailable
Lack of investment (government) in oral health	Appropriate oral health program not available	Higher rates of poor oral health in community

Source: First Nations Health Authority (2014), Lavery (2015), Meihubers (2012), Rogers (2011), Shiikha, Kruger, & Tennant (2015), Smith et al. (2007)

5.7.1 Service availability/provision

Compared with Australians living in major cities, remote and rural Australians have access to fewer health services (Crocombe, Stewart, Brennan, Slade, & Spencer, 2012), and the provision of health services reduces with increasing remoteness (The Centre for International Economics, 2015; Willie-Stephens, Kruger, & Tennant, 2014). Where no services exist, people are unable to have their dental needs met. Consequently, a lack of availability or provision of dental services in remote and rural Australia is a significant barrier to seeking dental treatment.

5.7.2 Service access

Timely access to oral health services is critical and facilitates opportunities for preventative dental checks, early diagnosis of oral diseases and conditions, and health promotion and educational awareness regarding oral health (Marino et al., 2014). Poor access to oral health services in remote and rural areas is well documented and is a major barrier to receiving oral health services (Crocombe et al., 2010; Crocombe et al., 2012). The Australian Institute of Health and Welfare's (AIHW) Access Relative to Need Index, which considers access to primary health care relative to predicted needs, demonstrated that people in areas outside major cities have poorer access to services and a higher need for these services (Australian Institute of Health and Welfare, 2014a). Reasons for poorer access to services may include longer distances to travel and perceived lack of time available for travel and lack of available transport (Oral Health Monitoring Group, 2014; The Centre for International Economics, 2015).

There was an increase in the proportion of dental visits for preventative checks between 1994 and 2008 (Richardson & Richardson, 2011). The proportion of people who visited a dentist for preventative dental care rose from 46% in 1994 to 55% in 2008 (Richardson & Richardson, 2011). However, the increase in preventative dental visits was not uniform, with remote and rural Australians being one of the groups that did not demonstrate the same increase in access for preventative checks (Richardson & Richardson, 2011).

5.7.3 Cost of dental treatment

The cost of dental treatment can be a significant barrier to accessing dental services in remote and rural areas. Australian data from 2011 demonstrated that the average out-of-pocket expense for individuals using dental services was \$203 per service (Services for Australian Rural and Remote Allied Health, 2014). In 2013-2014, individuals contributed around 58% of the total cost of dental treatment (Australian Institute of Health and Welfare, 2014), indicating that the cost of dental care falls largely on individuals in Australia (Chrisopoulos, Luzzi, & Brennan, 2013).

Although there was an increase in the proportion of dental visits for preventative checks between 1994 and 2008, there was also an increase in the proportion of adults who reported they had avoided or delayed dental care due to cost, and this increased from 27.1% in 1994 to 34.3% in 2008 (Harford et al., 2011).

5.7.4 Workforce

Dental practitioners are unequally distributed between urban and rural areas in many developed countries (Godwin, Hoang, Crocombe, & Bell, 2014), including Australia (Shiikha et al., 2015). The distribution of accessible dental care outside of major capital cities in Australia is patchy and is an issue that needs to be addressed (Shiikha et al., 2015). Given their critical role in the provision of dental services, the maldistribution of dental practitioners can negatively impact on people living in these areas (Godwin et al., 2014).

In 2012, there were 19,462 dental practitioners registered in Australia, including 14,687 dentists (Australian Institute of Health and Welfare, 2014c). Table 8 shows the number of registered dental practitioners by practitioner type and remoteness category in Australia. These data demonstrate that major cities had more dentists per 100,000 population (72.3) than all other areas and that the number of dentists per 100,000 population decreased as remoteness increased. Remote/very remote areas demonstrated low numbers of dentists per 100,000 people (22.7) compared with major cities. In terms of other dental practitioners, oral health therapists and dental therapists were similarly represented amongst all remoteness categories, although they were only represented in small numbers (National Rural Health Alliance Inc., 2013).

Table 8. Registered dental practitioners per 100,000 population, by practitioner type, remoteness area^a, 2012

Practitioner type	Major cities	Inner regional	Outer regional	Remote /very remote ^b	Australia ^c
Dentists	72.3	45.6	39.7	22.7	64.7
Oral health therapists	3.3	3.3	3.0	1.3	3.2
Dental hygienists	8.4	3.7	4.0	2.1	7.0
Dental therapists	5.2	6.2	7.7	5.9	5.6
Dental prosthetists	5.4	5.6	3.2	0.4	5.1

^a Derived from remoteness area of main job where available; otherwise, remoteness area of principal practice is used as a proxy. If remoteness area details are unavailable, remoteness area of residence is used. Records with no information on all 3 locations are coded to 'not stated'

^b Includes migratory areas

^c Includes dental practitioners who did not state or adequately describe their location and those who were overseas

Source: Australian Institute of Health and Welfare (2014c, p. 6)

A shortage in the number of dentists in the early 2000s was suggested as an explanation for low numbers of dentists in remote and rural areas during this period (Insight Economics, 2012). Across the board, dental shortages have subsequently reduced, most likely due to an increase in dental training places (Australian Dental Association, 2012a; Insight Economics, 2012). Despite this, there is a lack of dentists in remote and rural Australia which has been attributed to the maldistribution of the workforce between major cities and remote and rural areas (Australian Dental Association, 2012a).

A systematic review of studies regarding rural dental workforce recruitment and retention, published between 1990 and June 2013, identified several factors that influence dental workforce recruitment and retention (Godwin et al., 2014). The review also identified existing strategies for recruitment and retention in remote and rural areas (Godwin et al., 2014). Eight positive factors and 12 negative factors towards rural practice were identified (Godwin et al., 2014). The positive factors “related to the nature of the type of clinical work being a ‘challenge’, close social and professional support networks, enjoyment of rural lifestyle and successful integration into the rural community” (Godwin et al., 2014, p. 1). The negative factors were related to “social and professional isolation, workload and type of clinical work, access to further education opportunities, access to facilities, education for children and job opportunities for a partner, and inability to integrate into the rural community” (Godwin et al., 2014, p. 1). The majority of strategies aimed at increasing recruitment of dental practitioners into the rural health workforce were financial in nature and included interventions such as increasing salaries and financial remuneration (Godwin et al., 2014). The strategies aimed at the retention of rural dental practitioners were focused on successful integration into rural communities and rural lifestyles through increasing rural exposure (Godwin et al., 2014). Previous research undertaken with health graduates, supports rural exposure as a factor influencing health graduate’s choice to practice in rural areas upon graduation (Playford, Larson, & Wheatland, 2006). Specifically, those with a rural background, or who were exposed to rural practice during their tertiary education, were more likely to choose to practice in a rural area upon graduation (Playford et al., 2006).

Practise viability and the personal choice of practitioners have also been identified as influencing practice location (Australian Dental Association, 2012a). A NSW study also found that drivers of economic sustainability are important in choosing a practice location and that private dental services cannot be sustained in many remote and rural areas due to the lack of dentists willing to work there, high costs and low population densities (Willie-Stephens et al., 2014). An example of how the Commonwealth Government has attempted to assist in addressing dental workforce maldistribution issues, by supporting economic sustainability of dental practices, is evidenced by the implementation of the Dental Relocation and Infrastructure Support Scheme (DRISS) (Department of Health, 2015). DRISS commenced in 2013-2014 and provides relocation grants and infrastructure grants to encourage and support dentists to relocate to remote and rural areas in the hope of improving dental workforce distribution and service delivery capacity in these areas (Department of Health, 2015).

There appear to be significant complexities in sustaining remote area dental services beyond those involved in urban service models (Dyson, Kruger, & Tennant, 2014). Consequently, many remote and rural communities rely on state government provided dental services and public dental practices (Willie-Stephens et al., 2014). The study by Willie-Stephens et al. (2014, p. 169) also demonstrated that the most socioeconomically disadvantaged Australians are also the ones located furthest from dental services and that “people from lower socioeconomic backgrounds in rural areas carry a higher burden of oral disease but have less access to dental care compared to the higher socioeconomic groups.”

5.7.5 Appropriateness of service for Indigenous Australians

The absence of culturally appropriate oral health services can be a barrier to seeking dental care for Indigenous Australians in remote and rural areas (Williams et al., 2011). Culturally appropriate oral health services are built on the principle of self-determination, and facilitate community involvement in the planning and ongoing development of the service (Williams et al., 2011). For example, the Nganampa Health Council is an Aboriginal Community Controlled Health Organisation (ACCHO) operating on the Anangu Pitjantjatjara Yankunytjatjara Lands in the far north west of South Australia, which provides a culturally appropriate dental program as part of its primary health care program (Teeth and Toilets, 2015). Since the program commenced in 2008, there have been substantial improvements in the dental health of the community, with an increase in the amount of activity, including more patients seen, more consultations and more completed treatments, an increase in the amount of preventative work that has been undertaken, a reduction in the percentage of consultations associated with emergency care, and a decrease in the percentage of consultations that involve both restorations of teeth and extractions of teeth (Teeth and Toilets, 2015).

A recent review on cultural competence in health care for Indigenous people identified five key strategies to improve cultural competence including:

- > Embedding it as part of quality improvement processes;
- > Identifying disparities in the quality of care provided to Indigenous Australians and determining the most appropriate cultural competence strategies for improvements;
- > Training healthcare practitioners to improve their knowledge, attitudes and skills to provide culturally competent health care, integrating cultural competence in the health curriculum;
- > Working with Indigenous Australian communities to culturally tailor interventions (customising content, approach or messaging) to improve the quality of care and patient satisfaction with care; and
- > Evaluating a systems-level intervention that combines best-evidence strategies to reduce disparities in healthcare delivery to Indigenous Australians and improves the cultural competency of healthcare services (Bainbridge, McCalman, & Clifford, 2015, p. 20).

5.7.6 Lack of government investment

The issue of responsibility for funding oral health services in Australia is contentious (Biggs, 2008). There is uncertainty about which government is responsible for providing access to dental care, despite the Australian Constitution providing the Commonwealth Government with the powers to legislate for the provision of dental services (Lavery, 2015). Specifically, s51xxiii(a) of the Constitution says,

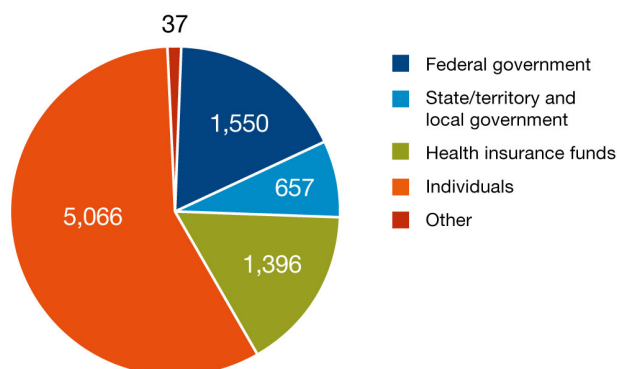
“The Parliament shall, subject to this Constitution, have power to make laws for the peace, order, and good government of the Commonwealth with respect to: the provision of maternity allowances, widows’ pensions, child endowment, unemployment, pharmaceutical, sickness and hospital benefits, medical and **dental services** (but not so as to authorize any form of civil conscription), benefits to students and family allowances.” (“Commonwealth of Australia Constitution Act (Cth), 1900”).

Prior to this amendment to the Constitution in 1946, the states and territories had sole responsibility for public dental health and the Commonwealth was only responsible for health services for war service veterans (their dependants and widows) (National Advisory Council on Dental Health, 2012, p. 23). Now, both levels of government have overlapping roles, and this “invites confusion as to whether the Commonwealth or the state governments (or both) have ultimate responsibility for government provision of dental health services” (National Advisory Council on Dental Health, 2012, p. 23).

Additionally, dental health services are classified as ancillary services, and the majority of dental services are therefore not claimable under the Australian national health insurance scheme, Medicare (Biggs, 2008). Consequently, the majority of dental services are not funded by either state and territory governments or the Commonwealth, and service costs are primarily the responsibility of individuals. Rising costs for dental services means that access to private dental care may be unaffordable for many Australians, especially those residing in remote and rural communities.

Specifically, more than \$8.7 billion was spent on dental services in Australia in 2012-2013 (Australian Institute of Health and Welfare, 2014) (See Figure 4). The majority of expenditure was borne by individuals, who contributed 58% to the cost of dental services, compared with the federal government, who contributed 18% and state and territory governments who contributed 8%. Similar amounts have been spent in previous years. In 2010-2011, almost \$7.9 billion was spent on dental services (Chrisopoulos & Harford, 2013) and the average out-of-pocket expense for individuals using dental services was \$203 per service (Services for Australian Rural and Remote Allied Health, 2014). In 2011-2012, consumers funded 57% of oral health expenditure compared to 12% of expenditure on other primary health services (Oral Health Monitoring Group, 2014). The Commonwealth provided \$1.55 billion for dental services in 2012-2013, which represented 6.8% of its primary health care expenditure (Extrapolated from Australian Institute of Health and Welfare, 2014, p. 65).

Figure 4. Expenditure on dental services, 2012-13 (\$ million)



Source: Extrapolated from Australian Institute of Health and Welfare (2014, p. 65)

For all dental services, across all years, standardised expenditure levels were highest for residents of major cities, with expenditure levels typically lower with increasing remoteness. Additionally, the relative level of expenditure on specialist, dental and other allied services for residents of major cities was substantially higher than the expenditure levels for the other regions.

With the associations between oral health and general health becoming more apparent, health policy decisions need to resolve uncertainty about government responsibility for dental services.

5.7.7 Summary

Six barriers that impact remote and rural Australian's ability to use oral health services were identified in Table 7. There are likely to be cumulative negative impacts on the oral health of remote and rural Australians when these barriers are considered alongside the risk factors identified in the previous section. With some of the most geographically remote areas of Australia also being some of the most socioeconomically disadvantaged, the cumulative effects of limited service availability, limited access to services, high costs of dental treatment, workforce maldistribution, limited access to culturally appropriate services and lack of government investment in service provision, are likely to result in poorer oral health outcomes for remote and rural Australians. It is unsurprising, then, that remote and rural Australians display lower rates of favourable dental visiting patterns, greater levels of decay, more gum disease and greater tooth loss than Australians in major cities (Australian Institute of Health and Welfare et al., 2013; Chrisopoulos & Harford, 2013).

To address these disparities, the RFDS has established a number of innovative state-based oral health programs, which are described in the following section.

6.0 Role of RFDS in provision of remote and rural oral health services

Anecdotal evidence from RFDS oral health programs indicates that delivery of preventative oral health services to remote and rural communities leads to fewer emergency visits for oral health problems. In major cities, and areas outside Australia's major cities that support permanent dentists, individuals would normally attend a dental appointment in a private dental clinic (Meihubers, 2012). However, a large proportion of people living in remote and rural Australia do not have access to a regular dental service.

In the last five years, the RFDS commenced delivering new oral health services, and expanded its existing oral health services, to fill this service gap, and provide access to timely and appropriate oral health care for remote and rural Australians. These people are often beyond the reach of normal medical infrastructure and in many remote and rural communities, the RFDS is the only organisation providing oral health services to these communities (The Centre for International Economics, 2015). The RFDS is now a significant provider of oral health services to remote and rural communities that do not otherwise have access to dental services. RFDS services are delivered using fly-in, fly-out, mobile and outreach service delivery models. These models are a crucial and effective way to provide comprehensive oral health care to people outside major cities, yet such services are traditionally underfunded and under resourced.

In many instances, RFDS oral health clinics operate alongside RFDS primary healthcare clinics, child and family nurse clinics, and chronic disease clinics, enabling the RFDS to provide integrated health care, that includes management of oral health conditions.

“People in remote areas find it difficult to access medical and dental services. At our clinics, medical and allied health staff work together to provide an integrated approach to patient health care.”

Dr Lyn Mayne, RFDS dentist, South Eastern Section

6.1 Oral health programs delivered by the RFDS and the usage and uptake of services

The RFDS provided oral health services to more than 11,500 individuals in 2013-2014 (see Table 9), through 11 different state-based oral health models (see Table 10). These oral health service models are provided through the RFDS operating sections and include daily and longer fly-in, fly-out dental services, supporting existing providers through working partnerships, partnering with universities, schools, other non-government organisations (NGOs), local health networks, Aboriginal Medical Services (AMSs), state and territory health authorities and local health authorities to deliver community and school-based preventive, diagnostic and restorative services, and mobile dental units rotating through rural and remote communities.

Table 9. 2012-2014 RFDS oral health activity levels by Section/Operation

Section	Number of programs	Number of patients examined 2012/13	Number of patients examined 2013/14
Victorian Section	1	600	1,249
South Eastern Section	2	4,248	4,392
Central Operations	1	139	97
Western Operations	2	639	1,120
Tasmanian Section	3	277	271
Queensland Section	2	1,000	2,471
Total	11	6,903	9,600

Source: Annual reports for each RFDS section, raw data provided by sections.

RFDS Remote Oral Health Care Program (ROHCP)

Data collected through the Remote Oral Health Care Program, delivered through RFDS Central Operations, revealed that young children living in remote South Australia are twice as likely to have cavities, missing or filled teeth compared to children in major cities. In 2011, 68% of school-age children and 77% of adults examined by RFDS dentists through the Remote Oral Health Care Program had at least one cavity.

Source: Royal Flying Doctor Service (2012b)

Table 10. RFDS oral health programs by section

RFDS Section	Program (commenced)	Partnerships	Funding	Area serviced	Service model	Who is employed	Services provided
Victoria	Mobile Dental Care Program (2012)	RFDS Victoria, Department of Health Victoria, Dental Health Services Victoria, Australian Dental Association Victorian Branch, Murray Valley Aboriginal Co-operative in Robinvale	Multiple sources including RFDS charitable funds	North Mallee and recently expanded into the West Wimmera, Mildura, Robinvale	Mobile transportable dental unit	2 dentists – volunteers, other volunteer health professionals	Preventative services, dental examinations, minor treatment, x-rays, tooth extractions, fillings, scaling, oral health promotion referred for complex treatment
Queensland	QCoal Community Dental Service (2013)	RFDS QLD Section, QCoal	Short term corporate/private sector funds	Based in Townsville, services regional communities in Central Queensland including, but not limited to, Dajarra, Carnooweal, Richmond, Greenvale, Sapphire, Bowen, Theodore, Monto, Collinsville, and Winton	Fully equipped, purpose-built, transportable dental unit (2 dental suites)	Multidisciplinary dental team – employed by RFDS	Preventative, diagnostic and corrective services, dental hygiene, extractions
Queensland	QLD Health Program	RFDS QLD Section, Queensland Health	Queensland Health	Indigenous communities of Cape York		Multiple – employed through QLD Health	
South Eastern	The Outback Oral Treatment and Health Program (TOOTH) (2012)	RFDS South Eastern Section, Investec Foundation, Gonski Foundation	Short-term funds from philanthropic and corporate/private sector, RFDS charitable funds	Western NSW communities of Dubbo, Bourke, Collarenebri, Goodooga and Lightning Ridge, fly-in, fly-out to most of these communities	Fly-in, fly-out service	Multidisciplinary dental team – dentist, dental therapist, dental assistant – employed by RFDS	Preventative, diagnostic and corrective services, dental hygiene, oral health promotion
South Eastern	The Broken Hill Dental Scheme (1998)	RFDS South Eastern Section, Maari Ma Aboriginal Health Service, Greater Western Area Health Service	Long-term state government funds, RFDS charitable funds	Broken Hill, Correctional health services in Broken Hill, Ivanhoe, fly-in, fly-out from Broken Hill to surrounding remote communities	Hub (Broken Hill) and spoke (fly-in, fly-out) to surrounding remote communities	Two dentists – employed by RFDS	Fully equipped mobile dental service. Preventative services, restorations, extractions, dentures, root canals, school screening services, oral health promotion

Table 10. RFDS oral health programs by section

RFDS Section	Program (commenced)	Partnerships	Funding	Area serviced	Service model	Who is employed	Services provided
Western Operations	Remote Area Dental Service	RFDS Western Operations, Western Australian Government	WA Government	Wiluna, Warburton	Fly-in, fly-out service	Dentist – employed by RFDS, dental assistant – employed by RFDS	
Western Operations	Mobile Dental Service (2013)	RFDS Western Operations, Karara Mining, Rapid Crushing and Screening Contractors, Shires of Mingenew, Morawa and Perenjori	RFDS Western Operations, corporate/private sector, local councils	Shires of Mingenew, Morowa and Perenjori	Mobile dental unit		Clinical services, education and preventative services
Central Operations	Remote Oral Health Care Program (2011)	RFDS Central Operations, SA Dental Service (SADS), private dentists, University of Adelaide School of Dentistry, Adelaide Airport Limited	Short term funds from corporate/private sector	Fly-in, fly-out services from Port Augusta to Marree, Oodnadatta, Marla (2011-13), Marla/Mintable, Kingoonya and Mungerannie (funded from 2014-2016)	Fly-in, fly-out services	Volunteer dental and oral health tutors supervise final year dental and oral health students	Oral health instruction, Atraumatic restorative treatment, fissure sealant, scale and clean, simple fillings, simple extractions, check ups, fluoride treatment
Tasmania	Southern Tasmania School Pilot	RFDS Tasmania Section, Oral Health Services (OHS) Tasmania (part of Department of Health)	Joint funding from RFDS Victoria and Tasmania	School in southern Tasmania			School students screened, where indicated, received fluoride varnishing, fissure sealant. Referred for more complex treatment. Provided with RFDS 'pack' including information on dental hygiene
Tasmania	Flinders Island Clinic		RFDS Tasmanian Section, RFDS charitable funds	Flinders Island	Funding supports regular visiting dental service, including fitting out the clinic	Supply air transport for dental personnel and donate dental equipment, do not directly employ staff	Flinders Island Clinic
Tasmania	South East Tasmanian Aboriginal Corporation (SETAC) (2014)	RFDS Tasmanian Section, SETAC, OHS	RFDS Tasmania and Victoria	Schools in southern Tasmania			The clinics involved screening and application of fluoride varnish and fissure sealants



QCoal Community Dental Service

Table 10 described the 11 different oral health services provided through the RFDS sections. The current section explores one of these, the QCoal community dental service.

The QCoal community dental service is a mobile dental health service delivered by the Queensland Section of the RFDS in partnership with QCoal. Dental care is delivered from a purpose-built semi-trailer, comprising two fully equipped dental suites. It is based in Townsville, and services regional communities in Central Queensland including, but not limited to, Dajarra, Camooweal, Richmond, Greenvale, Sapphire, Bowen, Theodore, Monto, Collinsville, and Winton.

The multidisciplinary dental team provides preventative, diagnostic and corrective services, as well as dental hygiene and extractions, at no cost to patients. Patients requiring additional specialised dental services, such as removable denture construction or maintenance, fixed prosthetics, orthodontic treatment (initial examination excepted) and other specialist services, are referred for treatment. However, a lack of specialists in some of these regions means that it can be difficult for patients to access specialist services.

Specific patient and service data from the QCoal community dental service, for 2013-2014, are presented in Table 11.

The data in Table 11 demonstrate that 18 QCoal clinics were delivered between July 2013 and June 2014 and that dental services were delivered to 2471 individuals. More than half of all services (54.3%) were provided to women. Indigenous patients comprised 17.7% of all patients and non-Indigenous patients made up 56.0%. Almost one-quarter of patients did not specify their Indigenous status. Patients were examined from all age groups, but young people, aged 0-14 years (14.7%) made up the highest proportion of patients examined. Around four in 10 patients (38.8%) were card holders, with pensioner concession and health care card holders (38.5%) representing the majority of card holders. Around one in five patients (21.0%) were either students, children or apprentices. Pensioners and retirees were the next most likely group to access the services, comprising 15.0% of patients, closely followed by people engaged in home duties/carers (10.4%).

QCoal clinic staff provided 12,805 services to patients with an average of five services delivered to each patient. Almost 5,000 of these were diagnostic services, including examinations and x-rays. Restorative services (fillings), were common, with 3,968 provided. Almost 2,500 preventative services, including advice, fluoride applications, and fissure sealants, were provided.

Table 11. 2013-2014 QCoal dental data

Indicator	Number	Percentage (where applicable)
Clinics provided	18	-
Individuals seen	2,471	-
Patient visits (1 patient may have several visits)	3,122	-
Gender		-
Male	1,073	43.4%
Female	1,342	54.3%
Missing	56	2.3%
Indigenous Status		
Aboriginal but not Torres Strait Islander	387	15.6%
Both Aboriginal and Torres Strait Islander	37	1.5%
Torres Strait Islander but not Aboriginal	16	0.6%
Neither Aboriginal or Torres Strait Islander	1,382	56.0%
Not stated/unspecified	593	24.0%
Missing	56	2.3%
Age		
0-14 years	437	17.7%
15-24 years	264	10.7%
25-34 years	344	13.9%
35-44 years	306	12.4%
45-54 years	367	14.8%
55-64 years	332	13.4%
65+ years	365	14.8%
Missing	56	2.3%
Card Holder Status		
DVA Gold	8	0.3%
DVA White	1	0.04%
Health Care Card	373	15.1%
Pensioner Concession Card	578	23.4%
Non card holder	1,455	58.9%
Missing	56	2.3%
Top three occupation groups		
Student/child/apprentice	515	21.0%
Pensioner/retired	371	15.0%
Home duties/carer	257	10.4%
Top three services provided		
Diagnostic*	4,989	
Restorative**	3,968	
Preventative***	2,426	
Total number of services provided	12,805	
Average number of services per patient	5.2	

*Diagnostic services includes examinations and x-rays, **Restorative services includes fillings, *** Preventive services includes advice, fluoride applications, fissure sealants³

³ Fissure sealant: "Materials that are applied to the pit and fissure surfaces of the teeth by dental professionals. They protect teeth from decay by creating a thin barrier that protects the sealed surface from the bacteria that cause decay" (Ha et al., 2013, p. 3).

6.2 Principles underlying RFDS oral health services

Delivery of oral health services through the RFDS is underpinned by a number of principles. RFDS oral health services:

- > Operate where other service providers do not;
- > Employ different service models depending on the needs of the community and available funding. These include fly-in, fly-out, mobile and outreach models and may operate over several days in the one region;
- > Ensure close cooperation with other service providers in each region to avoid duplication of services and to provide optimal oral health care for the population group;
- > Provide preventative, early intervention and treatment services based on existing evidence and best practice;
- > Orientate services towards the potential to prevent future disease, assist early diagnosis and provide appropriate care to groups considered at higher risk of dental disease; and
- > Structure visits so as to maximise outcomes and move beyond emergency and demand dental care: greater effectiveness is possible with longer and regular visits (Adapted from Meihubers, 2012; Royal Flying Doctor Service, 2013).

6.3 Summary

The RFDS has responded to market failure by developing 11 state and territory based oral health services, delivered through RFDS sections. The RFDS has employed a variety of innovative service delivery models including fly-in, fly-out, mobile and outreach models to serve remote and rural Australians. More than 11,500 Australians received dental care from the RFDS in 2013-2014, and the number of Australians receiving dental care over the coming year is expected to grow.

Various funding approaches currently support these services. The majority of RFDS services have not been funded by government, but through a mixture of philanthropy, charitable donations and industry partnerships. Significant government investment is required to maintain and expand these services to provide universal access for remote and rural Australians.

The following section proposes solutions to improve oral health in remote and rural areas and discusses innovative approaches to reducing inequalities for remote and rural Australians.

7.0 Solutions to improve oral health in remote and rural areas and reduce inequalities

Increased investment in oral health services for remote and rural Australians is necessary in order to ensure equitable oral health care for all Australians and reduce the disparities in oral health between remote and rural Australians and Australians living in major cities.

To improve outcomes for remote and rural Australians, investment in oral health should be directed towards solution-focused and evidence-based strategies that address the significant risk factors and barriers that adversely impact on outcomes for remote and rural Australians. Innovative solutions to improving oral health outcomes for remote and rural Australians should be considered as they emerge.

Individual, whole of population, and targeted approaches are required to improve oral health outcomes for remote and rural Australians (NSW Health, 2013). Integrated initiatives that address the social determinants of oral disease and risk factors for oral disease and chronic disease (Sheiham & Watt, 2000), incorporate promotion activities, and facilitate improved access to dental services are likely to yield the best outcomes (NSW Health, 2013). However, some sub populations of Australians require additional focus to reduce the disparities in oral health (NSW Health, 2013). Remote and rural Australians are one of these priority groups.

The remainder of section seven provides examples of potential solutions and innovative approaches to reducing inequalities amongst remote and rural Australians, and links these directly to each of the risk factors and barriers identified in section five of this document. This list is not exhaustive – it only provides examples of potential evidence-based solutions. Any future strategy targeted at improving oral health for remote and rural Australians should be underpinned by a thorough review of the evidence.

7.1 Oral health plans

There are many different population level strategies that can be employed to improve oral health outcomes for the broader population. Most Australian states and territories have developed oral health plans to address the oral health needs of the populations they serve. Currently, there is no overarching national oral health plan around united action to improve oral health in Australia, although a consultation draft has been developed (Oral Health Monitoring Group, 2014).

The previous Australian national oral health plan, *Healthy Mouths Health Lives*, operated from 2004-2013, and aimed to improve health and wellbeing across the Australian population by improving oral health status and reducing the burden of oral disease (National Advisory Committee on Oral Health, 2004). The plan had a focus on reducing the major disparities in oral health status and inequities in access to oral health care and identified a number of priority groups (National Advisory Committee on Oral Health, 2004). However, remote and rural residents were not identified as a stand-alone priority group in the initial plan, but were included under the “low income and social disadvantage” priority group. A review of the plan saw them included as a “rural and remote” priority group in 2011-2012.

A draft *National Oral Health Plan 2015-2024* (Oral Health Monitoring Group, 2014) has been developed, but has not yet been finalised for release. It is slated as a blue print for united action by states, territories and the Commonwealth to ensure all Australians enjoy good oral health and identifies rural and remote residents as a priority group who display higher rates of poor oral health, face significant challenges in accessing oral health services, and need targeted additional strategies to overcome these inequalities (Oral Health Monitoring Group, 2014).

7.2 Evidence-based oral health promotion resources

The World Health Organization (WHO) developed a framework that considers social determinants of health and identifies broad-based entry points for interventions to address oral health inequalities (Kwan & Petersen, 2010 cited in Rogers, 2011). Evidence-based oral health guidelines have also been developed in Victoria, Australia (Rogers, 2011) and, more recently, overseas, in the United Kingdom (UK) (Public Health England, 2014). In the Victorian resource, the authors reviewed oral health promotion strategies, and identified the strategies with the strongest evidence of effectiveness (Rogers, 2011). Public Health England released an evidence based toolkit for improving oral health in the United Kingdom (Public Health England, 2014), which provides practical, evidence-based guidance to assist oral health professionals to promote good oral health and prevent oral disease (Public Health England, 2014).

The publications cited above each used different criteria to assess the strength of evidence around effectiveness of interventions to improve oral health outcomes. However, all used robust methodologies in determining their recommendations. These evidence-based publications formed the basis for the examples of potential interventions that could be used to improve oral health in remote and rural communities in the remainder of this discussion paper. Where appropriate, additional references have also been cited that support the implementation of other strategies to reduce disparities in oral health between remote and rural Australians and those living in major cities.

7.3 Reducing inequalities in oral health outcomes by addressing risk factors and barriers

The broad integrated risk factor approach, described in section five, recognised that many factors that cause or increase the development of poor general health also impact on oral health. Section five also identified additional risk factors and barriers that contribute to the markedly poorer oral health experienced by people residing in remote and rural communities.

It is widely understood that an integrated risk factor approach that directs action on the most common risks, and their social determinants, will result in improvements to a range of chronic diseases and health conditions, including oral disease, at a lower cost, and with greater efficiency and effectiveness (NSW Health, 2013; Sheiham & Watt, 2000).

Using the evidence-based resources described above, as well as additional references where required, examples of solutions to each of the risk factors and barriers described in section five have been identified (see Table 12).

Strategies implemented by governments are often described as broad or upstream measures. The evidence suggests broad measures can achieve dramatic improvements in oral health and reductions in costs (National Advisory Committee on Oral Health, 2004). Individual prevention strategies describe the actions that individuals can implement for themselves and for persons under their care, to prevent oral disease and maintain good oral health. Individual and government solutions are included for the risk factors, but only government solutions are included for the barriers (as these are systemic barriers).

Upstream prevention includes strategies such as water fluoridation, regulation of television advertisements promoting unhealthy food and drinks, legislation on food labelling and nutritional claims, taxation and legislation around harmful products, such as tobacco, implementing strategies to reduce costs of healthy food outside of major cities, integrating oral health programs into community, local and national health programs and removal of taxes around oral health hygiene products in remote and rural areas.

For example, there is good evidence that water fluoridation improves population level outcomes (Cobiac & Vos, 2012) and has been described as one of the 10 great public health interventions of the 20th century by the Centers for Disease Control (CDC) in the United States of America (Centers for Disease Control and Prevention, 2015; Ponnusamy, Monty, Alam, Kruger, & Tennant). American data indicated an estimated annual return on investment for fluoridated communities of between \$USD5 and \$USD32 per person, depending on the size of the community (Centers for Disease Control and Prevention, 2015). Research conducted in 2002 in Queensland, Australia demonstrated that for each \$1 invested in water fluoridation, estimates of the savings in dental treatment costs ranged from \$AUD6 to \$AUD20, and that the greatest health benefits accrue to those who are most disadvantaged (National Advisory Committee on Oral Health, 2004).

Individual prevention strategies include strategies such as eating healthy food, eliminating tobacco use, reducing alcohol consumption, or maintaining good oral hygiene.

Table 12 includes potential government and individual responses to improving oral health outcomes in remote and rural Australia. The list of potential solutions is not exhaustive but provides a snapshot of possible interventions.

Table 12. Potential ways to improve oral health outcomes in remote and rural Australia

Risk factors or barriers (responsibility)	Potential solutions
Poor diet	
Government	<ul style="list-style-type: none"> > Taxation and legislation (Kwan & Petersen, 2010 cited in Rogers, 2011), e.g. taxing 'junk food' > Promote equitable policies (Kwan & Petersen, 2010 cited in Rogers, 2011), e.g. > Better food labelling – showing fats, sugars etc. (Kwan & Petersen, 2010 cited in Rogers, 2011) > Restrict advertising of unhealthy food (Kwan & Petersen, 2010 cited in Rogers, 2011) > Campaigns – healthy food (Russell, 2014)
Individual	> Improve diet – reduce sugary food intake, reduce soft drink consumption, increase fruit and vegetable intake (World Health Organization, 2015b)
Tobacco use	
Government	> Regulate tobacco (Kwan & Petersen, 2010 cited in Rogers, 2011)
Individual	> Quit smoking (World Health Organization, 2015b)
Harmful alcohol use	
Government	> Regulate alcohol (Kwan & Petersen, 2010 cited in Rogers, 2011)
Individual	> Reduce alcohol consumption (World Health Organization, 2015b)
High stress and low control	
Government	> Support healthy physical and psychosocial environments (Kwan & Petersen, 2010 cited in Rogers, 2011)
Individual	> Implement stress management techniques (Dental Health Foundation Ireland, 2015)
Poor dental hygiene	
Government	<ul style="list-style-type: none"> > Targeted school-based tooth brushing and mouth rinsing programs (primary school children) (Rogers, 2011) > School-based oral health education (primary and secondary school children) (Rogers, 2011) > Orally healthy school policies – including integration of oral health promotion in curriculum (schools) (Rogers, 2011) > Community/school and clinic-based programs (schools) (Rogers, 2011) > Targeted chewing gum programs (Rogers, 2011)
Individual	> Brush teeth twice daily with fluoride toothpaste, floss daily (Australian Dental Association, 2012b)
Poor oral health literacy	
Government	<ul style="list-style-type: none"> > School-based oral health education (Rogers, 2011) > Promote oral health through healthy settings initiatives in schools, workplaces (Kwan & Petersen, 2010 cited in Rogers, 2011) > Implement a national oral health literacy campaign (Victorian Department of Health, 2013)
Reduced access to fluoridated	
Government	<ul style="list-style-type: none"> > Regulation of fluoridation to ensure optimum exposure to fluoride (Kwan & Petersen, 2010 cited in Rogers, 2011) in line with best practice guidelines > Where fluoridated water is not available, strategies that provide fluoride in other forms, such as fluoride varnish programs, and access to affordable oral hygiene products (Oral Health Monitoring Group, 2014) > Develop/distribute fluoride protocols to people without access to fluoridated water (Victorian Department of Health, 2013)

Table 12. Potential ways to improve oral health outcomes in remote and rural Australia

Risk factors or barriers (responsibility) Potential solutions	
Limited access to fruit and vegetables	
Government	> Explore mechanisms to reduce costs of healthy food outside of major cities (Oral Health Monitoring Group, 2014), subsidies for fresh food
High cost of dental products	
Government	> Remove taxes on oral health products or subsidise cost (Kwan & Petersen, 2010 cited in Rogers, 2011)
Service availability	
Government	> Community/school and clinic-based programs (Rogers, 2011) > Develop infrastructure for oral health services (Kwan & Petersen, 2010 cited in Rogers, 2011) > Support partnerships between government, private and non-government organisations to enable development of sustainable oral health service models (Oral Health Monitoring Group, 2014)
Service access	
Government	> Implement outreach programs to ensure equitable access to oral health care (Kwan & Petersen, 2010 cited in Rogers, 2011)
Cost of dental treatment	
Government	> Third party payment systems to reduce inequality in payment of oral health services (Kwan & Petersen, 2010 cited in Rogers, 2011)
Workforce maldistribution	
Government	> Identify ways to recruit and retain oral health professionals in remote and rural areas by addressing social issues (e.g. issues related to rural lifestyle, support networks, sense of community and belonging, social isolation, access to facilities and social activities, education for children of oral health professionals, jobs for partners, multiculturalism) and job issues (e.g. experience and mentoring, especially for new graduates, challenging job opportunities, professional isolation, workload and time off, professional development and financial incentives) (Godwin et al., 2014) Implement and regularly review rural incentives schemes to address maldistribution and encourage rural/remote relocations e.g. DRIS (Department of Health, 2015)
Appropriateness of service	
Government	> Government, local communities and stakeholders collaborate to develop culturally appropriate services, especially for Indigenous Australians (Kwan & Petersen, 2010 cited in Rogers, 2011)
Lack of investment in oral health	
Government	> Integrate oral health programs into community, local, national health programs (Kwan & Petersen, 2010 cited in Rogers, 2011) > Fund flexible oral health service delivery models that have evidence of effectiveness (Oral Health Monitoring Group, 2014)
Other	> Additional approaches to support improved oral health for Indigenous Australians should be considered separate to this report. Recommend these are based on a comprehensive and separate review of Indigenous oral health such as that conducted by Williams et al. (2011)

7.4 Management of chronic diseases and other health conditions

Section 5.5 indicated that many diseases share common risk factors and discussed potential associations between poor oral health and CVD, respiratory diseases, diabetes, infective endocarditis, stroke, aspiration pneumonia, some types of cancer, osteoporosis, obesity, malnutrition, ARH, RHD, and kidney disease.

As part of the management of chronic conditions, oral health status should be considered and managed. For example, improving oral hygiene and performing necessary dental and oral treatment before haemodialysis or transplantation in patients with chronic renal disease may prevent endocarditis and septicaemia in these patients (Gupta, Gupta, & Abhishek, 2015). Additionally, treatment plans for patients with renal disease, that improve the patient's dentition prior to treatment of their condition, can protect them from potentially severe infections of dental origin (Gupta et al., 2015).

Evidence is emerging regarding associations between oral health, overall health, and some diseases. Maintaining good oral health, through regular preventative dental visits and treating oral health problems promptly, may be beneficial for overall health.

7.5 Innovative service delivery models to improving oral health for rural and remote Australians

Innovative service delivery models that demonstrate evidence of effectiveness should also be considered when investigating strategies to improve oral health outcomes for rural and remote Australians.

For example, specialist oral health consultations were conducted with 43 children, in three regional areas of Victoria, via paediatric teledentistry (Marino et al., 2014). Teledentistry uses information and communication technologies and practices to facilitate specialist oral health care to communities that face difficulties in accessing services because they live outside a major city (Marino et al., 2014). In addition to enhanced access to specialist dental care and reduced costs, teledentistry improves outcomes by overcoming socioeconomic, geographic and cultural barriers (Marino et al., 2014). In the current field trial, three Victorian general dental practitioners in regional areas were trained to use teledentistry. With their clients, they linked in with specialists at the Royal Children's Hospital in Melbourne who conducted a virtual dental examination of the patient and worked with the local dentist to develop a treatment plan (Marino et al., 2014). The model provides an alternative and cost effective way to deliver treatment to patients who may otherwise not have access to specialist services (Marino et al., 2014).

Another example of an innovative approach to service delivery is the Text2Floss study that was developed in the United States of America and evaluated through a randomised controlled trial (Hashemian, Kritz-Silverstein, & Baker, 2015) of 129 participants. The Text2Floss study examined the feasibility and utility of a 7-day text messaging intervention to improve oral health knowledge and behaviour in mothers of young children who were recruited through a private practice and community dental clinic (Hashemian et al., 2015). Results demonstrated that mothers receiving text messages improved their own oral health behaviours and knowledge as well as their behaviours regarding their children's oral health (Hashemian et al., 2015). Text messaging programs may be a viable and cost effective method of improving oral health behaviours and knowledge in remote and rural communities where people have access to a mobile phone.

These two examples of innovative service delivery demonstrate that there are alternatives to traditional models of oral health service provision. Implemented in conjunction with traditional models of service delivery, these interventions may improve access to oral health services and improve outcomes for remote and rural Australians. Future service planners should consider the applicability of new and emerging technologies and service delivery models for improving access to oral health services in remote and rural areas.

7.6 RFDS recommendations

Section 7 identified solutions to improve oral health in remote and rural areas and reduce inequalities in oral health between remote and rural Australians and those living in major cities. It considered the importance of implementing evidence-based solutions, addressing risk factors and barriers, and considering the links between chronic disease and poor oral health. It identified additional suggestions for improving oral health, including innovative service models appropriate to rural and remote communities.

In addition to addressing the risk factors and barriers identified in section 7.3, the RFDS recommends that the following strategies are implemented in a timely manner to reduce disparities in oral health outcomes between remote and rural Australians and those that live in major cities. These include:

- > Scaling up, and extending, successful oral health programs and dental services that are currently being delivered in remote and rural areas (such as those being delivered by the RFDS), to facilitate national and equitable access for people in remote and very remote areas;
- > Placing oral health within primary healthcare (Kwan & Petersen, 2010 cited in Rogers, 2011) to facilitate a holistic healthcare approach;
- > Including oral health training to members of primary health care teams (Kwan & Petersen, 2010 cited in Rogers, 2011), (Russell, 2014);
- > Integrating oral health messages into general health promotion (Victorian Department of Health, 2013);
- > Encouraging interventions that promote a common risk factor approach (Kwan & Petersen, 2010 cited in Rogers, 2011);
- > Regulating sale of unhealthy/harmful products in some communities (Kwan & Petersen, 2010 cited in Rogers, 2011);
- > Promoting oral health through chronic disease prevention (Kwan & Petersen, 2010 cited in Rogers, 2011);
- > Supporting interventions and making tools available to break poverty and social inequalities (Kwan & Petersen, 2010 cited in Rogers, 2011);
- > Providing universal dental care (Russell, 2014); and
- > Strengthening prevention and early intervention programs (Victorian Department of Health, 2013).

To ensure best outcomes for remote and rural Australians, the following principles should be adhered to:

- > Commonwealth, state and territory governments develop comprehensive, whole of population, oral health plans and include remote and rural populations as a priority group;
- > Oral health promotion and prevention strategies are based on best evidence and address risk factors for remote and rural Australians;
- > Services are accessible, affordable, culturally appropriate and well-resourced by government; and
- > Governments invest in innovative oral health service delivery models to enable equity of access in remote and rural areas (e.g. rural outreach, fly-in, fly-out, and mobile oral health services such as those delivered by RFDS), where market failure means it is unviable for permanent services to exist.

8.0 Conclusion

Poor oral health is one of the most common health problems affecting remote and rural Australians, who experience poor oral health at significantly higher rates than people living in major cities.

Compared to people living in major cities, remote and rural Australians have higher DMFT/dmft rates, more decay, more filled teeth, higher rates of gum disease, higher rates of edentulism, higher rates of missing teeth, more potentially preventable hospitalisations from oral disease, lower rates of favourable dental visiting patterns and higher rates of unfavourable visiting patterns.

The disparity in oral health outcomes between major city residents and people living in remote and rural areas is related to disparities in dental care availability and access, which is significantly poorer in remote and rural areas. It is also influenced by a greater prevalence of oral health risk factors and barriers relating to diet, tobacco use, harmful alcohol use, stress, dental hygiene, health literacy, access to fluoridated water, dental product cost, fruit and vegetable access, cost of dental services, and dental workforce maldistribution. The impact of social determinants of health is also felt more acutely in country areas.

Increased investment in oral health services for remote and rural Australians is necessary in order to ensure equitable oral health care for all Australians and reduce the disparities in oral health between remote and rural Australians and Australians living in major cities. To improve outcomes for remote and rural Australians, investment in oral health should be directed towards solution-focused and evidence-based strategies that address the significant risk factors and barriers that adversely impact on outcomes for remote and rural Australians. Successful dental outreach models, such as those delivered by the RFDS, should be funded and scaled up to facilitate greater access to dental services for people in remote and rural areas. Innovative solutions to improving oral health outcomes for remote and rural Australians should be considered as they emerge.

Individual, whole of population, and targeted approaches are required to improve oral health outcomes for remote and rural Australians. Integrated initiatives that address the social determinants of oral disease and risk factors for oral disease and chronic disease, incorporate promotion activities, and facilitate improved access to dental services are likely to yield the best outcomes for remote and rural Australians.

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