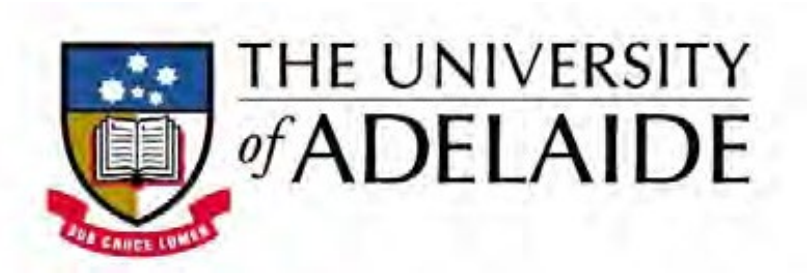

Psychosocial factors and oral health outcomes amongst Aboriginal adults in regional South Australia

by

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Chapter 1: General Thesis Inclusions:

Citations of publications, Abstract, Declaration and Acknowledgments

1.1 Citations Listing of Included Publications

Published Papers

Parker, EJ, Misan, G, Chong, A, Mills, H, Roberts-Thomson, K, Horowitz, AM & Jamieson, LM 2012, 'An oral health literacy intervention for Indigenous adults in a rural setting in Australia', *BMC Public Health*, vol. 12, Jun 20, p. 461. (Presented in Chapter 3).

Parker, EJ, Mills, H, Spencer, AJ, Mejia, GC, Roberts-Thomson, KF & Jamieson, LM 2016, 'Oral Health Impact among Rural-dwelling Indigenous Adults in South Australia', *J Health Care Poor Underserved*, vol. 27, no. 1A, pp. 207-219. (Presented in Chapter 4).

Parker EJ, Spencer AJ, Roberts-Thomson, K, Mills H, and Jamieson LM. 2021 'Oral health-related self-efficacy and fatalism in a regional South Australian Aboriginal population'. *Community Dental Health* vol 38, 1-7. (Presented in Chapter 6).

Paper in press / published online ahead of print

Parker, EJ, Mejia, G, Spencer, AJ, Roberts-Thomson, KF, Haag, D & Jamieson, LM 2021, 'Self-rated oral and general health among Aboriginal adults in regional South Australia', *Australian Dental Journal*. Paper proof received 10th December 2021. (Presented in Chapter 5).

Papers submitted but not yet accepted for publication

Parker EJ, Haag D, Ribeiro Santiago PH, Spencer AJ, Roberts-Thomson K, Jamieson L. 'Perceived stress is associated with poorer self-rated oral health and greater oral health impact in a regional Australian Aboriginal population'. *Submitted to Community Dentistry Oral Epidemiology on the 6th November 2021.* (Presented in Chapter 7).

Parker EJ, Haag D, Spencer AJ, Roberts-Thomson K, Jamieson LM. 'Self-efficacy and oral health outcomes in a regional Australian Aboriginal population'. *Submitted to BMC Oral Health on the 27th November 2021.* (Presented in Chapter 8).

1.2 Thesis Abstract

Aboriginal people in Australia continue to suffer from the impacts of ongoing colonisation, with impacts experienced across a multitude of factors which are known to affect health and oral health. The literature describing the relationship of psychosocial factors with oral health outcomes among Aboriginal adults in Australia is sparse. This research therefore aimed to quantify self-reported oral health outcomes and examine associations between these oral health outcomes and general and oral health-specific psychosocial factors for a convenience sample of Aboriginal adults in regional South Australia (SA) participating in the Indigenous Oral Health Literacy Project (IOHLP).

The first original research paper presented in this thesis describes the impacts of oral health conditions amongst this sample of Aboriginal adults and compares findings with nationally representative data from the National Survey of Adult Oral Health (NSAOH) 2004-2006. The impact of oral disease was measured using the short form of the Oral Health Impact Profile, OHIP-14. Individual items as well as the three summary measures for OHIP-14 were assessed. For each measure, the impact was greater for the participants of the IOHLP when compared with both Aboriginal and non-Aboriginal participants of NSAOH.

The second paper describes the proportion of Aboriginal adults from regional SA rating their oral health and general health highly and compares these findings with nationally representative data from the NSAOH. For each variable reported, regional SA Aboriginal participants were worse off when compared with non-Aboriginal participants at a national level and had lower levels of self-rated general health and oral health than Aboriginal participants of NSAOH. This finding suggested that national level data may underestimate the proportion of regional Aboriginal Australians with poor oral health, an important consideration when planning for prevention and intervention strategies.

The third paper assesses the validity of measures of oral health-related self-efficacy and fatalism among Aboriginal adults. The scales used to measure oral health-related self-efficacy and fatalism demonstrated community acceptability, acceptable face, content, criterion and known-groups validity, and internal reliability.

The fourth paper quantifies levels of the two dimensions of the Perceived Stress Scale, perceived distress and perceived coping, determined associations with key measures of self-reported oral health and general health and assessed where associations remain after controlling for sociodemographic characteristics. Perceived coping showed no associations with outcome measures. The association between levels of stress and oral health impacts persisted despite

controlling for multiple sociodemographic and economic measures. The gradient of increasing oral health impacts and prevalence of poor self-rated general and oral health across levels of stress indicated that experiences of stress was an important determinant of health and oral health in this Aboriginal community.

The final original research paper quantifies levels of oral health-related self-efficacy and identifies associations with oral health outcomes, determining if these associations remain after controlling for a broad range of sociodemographic measures, perceived stress, perceived coping and oral health-related fatalism. Oral health-related self-efficacy remained associated with poor self-rated oral health and oral health impact severity in all models, suggesting that further investigation, including longitudinal studies with culturally safe interventions aimed at improving self-efficacy are warranted.

1.3 Thesis Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

The author acknowledges that copyright of published works contained within the thesis resides with the copyright holder(s) of those works.

I also give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

I acknowledge the support I have received for my research through the provision of an Australian Government Research Training Program Scholarship.

Signature:

Date: 13/12/2021

1.4 Acknowledgement of traditional owners of the land on which this work was conducted

The original project from which the data utilised in this thesis were drawn was carried out in Port Augusta, South Australia, the land of the Barngarla people.

The analysis of data and writing of this thesis occurred in Adelaide, South Australia, the land of the Kuarna people.

I acknowledge the Barngarla and Kuarna people as the traditional owners and custodians of the land on which the research for and writing of this thesis has occurred.

I acknowledge their continuing connection to land, culture and community.

I pay my respect to their Elders past, present and emerging.

This always was and always will be Aboriginal land.

1.5 Thesis acknowledgements

This has been a very long road and seen many personal and professional changes for me throughout my candidature (and periods of leave!). I am immensely grateful to everyone who has helped me along the way. Whether it was encouragement before I even enrolled, reassurance when the road was bumpy, pushing when I thought it was not possible, or just being there and by being themselves, inspiring me - I am grateful to many for the role they have played.

I must thank my parents who instilled in me a deep sense of social justice, and particularly thank them for modelling these values that I admire and that have shaped my career path. They taught me important lessons for life, including a sense of obligation to firstly acknowledge the privilege that I am fortunate to have, and secondly, that I should use this position of privilege to do good for others, for the community, and most importantly, to have the courage to speak up on behalf of those who are not so fortunate. As a child, I may not have always understood or appreciated these lessons, and maybe occasionally felt it was rough (like having to give away all but one of the chocolates in the Easter raffle I'd won to children who were less fortunate), but now I see how valuable these experiences were.

When I look at those whom I respect and have valued as mentors professionally, I realise that I have been drawn to them as I see these qualities and beliefs in the way they approach life and their work.

A special thank you to my mum, for doing all the extra things to support me to have time for writing, for being such an active and involved grandma, and for knowing not to ask too often about "the PhD" knowing how hard it has been for me to make progress since becoming a mum, and wanting to support me without adding pressure.

To my husband, Badakhsh, for always believing I was capable, supporting me and encouraging me, for making Saturdays extra fun for our kids so I could focus on writing and not feel guilty about how much I was away in recent months, for doing more at home (as long as it didn't involve getting out of bed early on a Sunday). Your resilience and approach to navigating obstacles and providing humour along the way is inspirational. Although your ability to just go with the flow, take things easy and not get stressed drives me crazy at times, it is essential in our partnership, balances me and enables me to achieve what I have professionally.

My wonderful children, Leelu and Mahalia, who did not exist when I embarked on this challenging adventure, and have naturally drawn my focus away from research and writing a thesis. Being their mother has taught me more about the world, about kindness, about the advantage some children have over others even before their birth, about the way we should treat others, about myself and

even helped me understand the behaviour of other adults- more than any formal study ever could. Even though they don't quite understand what a PhD or a thesis is, they are proud of me, encourage me, give me hugs and make me coffee, offer to keep quiet or get me headphones, as their way of supporting me to finish (all in the hope of having a day off school for my graduation!)

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John Spencer, who might not realise it, but helped sow the seed for my involvement with ARCPOH many years ago, when as a recent graduate you asked me to speak to BDS 1 students about my experiences working in public dentistry and in Aboriginal Health. Kaye told me that after the session you'd spoken positively about my presentation and said something along the lines of "needing to make sure they get me more involved with the School and ARCPOH". Knowing that Professor John Spencer believed I had some combination of ability, passion, beliefs or personal qualities that could contribute to the activities of ARCPOH did a lot for my confidence and helped me believe that I had something to offer the school as an academic. In Barcelona at my first international conference, when I was still feeling very junior and unsure if I belonged, your automatic inclusion of me and my family into the broader ARCPOH family meant a lot. John, your feedback on my work always pushes me to think and learn, and absolutely improves the quality of the final result. Thank you.

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would have come to fruition. She has become a true friend and guide through these final months. I sincerely thank you.

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Helen Mills, Dianne George, Maria Calyun, Angela Russell, all early career mentors and friends, supporting me as a new graduate in Port Augusta finding my way in dentistry and Aboriginal health, all contributed to my development in different ways. Helen, who cries with me when we remember the challenges we faced in the early days at the Pika Wiya Dental Clinic, seeing young children with extensive disease, you are a strong and beautiful soul that I have learnt a lot from.

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The saying “it takes a village to raise a child”, in this case, could certainly be applied to creating and preparing a thesis!

To all of you, and others who have played additional roles, I will be forever grateful.

1.6 Personal reflection on the evolution of the literature and research methods throughout candidature

For a variety of personal and professional reasons, my candidature has extended from 2009 to 2021, with significant periods of leave and "pausing" my research. During this time, there has been a building body of literature in the area of Aboriginal oral health, largely due to the work of colleagues in the Indigenous Oral Health Unit, Australian Research Centre of Population Oral Health. The focus of my work has needed to transform during this long candidature to ensure I build on the work of colleagues, rather than repeat similar analyses or perform psychometric analyses to validate measures that are no longer necessary. This has enabled my work to progress, particularly in the last six months, and enabled me to learn from the work of these generous colleagues. One example is the excellent recent work of a colleague during his PhD candidature, on perceived stress in Australia and in particular amongst pregnant Aboriginal women in South Australia[1, 2]. Rather than repeat psychometric analyses for these measures (originally intended), I have been able to draw upon his findings and utilise adapted versions validated in an Aboriginal population.

During this long candidature, approaches to analyses, presentation and interpretation of results in the field of oral epidemiology have evolved. Key developments in philosophy have been adopted by leading journals in the field of oral epidemiology, but less so in others. One example of this is the decreased focus and reliance on *p* values to indicate statistical significance; another is the concept of "Table 2 fallacy" and inappropriate presentation and interpretation of results from multivariable analyses. These two key areas of progress in the field have influenced my approach to more recent publications, with the degree of adoption of these dependent upon the journal for which the paper has been written.

The author guidelines for *Community Dentistry and Oral Epidemiology*, a high impact journal relevant to my research area, indicate that less emphasis should be made on statistical significance and that results should not focus too heavily on *p* values. This is in accordance with recent calls in the international research community for a move away from relying on statistical significance to determine whether there is an association or not. This shift is to avoid inappropriate interpretation of results, such as assuming non-significance means no effect, or an effect is not present because a confidence interval includes zero [3]. The recommendation is to interpret *p* values and confidence intervals in the context of the data, study design, and potential reasons for the findings [3] . This is particularly relevant to my research with a small sample size (400 participants) and associated wide

confidence intervals. In my more recent work I have worked with this approach of discussing the magnitude of the findings relative to my sample, rather than relying on a *p* value alone.

The concept of "Table 2 fallacy" is a phrase used to describe the approach of reporting estimates for both the exposure of interests and covariates in one table leading to confusion and inappropriate interpretation of findings [4]. The issue occurs when one table is used to present the effect of both primary and secondary exposures in the same way, leading readers to believe that the effects are equivalent [5]. The issue is complex, and the impact depends upon the assumptions made on causal pathways, confounders and modifiers. Examples in the literature demonstrate the impact of the misinterpretation of results with practical implications for interventional studies[5]. Although the approach described as "Table 2 fallacy" has been relatively common in the oral health literature[6], there is move away from this, which I have adapted in my most recent work.

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Chapter 2: Background, rationale, aims and objectives

2.1 Background overview

Oral health is fundamental to general health and wellbeing, yet Aboriginal adults in Australia experience high levels of oral disease, oral health impacts, and in many areas, a lack of culturally safe health promotion and treatment services to address their oral health needs.

Psychosocial factors and their relationship to health and oral health status have received attention in the international literature in recent decades, but for Aboriginal adults in Australia the literature is scarce. One psychosocial factor accepted as core to health and oral health behaviours internationally is that of perceived self-efficacy. Again, there is a lack of literature reporting on self-efficacy in the oral health context for Aboriginal adults.

This chapter includes a review of the key literature pertinent to the following chapters of this thesis, demonstrating why the research described was important to conduct. This chapter also establishes a rationale for the research undertaken and the specific aims that will be addressed through the published and submitted papers.

Firstly, the available data related to Aboriginal oral health in Australia are described. A case is presented for the reasons why nationally representative studies such as the National Survey of Adult Oral Health (NSAOH) 2004-2006 may have underestimated the burden of oral disease in regional Aboriginal communities.

The second aspect of the literature described pertains to the two oral health outcome measures utilised in the research undertaken, specifically the impact of oral health conditions and self-rated oral health.

Next, the evidence for the relationship of general psychosocial factors with health and oral health outcomes is reported. Following this is a focus on perceived self-efficacy, a core component of Bandura's Social Cognitive Theory that has been incorporated into other internationally recognised models of health promotion and health behaviour research. The evidence for oral health-related self-efficacy, oral health behaviours and oral health outcomes is described.

This chapter concludes with a summary of the gap in the literature that can be addressed and the rationale for the research undertaken. It helps to identify why this research is important for policy development in Australia aimed at closing the gap in oral health between Aboriginal and non-Aboriginal adults. This chapter concludes with the overall aim and specific objectives of the research described in this thesis.

2.2 Indigenous health and oral health in Australia

Indigenous peoples are those who inhabited land prior to the arrival of others from other ethnic groups, with those arriving often obtaining or settling on the land with force [1]. The United Nations estimates that indigenous people, spread across more than 70 countries, total over 370 million people worldwide[1]. Indigenous people have a special relationship with their land, carry unique knowledge, belief systems and language. In Australia, Indigenous people include those who identify as being of Aboriginal and/or Torres Strait Islander descent, totalling over three percent of the total Australian population in 2016, an increase from the previous Census [2]. Indigenous Australians are a diverse population, speaking many different languages, living in a wide variety of locations and belonging to many distinct descent groups. The land on which this study was based belonged to Aboriginal people, and therefore most of the writing within the thesis will refer to Aboriginal people only. However, where referring to the broader population and for some of the journals with a more international audience, the term "Indigenous" may be used interchangeably with the term "Aboriginal".

Indigenous populations internationally experience social, political and health disadvantage, with disparities in oral health clearly established[3]. Health disparities are also well documented in Australia, with Aboriginal people more likely to suffer from chronic diseases including diabetes, kidney and cardiovascular disease as well as infections and reduced life expectancy[4]. Disparities exist across a broad range of social determinants of health[5, 6].

Oral health is fundamental to overall health and wellbeing, with oral conditions affecting quality of life, with physical, social, psychological as well as economic consequences for individuals and communities[7]. Oral health disparities are evident in Australia, with a decline in the oral health of Aboriginal people occurring since colonisation and the adoption of a Westernised diet[3]. National estimates over the last 20-25 years have consistently demonstrated the greater oral health burden experienced by Aboriginal adults, including untreated dental caries, more severe periodontal disease and higher rates of edentulism[8-10]. The National Survey of Adult Oral Health 2004-2006 (NSAOH) identified that a higher proportion of Aboriginal participants reported avoiding food due to dental problems, rated their oral health as fair or poor, reported toothache and perceived a need for dental care (dentures, extraction or filling) than non-Aboriginal Australians[8]. Findings from the most recent National Survey of Adult Oral Health (2017-18) demonstrated that Indigenous Australians continued to have higher levels of dental caries experience, higher prevalence of moderate to severe periodontal disease, greater prevalence of problem-based dental attendance and lower rates of excellent or very good self-ratings of oral health than non-Indigenous Australians[11]. Other studies

with Aboriginal adults in specific communities or geographical locations support these findings and suggest that an even greater level of oral health disadvantage may exist for both clinical and self-report measures of oral health across Australia, beyond that which is reported from nationally representative data[12-15].

In Australia, health varies across residential location[16]. Chronic health conditions including diabetes, cardiovascular disease, arthritis and asthma occur less frequently amongst people residing in major cities. Patterns of smoking and alcohol misuse follow a similar pattern[16]. Self-rated general health also varies by level of disadvantage with people living in the most disadvantaged areas of Australia being more likely to report fair or poor health when compared to those living in less disadvantaged areas[17]. There is evidence of oral health disparities by residential location, with increased tooth loss, greater levels of untreated and more severe dental decay and more severe tooth wear for those residing outside of capital cities [8]. The residential distribution of the Aboriginal and non-Aboriginal populations differ, with a greater proportion of Aboriginal people living outside major cities and in regional and remote Australia when compared with non-Aboriginal Australians. This differing distribution is clear in South Australia with one regional centre having more than 19 percent of the population identifying as Aboriginal[18]. This means that Aboriginal Australians living in remote and regional locations may face multiple forms of disadvantage that combine to create an excess vulnerability to poor general and oral health.

Although there is evidence for the disease burden experienced by Aboriginal adults in Australia, nationally representative data available may in fact underestimate the level of disease and oral health impacts experienced by Aboriginal adults outside of capital cities, and in particular, for those experiencing greater socioeconomic and geographic disadvantage. Reasons include the small number of Aboriginal participants in national surveys in addition to the nature of national survey recruitment and requirements for participation potentially selecting for Aboriginal participants that are more advantaged. For example, having a home telephone and being able to navigate themselves to a dental clinic, and further potential issues with cultural acceptability of survey design and implementation[3]. Utilising smaller studies may be a more culturally acceptable approach to quantifying the oral health needs of Aboriginal communities outside of capital cities and enable the unique needs of each community to be more appropriately investigated and documented.

2.3 Subjective measures of oral health / self-report measures of oral health

Consistent with a paradigm shift away from a biomedical model of health to a biopsychosocial model, there has been an increasing focus on using self-report measures of oral health to capture the subjective experiences and interpretations of health and illness rather than purely clinical measures of oral health and disease. Given the documented burden of oral disease for Aboriginal adults and the potential for physical and psychological impacts of oral health to further add to the social, economic and political disadvantage faced by Aboriginal communities, measuring the impact of oral conditions is highly relevant.

One of the most utilised measures internationally to assess the impact of oral health conditions is the Oral Health Impact Profile in both the original 49 items[19]and short form with 14 items[20]. This measure captures seven dimensions of impacts of oral health conditions, including functional limitations, physical disability and psychological discomfort. A brief literature search identifies that the shortened version of the Oral Health Impact Profile (OHIP-14) has been translated and validated in many languages, on every continent, and is used routinely in oral health research, including in national oral health surveys and among populations at high risk of disease and social disadvantage[21, 22]. The OHIP-14 has been validated among Aboriginal populations[23], with experiences of racism associated with oral health impact scores[24].

Global measures of self-rated health and oral health ask individuals to rate their health or oral health on a given scale, sometimes in relation to their peers. These global questions enable respondents to take into account perspectives that are not easily measured in clinical evaluations[25]. Self-rated general health is a predictor of mortality[26] and functional limitation[27]. Associations between self-rated oral health and a multitude of objective clinical and subjective self-report measures, as well as oral health behaviours, have been documented [28]. The clinical validity of self-rated oral health has been demonstrated in an Australian adult population, with ratings of oral health associated with tooth loss and caries experience[29]. Self-rated oral health and general health have been shown to vary across population groups and across key social determinants including education, income, ethnicity and race[28, 30, 31]. There are also indications that the referents people use for evaluating and rating their general or oral health vary across age groups, race or ethnicity and level of education[32, 33].

2.4 Psychosocial factors, health and oral health

Psychosocial constructs are important determinants of health[34]. Long term accumulation of psychosocial risks, such as a lack of control in home and work environments, lack of social support and experience of anxiety, serve as continual stressors and impact on both physical and psychological health and wellbeing[34]. Understanding the role that psychosocial factors play in poor oral health among disadvantaged populations may serve to assist in developing broader strategies to address oral health inequalities.

The Aboriginal view of health is generally accepted as being a broader and more holistic view of health than in Western societies, encompassing the social, emotional and cultural well-being of the community as well as the physical and emotional health of the individual [35]. The whole-of-life view and integration of health into all aspects of life suggest that psychosocial factors may be particularly important when investigating determinants of oral health for Aboriginal populations.

A psychosocial factor that has received significant attention internationally in terms of both general and oral health is that of perceived stress. Perceived stress refers to an individual's subjective assessment or appraisal of the level of stress in their life[36], with the most commonly used instrument to measure perceived stress, the Perceived Stress Scale, encompassing both the evaluation of stressful events and an individual's perception of their coping abilities [36]. This is based on the premise that an individual's perception of stressors or potentially stressful life events is more important in terms of the impact on psychological and physical wellbeing, rather than the type of event or event itself. This also accounts for the variation between individuals in their appraisal of similar situations and therefore the impact that the potentially stressful event has on their health. Internationally and in Australia, perceived stress is associated with a range of health and oral health indicators[36-39] having an even stronger relationship with poor self-rated oral health than tooth loss among Australian adults [40].

For Aboriginal Australians, self-reported perceptions of stress feature in both health and oral health contexts. Aboriginal adults report high levels of psychological stress [4], with over thirty percent of Indigenous people aged over 15 years reporting high psychological distress in 2003 [41]. Those who report high levels of stress were more likely to also report fair or poor health and engage in riskier health behaviours such as smoking, use of illicit substances and consumption of higher levels of alcohol [41]. This is consistent with research in South Australia, where Aboriginal mothers with high perceived stress had a 24 percent higher risk of smoking [42] and had poorer support from the community[43]. For oral health, higher levels of psychological distress were associated with self-

reported oral health for Indigenous adults in the Northern Territory [44] and with oral health outcomes amongst pregnant Aboriginal women[42].

There is evidence that socioeconomic factors mediate the effect between stress and oral health outcomes[45] and that stress accounts for much of the variation in oral and general health by socioeconomic status across ethnic groups[37]. This further indicates that the relationship between stress, socioeconomic factors and oral health outcomes is important when assessing oral health inequalities.

2.5 Self-efficacy, health behaviours and health outcomes

Self-efficacy refers to an individual's belief that they have control over their own behaviours. In 1997, Albert Bandura defined self-efficacy as the "conviction that one can successfully execute the behaviour required to produce the outcomes"[46]. Assessment of an individuals perceived self-efficacy is based on the premise that psychosocial processes play a role in determining a person's belief in their ability to carry out specific behaviours to produce a desired outcome[46]. Self-efficacy is at the core of Bandura's Social Cognitive Theory (SCT), with self-efficacy both influencing behaviour directly and indirectly by influencing how people evaluate and determine their personal goals and aspirations[46]. The assessment of an individual's self-efficacy most commonly asks about an individual's belief or confidence in their ability to perform health-related behaviours in the presence of potential impediments. Although self-efficacy has been most commonly association with Bandura's SCT, clear evidence for the role of self-efficacy in predicting health behaviours has led to the incorporation of self-efficacy into other models used to explain health behaviours and to underpin health promotion strategies.

The concept of self-efficacy features in other theoretical models used to evaluate and predict behaviours (see Table 1). Widely used in research focussed on health behaviours, the Health Belief Model [47, 48] has been adapted to incorporate self-efficacy forming an Extended Health Belief Model (EHBM) [49]. Incorporation of self-efficacy into the model has been utilised in both cross-sectional and intervention studies with the EHBM guiding study design and health education strategies [50-52]. Another widely utilised model used internationally is the Theory of Reasoned Action (TRA). In the oral health context, addition of self-efficacy to the TRA enhanced the ability of the model to predict reported oral health behaviours [53]. The theory of Planned Behaviour (TPB), based on the TRA, incorporates the concept of self-efficacy into the framework, however, includes self-efficacy under the concept of perceived behavioural control. The incorporation of self-efficacy into these established models used to explain health behaviours supports the notion that self-efficacy is an important construct in health research.

Table 1: Theoretical Models of Health Behaviour

Model	Does self-efficacy feature in the model?
Social Cognitive Theory (SCT)	Yes: self-efficacy is at the core of the SCT[46]
Extended Health Belief Model (EHBM)	Yes: original model did not, however the extended model does incorporate self-efficacy[49]
Theory of Reasoned Action (TRA)	No, original model does not, however incorporation of self-efficacy into the model improved ability to predict behaviours [53]
Theory of Planned Behaviour (TPB)	Yes, however is placed within a more general framework and termed perceived behavioural control [54]

Whilst SCT has traditionally focussed on the individual, Bandura has also described the role of social support in behaviour change [55]. In 2004, Bandura highlighted that shared beliefs in a broader community or collective efficacy is important in social change and health promotion [55]. The concept of social support and a collective or communal efficacy being important in individual and community health strategies is salient in Aboriginal health given the culture of strong interpersonal relationships and collective support in Aboriginal communities and embedded within Aboriginal culture.

Self-efficacy and general health

While approaches to evaluating self-efficacy has been diverse in methodology, the evidence consistently demonstrates that efficacy beliefs influence individual levels of motivation and performance, predicting differences between individuals but also differences within an individual at different points in time[56].

The relationship of self-efficacy and self-management of chronic disease including diabetes, arthritis, multiple sclerosis and cardiovascular disease, has been described for almost half a century. For patients with cardiac conditions, self-efficacy can predict uptake of specific behaviours related to self-management, is correlated with less psychological distress, better health-related quality of life and self-management [57]. In addition, self-efficacy has predicted self-management outcomes after a three month period, after controlling for initial self-management scores[57]. For patients with multiple sclerosis undergoing treatment, baseline as well as changes in self-efficacy were strong and independent predictors of change in health status[58]. Consistent with self-efficacy instruments normally focussing on specific health behaviours, the diabetes management self-efficacy scale

comprises sub-scales that reflect differing elements of diabetes management, such as diet, medication and foot care [59]. Amongst adults with Type 2 diabetes in Jordan, self-efficacy was associated with self-reported management behaviours, with diet self-efficacy a predictor of glycaemic control[59]. Consistent with these findings, greater self-efficacy was a significant predictor of better self-care and indicators of diabetic control at baseline as well as being a significant longitudinal predictor of better self-care and glycaemic control for adults with Type 1 diabetes[60].

Recent systematic reviews support the role of self-efficacy in chronic disease and pain management. For patients with arthritis, higher self-efficacy was associated with pain, physical function, psychological impacts and quality of life [61]. For patients with chronic musculoskeletal pain, the systematic review demonstrated that self-efficacy should be considered in patient assessment and care planning, with self-efficacy associated with a wide range of outcome measures including pain intensity, fatigue, seeking care and psychological impacts such as depressive symptoms [62].

Self-efficacy and oral health

Self-efficacy has been consistently associated with preventive oral health behaviours among many population groups both internationally[53, 63-65] and in Australia[52], including among high risk population groups[66].

In Finland, for adults with diabetes, those who frequently brushed their teeth or who visited the dentist in accordance with their recommended recall visits, had higher dental self-efficacy scores and less decayed teeth[63]. Dental self-efficacy also predicted diabetic control, leading authors to suggest that self-efficacy may be a generalised characteristic in health behaviour[67]. This may indicate that enhancing self-efficacy in one area of health behaviour may also increase self-efficacy related to other health behaviours, an important consideration in planning health interventions.

Self-efficacy of caregivers has been investigated in relation to early childhood caries among high risk groups in the Unites States of America (USA) using both the SCT and EHBM theoretical models to underpin instrument design and analysis [51, 68]. Findings suggest that parental self-efficacy plays a role in health behaviours known to be associated with a child's caries risk. For Latino mothers, maternal self-efficacy was associated with oral health knowledge and knowledge on dental utilization [51]. Finlayson and colleagues validated measures of oral health-related self-efficacy, knowledge and fatalism among African-American mothers in Detroit, USA, finding that a mother's tooth brushing self-efficacy was positively correlated with children's brushing frequency[68]. Amongst children from

low-income families in Detroit, USA, low self-efficacy has been shown to be associated with high sugar intake [69].

For Aboriginal adults, low self-efficacy has been identified as a predictor of poor self-rated oral health among pregnant Aboriginal women [70], with the mediating effect of self-efficacy on the relationship between oral health literacy and self-rated oral health reported [71]. Despite these two studies, the literature is lacking for Aboriginal adults, and in particular, those residing outside of capital cities.

Evidence for modifying self-efficacy through interventions

In theory, given the association of self-efficacy with health behaviours and health outcomes, improving an individual's self-efficacy could provide an opportunity to intervene with supportive programs in order to improve oral health outcomes.

Health education programs have been shown to improve self-efficacy for patients with chronic disease [72] and in relation to health promoting behaviours such as cancer screening[73, 74]. Modest improvements in self-efficacy scores have been reported after treatment programs for patients with multiple sclerosis[58]. An intervention for older diabetic patients using telemedicine improved self-efficacy and glycaemic control [75]. In the oral health context, health promotion interventions have improved oral health self-efficacy and preventive behaviours for pregnant women[76].

2.5 The research gap and study rationale

In Australia there remains a gap in the published literature pertaining to the current oral health status and associated oral health needs of Aboriginal adults in regional and rural areas, as well as a lack of studies investigating the association between psychosocial factors and oral health for these high risk groups. With data from nationally representative studies potentially underestimating the burden of disease and impacts in regional Aboriginal communities, it is important to further investigate and quantify local oral health issues in partnership with Aboriginal communities.

The psychosocial factors of perceived stress and control have been associated with key indicators of oral health and oral health outcomes in the Australian population[38, 77], and more recently among pregnant Aboriginal women in South Australia[42]. Despite this recent study, there are very few studies that specifically investigate the relationship of psychosocial measures and oral health for Aboriginal people in Australia. With Aboriginal adults reporting high levels of stress, and those with high stress more likely to report poor health and risk behaviours[4, 41, 78], experiences of psychological stress may be a particularly important factor contributing to poorer oral health that warrants further investigation.

Oral health-specific psychosocial factors, including perceived self-efficacy and fatalism have received recent attention in Australia, for example, among adults experiencing homelessness [66]. The findings amongst Aboriginal adults of associations with self-rated oral health [70, 71], suggest that the role of self-efficacy and fatalism specific to oral health is worthy of further investigation.

In addition to the research gap identified, previous research with the Aboriginal community in Port Augusta, South Australia had identified through focus groups that there was a sense of powerlessness, with participants feeling a lack of control over their oral health and health care decisions, at both the individual and community level[79]. There was a clear perception that behaviours promoting oral health were not widely practised, significant barriers to dental care existed together with fatalistic views about oral health[79]. In addition, within this community, oral health impacts have been associated with lower dental service utilisation and non-ownership of a tooth brush[80].

These findings for this specific Aboriginal community highlight that psychosocial factors may be an important determinant of oral health that has not received adequate attention. Given that psychosocial factors have been shown to be important internationally and in Australia, particularly for disadvantaged groups, to better facilitate evidence-based and culturally safe oral health promotion policies for Aboriginal South Australians, it is imperative that self-reported oral health

and psychosocial factors for this community are quantified. Further, it is important to investigate the relationship between general and oral health-specific psychosocial factors and oral health outcomes, with the purpose being to better facilitate strategies aimed at improving oral health to account for these potentially important determinants of oral health.

2.6 Thesis aims and objectives

Overall aim

The overarching aim of this research was to compare self-reported measures of oral health among a group of Aboriginal adults in regional South Australia with nationally representative data, and, to investigate associations between psychosocial factors and self-reported oral health among regional-dwelling Aboriginal adults.

Specific objectives

1. To describe the prevalence, severity, and extent of oral health impacts among Aboriginal adults in regional South Australia and compare against non-Aboriginal and Aboriginal participants in the 2004-06 National Survey of Adult Oral Health (NSAOH).

2. To quantify the prevalence of excellent, very good or good self-rated oral and general health among regional dwelling Aboriginal South Australians and compare against non-Aboriginal and Aboriginal participants in the 2004-06 National Survey of Oral Health (NSAOH).

3. To examine the validity of oral health-specific self-efficacy and fatalism instruments in an Aboriginal adult population in regional South Australia.

4. To quantify levels of the two dimensions of the Perceived Stress Scale (perceived stress and coping) and determine associations with self-reported oral health and general health among Aboriginal adults in regional South Australia.

5. To investigate associations between oral health-related self-efficacy and oral health outcomes and investigate whether these associations persists after adjusting for sociodemographic and psychosocial confounders, specifically perceived stress, coping and oral health-related fatalism.

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Chapter 3: Materials and Methods

This chapter consists of an overview of the study from which data for the analysis of this thesis were drawn. An overview of the analytic methods used in the papers of this thesis is provided. This chapter contains a published paper that describes the methods utilised for the primary study, the Indigenous Oral Health Literacy Project.

Published paper:

An oral health literacy intervention for Indigenous adults in a rural setting in Australia

Citation:

Parker, EJ, Misan, G, Chong, A, Mills, H, Roberts-Thomson, K, Horowitz, AM & Jamieson, LM 2012, 'An oral health literacy intervention for Indigenous adults in a rural setting in Australia', *BMC Public Health*, vol. 12, Jun 20, p. 461.

3.1 Overview of primary study

The Indigenous Oral Health Literacy Project: primary data source

The Indigenous Oral Health Literacy Project (IOHLP) was a National Health and Medical Research Council (NHMRC) funded project, based in Port Augusta South Australia. I was a Chief Investigator for this project and played a key role in implementation, including developing and formatting the questionnaire, consulting with expert and Aboriginal advisory groups, developing guidelines for project officers and working with project officers to develop intervention tools.

The published paper included within this chapter describes the study in detail.

The IOHLP was named "Teeth Talk" by the Aboriginal advisory group, recognising the focus on oral health literacy and the interventions being focused around talking, sharing and learning as a group. An important component of the study design was that of working with Aboriginal community members to recruit participants, develop the questionnaire, develop the intervention and monitor study progress. Collaborating with Aboriginal community members as real partners is essential if research with Aboriginal communities is to be culturally safe and successful.

The Port Augusta community was selected for this study because of the connections already established with the community, community feedback around previous research and the engagement and support for research within a fairly large Aboriginal community. I had personal connections within this community having worked to establish and then manage an oral health program, including a dental service, with in the Aboriginal Health Service. Our research team had developed a relationship with this same community in Port Augusta, South Australia over the past 10 years, enabling development of this study in partnership with the community.

Port Augusta is a regional centre in South Australia, with around 13,800 residents in the wider Port Augusta Council Area, of which just over 18% identify as Aboriginal and/or Torres Strait Islander[1]. Within this community, the majority identify as Aboriginal (97.5%), and few as Torres Strait Islander (1.0%) or both Aboriginal and Torres Strait Islander (1.5%)[2]. This community of over 2,500 people reside across 885 households and has a fairly even proportion of males and females (50.6% male)[2]. The median age of 26 years is slightly higher than the overall state median of 23 years, with the age distribution across the Indigenous population in Port Augusta being highly skewed towards the young (31.4% aged 0-14 years compared with only 5.3% aged 65 and over). Although English is only spoken at home in the majority of households (80.8 %), Indigenous languages are spoken in multiple household with the main languages including Pitjantjatjara, Adnymathanha, Arabana and Yankunytjatjara[2]. For those aged 15 years and over, 28 percent indicated they were unemployed in

the 2016 Census, higher than the rest of South Australia (19.9%) and Australia (18.2%), with a lower median income than for Aboriginal and Torres Strait Islander people in broader South Australia and Australia[2]. This indicates the socio-economic disadvantaged experienced by the Port Augusta Aboriginal and Torres Strait Islander community.

This study involved a convenience sample of Aboriginal adults. Previous work with this community and other vulnerable populations by our research group have shown that recruitment methods need to be tailored to suit each community. In this instance, Aboriginal project officers and a project manager who had worked in the local health service for many years were essential in making community connections. The study was promoted through the local Aboriginal Health Service, on local radio and in community centres. Word of mouth was a powerful tool, with participants recruiting family and friends to join the study, indicating community acceptance, engagement and belief in the benefits of the proposed intervention. This approach to recruitment impacts on randomisation, with family groups treated as clusters in preference to individual randomisation. The cluster randomisation approach is more culturally acceptable and accounts for the key role of extended family groups in Aboriginal communities.

The data utilised for all papers in this thesis are drawn from the baseline questionnaire of the IOHLP. The baseline questionnaires were administered in October and November 2010.

The questionnaire is included as an appendix to this thesis. The questionnaire was administered by Aboriginal project officers or the local project manager who had extensive experience working with the local dental program and developed community connections. Although designed to be self-completed, participants were given the choice of having the questionnaire completed as an interview, or a combination of self-complete and interview. This is another important aspect of study design which contributed to the acceptability and willingness of participants to complete the questionnaire. For some participants, vision was an issue, so project staff carried magnifying spectacles with them. For other participants, levels of literacy were a barrier to self-completion. For others, simply having the questionnaire read for them made it feel less formal and more comfortable as though it was a conversation. These are important strategies to note for future research with Aboriginal adults.

3.2 Overview of methods and conceptual model

Data for 400 Aboriginal adults were available from the baseline questionnaire of the IOHLP.

The primary outcome measures were self-rated oral health and the impacts of oral health, with psychosocial factors including self-efficacy a key focus of this research, as indicated by the conceptual model (Figure 1).

Data preparation and preliminary data analysis was performed using IBM SSPSS versions 20-28.

Where comparisons with population-level data were made, SAS-Callable SUSAAN was utilised as SPSS did not have the capabilities to perform the necessary analysis (at that time).

As my skills have progressed and statistical advice has been provided by co-authors more familiar with STATA, I have performed the analysis for the final two papers using STATA version 15.

Each paper provides details of the statistical methods utilised for the each analysis.

Conceptual model

The conceptual model is framed around oral health-related self-efficacy as the primary dependent variable of this research, with self-rated oral health and oral health impacts as the oral health outcomes. In this model the psychosocial factors of perceived stress and perceived coping have a direct effect on self-efficacy as well as on oral health outcomes. Oral health-related fatalism has a direct effect on oral health-related self-efficacy and oral health outcomes. Sociodemographic factors impact on each exposure and outcome measure.

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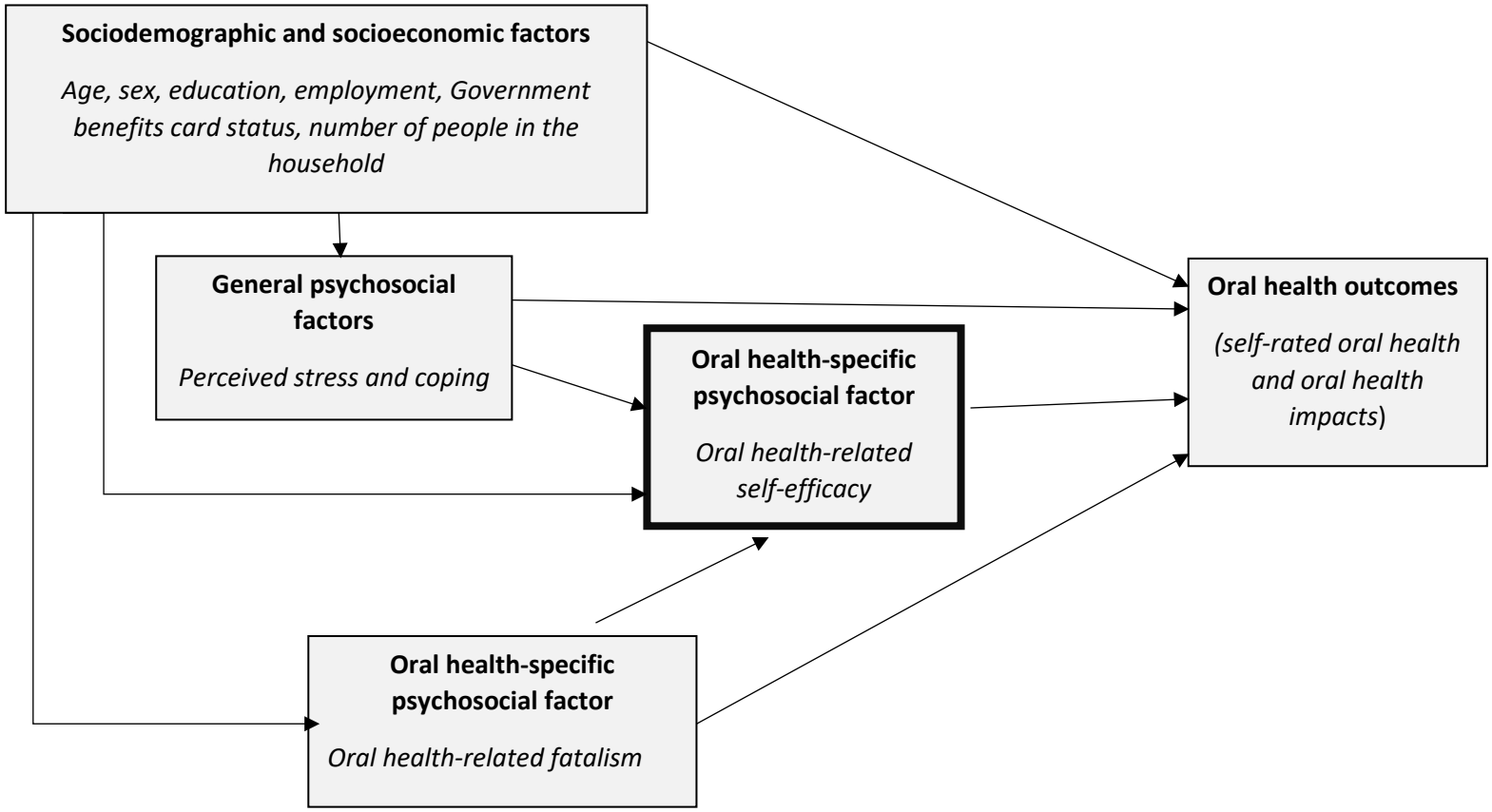

Figure 1: Overarching conceptual model

Statement of Authorship

Title of Paper	An oral health literacy intervention for Indigenous adults in a rural setting in Australia
Publication Status	☒ Published ☐ Accepted for Publication ☐ Submitted for Publication ☐ Unpublished and Unsubmitted w ork w ritten in manuscript style
Publication Details	Parker, E.J., Misan, G., Chong, A. Mills, H., Roberts-Thomson, K., Horowitz, A.M., and Jamieson, L.M. An oral health literacy intervention for Indigenous adults in a rural setting in Australia. BMC Public Health 12, 461 (2012). https://doi.org/10.1186/1471-2458-12-461

Principal Author

Name of Principal Author (Candidate)	Eleanor Parker		
Contribution to the Paper	Contributed to the design of the study. Completed the first draft of the manuscript and completed manuscript revisions. Acted as corresponding author.		
Overall percentage (%)	55%		
Certification: *Candidate has edited to reflect the type of paper*	This paper is a methods paper, describing the methods of the parent study from which data for my original research is drawn. I conducted this work during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	10/12//2021

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Lisa Jamieson		
Contribution to the Paper	Lead Investigator for the project. Design of the original research plan for the study and revision of the manuscript.		
Signature		Date	10/12/2021

Name of Co-Author	Kaye Roberts-Thomson
Contribution to the Paper	Contributed to the design of the study and manuscript revision.

Signature		Date	10/12/2021

Name of Co-Author	Helen Mills		
Contribution to the Paper	Project manager, contributing to design of the study and manuscript revision.		
Signature		Date	10/12/2021

Please note: Primary Supervisor, Professor Lisa Jamieson is authorising on behalf other co-authors not contactable at this time.

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STUDY PROTOCOL Open Access

An oral health literacy intervention for Indigenous adults in a rural setting in Australia

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Abstract

Background: Indigenous Australians suffer substantially poorer oral health than their non-Indigenous counterparts and new approaches are needed to address these disparities. Previous work in Port Augusta, South Australia, a regional town with a large Indigenous community, revealed associations between low oral health literacy scores and self-reported oral health outcomes. This study aims to determine if implementation of a functional, context-specific oral health literacy intervention improves oral health literacy-related outcomes measured by use of dental services, and assessment of oral health knowledge, oral health self-care and oral health- related self-efficacy.

Methods/design: This is a randomised controlled trial (RCT) that utilises a delayed intervention design. Participants are Indigenous adults, aged 18 years and older, who plan to reside in Port Augusta or a nearby community for the next two years. The intervention group will receive the intervention from the outset of the study while the control group will be offered the intervention 12 months following their enrolment in the study. The intervention consists of a series of five culturally sensitive, oral health education workshops delivered over a 12 month period by Indigenous project officers. Workshops consist of presentations, hands-on activities, interactive displays, group discussions and role plays. The themes addressed in the workshops are underpinned by oral health literacy concepts, and incorporate oral health-related self-efficacy, oral health-related fatalism, oral health knowledge, access to dental care and rights and entitlements as a patient. Data will be collected through a self-report questionnaire at baseline, at 12 months and at 24 months. The primary outcome measure is oral health literacy. Secondary outcome measures include oral health knowledge, oral health self-care, use of dental services, oral health-related self-efficacy and oral health-related fatalism.

Discussion: This study uses a functional, context-specific oral health literacy intervention to improve oral health literacy-related outcomes amongst rural-dwelling Indigenous adults. Outcomes of this study will have implications for policy and planning by providing evidence for the effectiveness of such interventions as well as provide a model for working with Indigenous communities.

Background

Indigenous Australians include people who identify as being of Aboriginal or Torres Strait Islander descent, representing 2.5% of the total Australian population in 2006 [1]. They are a diverse population, belonging to many distinct language groups and living in a wide variety of locations [2]. The majority of Indigenous Australians live outside major cities, with 43% living in regional and 25% in remote areas.

Indigenous Australians suffer from poorer oral health than non-Indigenous Australians. National estimates indicate that Indigenous Australian adults have higher rates of total tooth loss, higher percentage of reported toothache, lower mean number of dental visits, are more likely to visit for a problem rather than for a check-up and receive a lower mean number of dental fillings compared to non-Indigenous Australians [3]. Indigenous children experience, on average, twice the level of dental caries in both the deciduous and permanent dentitions with more untreated decay than their non-Indigenous counterparts [4]. In addition, at all ages between 4 and 15 years, a greater percentage have experienced dental

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caries when compared with their non-Indigenous counterparts [2]. Non-metropolitan Indigenous children and the more socially disadvantaged are even more severely positioned in terms of oral health outcomes [5-7].

Previous work

Previous oral health research with Indigenous adults in Port Augusta has revealed important findings [8-10]. Initial qualitative investigations identified a strong sense of powerlessness, with participants feeling a lack of control over their oral health and health care decisions, at both the individual and community level [8]. There was a clear perception that behaviours promoting oral health were not widely practised and that significant barriers to dental care existed together with fatalistic views about oral health [8]. In the later study, a convenience sample of 468 participants completed a self-report questionnaire, including the REALD-30 to measure oral health literacy [10]. This study revealed associations between oral health literacy and self-reported oral health. Lower oral health literacy scores were associated with poor oral health literacy-related outcomes, including a belief that either that teeth didn't need to be brushed or only needed to be brushed once a day; that cordial (flavoured sugary drink) was good for teeth; and that people didn't have their own toothbrush, or that even if they owned a toothbrush had not brushed the previous day. Each of these oral health literacy-related outcomes was in turn associated with poor self-reported oral health. In addition to the research findings, this study demonstrated that conducting oral health research utilising self-report questionnaires was successful in this community.

Oral health literacy, like general health literacy, incorporates the capacity a person has to learn and use information about oral health in making decisions about their oral health. Developing adequate levels of health literacy may depend on external factors such as education, experiences in health settings and family attitudes; and individual factors such as cognitive ability and prior knowledge [11]. Lower levels of health literacy are commonly found in people who have low levels of education and income or have a different first language [12]. These characteristics are prevalent in the Australian Indigenous population.

Having poor oral health literacy can bring significant challenges. A recent study in the United States described how caregivers with low oral health literacy displayed low levels of oral health knowledge and poor self-reported oral health, which was reflected in their children who also had sub-optimal oral health with related poor oral care behaviours [13].

Targeted interventions that used clear communication and tailored and supportive training techniques have had some success in improving health outcomes for people with low health literacy. One such intervention with diabetic participants reported enhanced and retained management skills with improved glycaemic control [14]. To date, there have not been any studies which involve interventions targeting oral health literacy in Indigenous populations.

Like health literacy, a number of screening tools have been developed to determine levels of oral health literacy. Some health literacy tools have been criticised for being too narrow in their range of testing, or relying heavily on the participant's ability to read [15]. This might also apply to their equivalents in dentistry. The Rapid Estimate of Adult Literacy in Dentistry (REALD-30) is a 30 item questionnaire that screens the participant's ability to read dental terminology with correct pronunciation [16]. The Test of Functional Health Literacy in Dentistry (TOFHLID) tests reading comprehension and numeracy skills [17]. These instruments have limited use in individuals who demonstrate low literacy and numeracy skills or where English is not their first language. These characteristics are not uncommon in older Indigenous Australians.

Given the limitations of health literacy screening tools, a new tool has recently been developed in Australia. The Health Literacy Measurement Scale (HeLMS) takes a broad approach to measuring health literacy, addressing many of the limitations of other health literacy tools [18]. The HeLMS was developed using a health literacy conceptual framework developed from a patient perspective. Consisting of 29 items, each rated on a 5 point Likert scale, the HeLMS scores 8 domains: patient attitudes towards their health, understanding health information, social support, socio-economic considerations, accessing general practitioner health care services, communicating with health care professionals, being proactive and using health information [18]. Using the HeLMS, people with chronic lower back pain were found to have lower scores for the domain assessing patient attitudes towards their health than those without chronic back pain, as well as lower scores for each item within that domain [18].

Aims

This study assesses oral health literacy and self-reported oral health outcomes among rural-dwelling Indigenous adults and will determine if implementation of a functional, context-specific oral health literacy intervention improves oral health literacy-related outcomes. For the purposes of this study, oral health literacy-related outcomes include use of dental services, oral health knowledge, oral health self-care and oral health-related self-efficacy.

Specifically, the aims are to:

- Describe the extent of poor oral health literacy among rural dwelling Indigenous adults
- Describe the relationship between oral health literacy and oral health literacy-related outcomes
- Determine if a functional, context-specific oral health literacy intervention improves oral health literacy
- Determine if a functional, context-specific oral health literacy intervention improves oral health literacy-related outcomes

Methods/design

Study design

This study is a randomised controlled trial, utilising a delayed intervention design where all participants will ultimately be offered the intervention. A study schema is presented in Figure 1.

Setting and location

The study is situated in Port Augusta, South Australia, and includes participants from outlying communities who frequent services in Port Augusta.

Participants

To be eligible participants must be Indigenous, aged 18 years and above, and intending to reside in Port Augusta or a nearby community for the duration of the study (two years).

Recruitment

Participants are recruited using a variety of methods previously used successfully with this community [10] including self-nomination, home visits, word of mouth, visits to community centres and referrals. Promotion of the study has occurred via posters in community centres and advertisements on the local Aboriginal radio station.

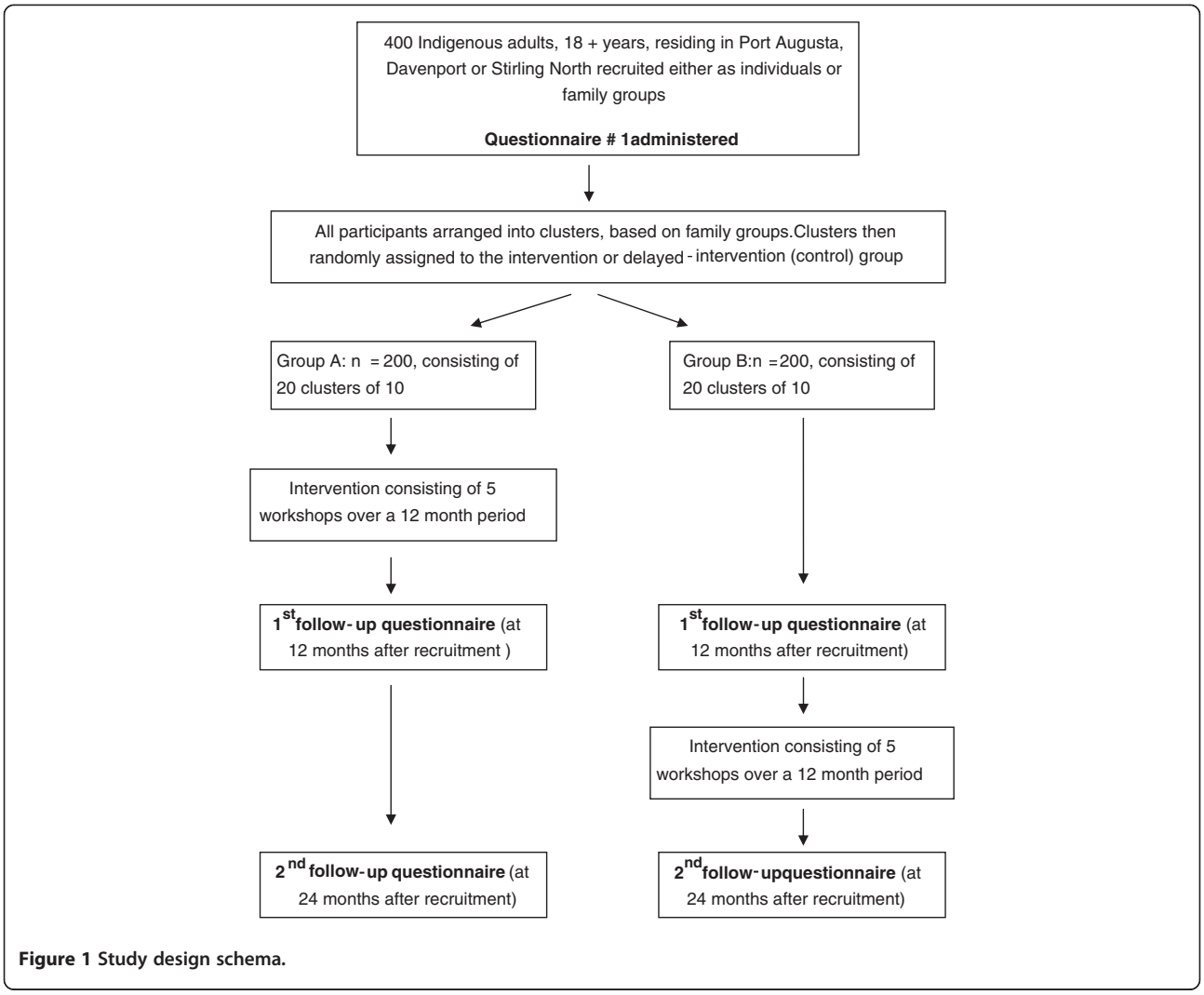

Figure 1 Study design schema.

Funding
Funding has been provided by the National Health and Medical Research Council of Australia (NHMRC, project grant 627101).

Staff
A total of four part-time staff are employed for the initial phase of the study including a dental therapist, employed as a project manager. The remaining three staff are of Indigenous descent and are employed as project officers. In addition to recruiting participants, administering questionnaires and delivering the intervention, the Indigenous research officers play an invaluable role in providing ongoing cultural advice for investigators. The Indigenous project officers have been provided with basic oral health theory training by the project manager, enabling them to deliver the intervention. All staff have lived or worked in the local area previously.

Advisory group
An advisory group has been established comprising seven Indigenous community representatives. The group includes people working in health and education as well as community Elders. The advisory group has provided input into the study design, promotion of the study and the data collection instruments and techniques. The advisory group continues to advise investigators and the study team in relation to appropriate implementation of the study in the local community.

Pilot study
A pilot study was conducted in a neighbouring regional centre, primarily for the purpose of field testing the intervention instruments and giving the Indigenous project officers experience in delivering the sessions. Participants were invited to be involved in the pilot study through contacts at the local Indigenous health service. Written consent was obtained and participants received supermarket vouchers in acknowledgement of their time commitment. Involvement included completion of a baseline questionnaire, attendance at group intervention sessions and completion of a follow-up questionnaire. Participants were asked for immediate feedback upon completion of the questionnaire and after each intervention session as well as at the completion of the pilot study. This feedback was used to refine the questionnaire and intervention instruments for the parent study.

Consent and incentives
Participants are provided with written and verbal information about the study prior to giving consent. In acknowledgement of their time commitment, participants receive a $20 supermarket gift voucher upon completion of each questionnaire and a $10 gift voucher for each intervention session attended. At each intervention session refreshments are offered and participants provided with a variety of products to reinforce the key messages from each session, for example, water bottles, tooth brush and tooth paste, disposable dental mirrors.

Intervention
The intervention consists of a series of five workshops delivered over a 12-month period.The instruments were developed collaboratively by the project manager, other study investigators and the Indigenous project officers, and are used to guide the project officers in delivering the intervention. Each workshop lasts approximately one and a half hours, including morning or afternoon tea and is conducted predominantly by the Indigenous project officers. Workshops consist of presentations, hands-on activities and interactive displays, group discussions and role plays. A key focus of the workshop series is on breaking down barriers and improving confidence of participants. Information around dental disease processes (ie dental caries, periodontal disease and dental erosion) is fundamental to workshop activities and discussion. The themes addressed in the workshops are underpinned by oral health literacy concepts and incorporate oral health-related self-efficacy, oral health-related fatalism, oral health knowledge, access to dental care and rights and entitlements as a patient.

Randomisation
The cluster randomisation method was selected as an appropriate approach for this study because of its acceptability to the participants and the local community (based on feedback from the advisory group and from the pilot study), as well as for the potential to increase the efficacy of the intervention through encouraging discussion amongst family groups and providing a supportive environment for participants' development or change.

After purposive recruitment of 400 individual participants largely through local knowledge of kinship and other networks of the Indigenous project officers, 40 groups are formed based on family and social groups. Group sizes range from 8–12 people. The Indigenous project officers are responsible for assigning participants to the groups, utilising their knowledge of the local community. Family groups (clusters) are randomly assigned on a 1:1 basis to either a test-immediate or control-delayed intervention group. A computer-generated permuted block randomisation sequence is used, developed by biostatisticians at the Australian Research Centre for Population Oral Health (ARCPOH) using a random number generator. Randomly selected block sizes of 4, 6 and 8 are used, such that there is an equal number of participants in each intervention arm within the blocks.

This ensures that if the study is stopped at any particular time there will be approximately an equal number of participants in each intervention arm (Figure 1).

Data collection

Data is collected through self-report questionnaires at baseline, at 12 months and at 24 months. The questionnaires include items pertaining to the primary and secondary outcomes and covariates. Questionnaires are administered by the Indigenous project officers and completed either as an interview or self-completed, with the degree of self-completion determined by the participant. The project officers are provided with a scripted method of introducing and administering the questionnaire. A log of attendance at the intervention sessions is collected.

Primary and secondary outcomes

The primary outcome measure is oral health literacy, measured using the HeLM [18] adapted by investigators for a dental context.

Secondary outcome measures include oral health knowledge, oral health self-care, dental service utilisation, oral health-related self-efficacy and oral health-related fatalism [19].

In the initial study design and pilot study, REALD-30 was utilised as the instrument to measure oral health literacy. After feedback from pilot study participants and the advisory group, it was deemed more culturally-appropriate to utilise the HeLM, adapted by study investigators and project officers for oral health, to measure oral health literacy. Specific feedback in relation to the use of REALD-30 included: (1) participants felt they were being tested and were hence intimidated; (2) the relevance of REALD-30 to the Indigenous oral health context was not clear; (3) the use of REALD-30 may be a barrier to full participation and completion of other components of the questionnaire.

Covariates

Socio-demographic covariates include age, gender, education level, employment, income source, number of people staying in the house the previous night, number of children under 18 living in the household and car ownership.

General health covariates include medical conditions, behaviours such as cigarette smoking and alcohol consumption status, and self-rated general health.

Oral health covariates include self-reported oral health, previous dental extractions and oral health-related quality of life.

Psychosocial covariates linked with oral health outcomes in the Australian population [20], include personal control [21] perceived stress [22] and an adapted version of the social support measure [23].

Data handling and statistical methods

There will be three main analyses. The first analyses will occur after baseline, to quantify the extent of poor oral health literacy and ascertain the relationship between oral health literacy and oral health literacy-related outcomes. The second analyses will occur after 12 months, providing a comparison between the intervention and delayed intervention (control) groups, in order to assess the impact of the intervention. The third analyses will occur after 24 months, assessing the sustainability of intervention impact 12 months post-completion in the initial intervention group.

The Generalised Linear Mixed Model (GLMM) approach will be adopted, using STATA statistical software. Initial analyses will be simple, unadjusted comparisons of individuals. If there appears to be substantial imbalances between individuals in terms of baseline covariates, adjusted analyses will also be performed. All variables that are $p<0.15$ in the GLMM univariate analyses will be entered into multivariate models using a stepwise approach. All effects will be estimated with 95% confidence intervals, with the threshold for statistical significance determined as a two tailed p-value less than or equal to 0.05. All participants with at least one set of follow-up oral health literacy-related outcome data will be included in multivariate modelling.

Power calculation

The initial study design utilised a calculation of sample size performed using PC-SIZE software (GE Dallal, 1990, Version 3). Based on the 2008 oral health literacy survey using REALD-30 [10], it was estimated that a sample size of 310 would be necessary to detect a 7.5 percent difference in the proportion of problem-based dental attenders (pre-intervention vs post-intervention), a 25 percent difference in the proportion of those who believe teeth should be brushed none or once daily (pre-intervention vs post-intervention) and a 30 percent difference in the proportion of those who believe cordial is good for teeth, don't own a toothbrush or own a toothbrush but didn't brush the previous day (pre-intervention vs post-intervention) at the significance criterion of 0.05 and a power of 0.80. Allowing for an attrition rate of 25 percent after 18 months, 388 participants would be necessary at base-line, rounded up to 400 for convenience; 200 in the intervention group and 200 in the control (delayed intervention) group.

During planning stages of the study, it was evident that some changes were necessary to study design. Specifically, a cluster randomisation approach was more appropriate for this study and community, the HeLM [18]

a more appropriate and acceptable tool for assessing oral health literacy than the READ-30, and a 12-month follow-up more practicable than the proposed 9-month follow-up. The original calculation was retained as the best indicator of sample size available in the absence of other data to perform a revised power calculation.

Ethics

Ethical approval was granted by the Aboriginal Health Council of South Australia and the Human Research Ethics Committee of the University of Adelaide. The Board of Management of the Pika Wiya Health Service (PWHS), the local community controlled Indigenous health service, also gave approval for the study. Comprised of representatives from the Indigenous community, the Board of Management is the peak body which governs the delivery of PWHS services and programs.

Discussion

This study will be the first study using a functional, context-specific oral health literacy intervention to improve oral health literacy-related outcomes amongst rural-dwelling Indigenous adults in Australia. Outcomes of this study will have implications for policy and planning by providing evidence for the effectiveness of such interventions as well as providing a model for working with Indigenous communities.

The design of this study has implications for future research where utilising a randomised, controlled study design with Indigenous communities is planned. The delayed intervention study design makes a controlled trial acceptable for the community and increases the proportion of the community potentially benefiting from the intervention.

Consistent with national recommendations for research with Indigenous communities, partnerships between the community and researchers have enabled community feedback to be incorporated into the design of the study. The grouping of participants into clusters was endorsed as the most appropriate method by the advisory group. The questionnaire instruments measuring oral health literacy were changed from READ-30 to an adapted form of the HeLM in response to feedback from the pilot study as it was deemed to be more acceptable and applicable. It is anticipated that these partnerships will enable greater success of the study and facilitate improved outcomes for the community and future partnerships [24,25]. In addition, the study has sought to involve local Indigenous staff wherever possible. The work of the Indigenous project officers, who are considered community champions, has enhanced the acceptability of the study to the local community, increased the potential for participant involvement and begun to build local research capacity. Substantial efforts have been made to ensure full participation of study participants is supported both through the design of study instruments and ensuring study protocols take into account practical considerations specific to the local community.

Competing interests

The authors declare no competing interests.

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Authors' contributions

EJP participated in study design, co-ordinated data collection and data management, and participated in manuscript preparation. GM, AC, KRT and AMH provided important intellectual input into the study design and revision of the manuscript. HM co-ordinated the pilot study, manages the parent project and was involved in manuscript preparation. LJ participated in study design, ethics applications, data management and participated in manuscript preparation. All authors were involved in revising the manuscript for important intellectual content and read and approved the final manuscript.

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Chapter 4: Oral Health Impacts

Published paper:

Oral Health Impact among Rural-dwelling Indigenous Adults in South Australia

Citation:

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4.1 Highlights and linkage to the body of work

This paper provided a detailed assessment of one of the self-report measures used as an oral health outcome in this thesis, the impact of oral conditions, measured with the shortened version of the oral health impact profile, OHIP-14. Comparing the impact of oral health conditions for the participants of the Indigenous Oral Health Literacy Project (IOHLP) with nationally representative data enabled better appreciation of the degree of oral health impact experienced by this group, providing a sound rationale for the use of this as an outcome measure in subsequent papers.

Although data from the National Survey of Adult Oral Health, 2004-2006 (NSAOH) provided evidence of poorer oral health among Indigenous Australian, we speculated that the results may underestimate the level of oral disease and impacts of oral conditions among Aboriginal adults outside of capital cities, where additional disadvantage exists for a range of socioeconomic and health service-related factors.

The collection of self-report data from this sample of 400 adults from a regional location in South Australia provided an opportunity for comparison with NSAOH participants. In order to provide more meaningful comparisons, three sub-populations from NSAOH were utilised; Indigenous Australians; non-Indigenous Australians; and, non-Indigenous South Australians residing in regional areas. In addition, given the differing age and sex distributions between samples, all estimates were produced using direct standardisation for age and sex utilising Census Estimates.

Three summary measures for OHIP-14 were utilised in addition to assessing each item score.

In writing this paper for a special edition of the Journal of Healthcare for the Poor and Underserved, it was deemed appropriate to use the term Indigenous, rather than Aboriginal. In addition, after feedback from reviewers, we described the location of the study as “rural”, to be more consistent with terms utilised by the international readership, and more specifically, those in the United States of America (where the journal was based) where terms such as “regional” could convey a different meaning than in Australia.

Findings from this paper demonstrated that IOHLP participants experience high levels of impact of oral conditions, with higher estimates than each comparison group, for every OHIP-14 item as well as each summary measure. The results indicated that for IOHLP participants, those that had oral health problems reported multiple impacts, with an OHIP-14 extent score five times that of the non-Indigenous participants of NSAOH.

Highlights

- Comparing oral health impacts of 400 Aboriginal adults from a rural / regional location of South Australia with three sub-groups from nationally representative data enabled the degree of oral health impacts to be quantified, but perhaps more importantly, the level of impacts was better appreciated when compared with Indigenous and non-Indigenous participants of NSAOH across Australia and non-Indigenous rural South Australians and demonstrated the magnitude of the burden of oral health impacts experienced.
- Standardising by age and sex to Census population estimates enabled more meaningful comparisons.
- Utilising three OHIP-14 summary scores as well as examining each OHIP-14 item score to the best of our knowledge had not been performed for Indigenous Australians previously.
- Demonstrated that the data for Indigenous Australians from nationally representative studies may significantly underestimate the oral health burden in regional Aboriginal communities.
- Aboriginal adults in regional South Australia clearly suffered a greater degree of oral health impacts than non-Indigenous adults across Australia, with the greatest relative difference identified for oral health conditions resulting in an inability to function.

Research and policy implications

The findings of this study added to the literature describing the impact of oral conditions for Aboriginal adults in a regional location in South Australia, clearly demonstrating that for this group, the impact of oral health conditions was significantly greater than NSAOH comparison groups. There are critical implications of this research when considering oral health policy at a national and local level.

Firstly, Aboriginal adults in regional South Australia, who already suffer social and economic disadvantage, are burdened by a high degree of oral health impacts, with oral health conditions affecting ability to function and carry out normal daily activities, as well as impacting psychological wellbeing. This suggests that oral health conditions may increase the overall socioeconomic disadvantage for this group, with wide-reaching implications for individuals as well as community function.

Secondly, although representative data from national surveys is critical for monitoring the multitude of factors related to oral health and supporting policy development, our findings indicate that Aboriginal Australians in regional areas are more disadvantaged than Indigenous participants in the

NSAOH of 2004-2006, across socioeconomic as well as oral health impact measures. This demonstrates two issues that should be pursued; a) planning for oral health improvement strategies across Australia cannot rely solely on national surveys if the oral health needs of regional dwelling Aboriginal communities is to be appropriately considered, and b) current approaches to recruiting participants for national surveys are likely to be unsuccessful among those who are more disadvantaged. Regional surveys with more culturally safe methods should be employed to be able to better quantify the oral health needs of Aboriginal communities across non-metropolitan Australia.

Statement of Authorship

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Name of Principal Author (Candidate)	Eleanor Parker		
Contribution to the Paper	Designed the study and performed analysis under the guidance of L Jamieson and G Mejia. Provided the first draft of the manuscript and completed manuscript revision. Acted as corresponding author.		
Overall percentage (%)	75%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Lisa Jamieson		
Contribution to the Paper	Provided guidance on study design, statistical analysis and contributed to manuscript revision.		
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Name of Co-Author	Kaye Roberts-Thomson		
Contribution to the Paper	Contributed to the design of the study and manuscript revision.		
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Contribution to the Paper	Contributed to data collection and manuscript revision.		
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Primary supervisor is signing on behalf of remaining co-author.

Oral Health Impact among Rural-dwelling Indigenous Adults in South Australia

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Abstract: **Aims**. The aim of this study was to describe the impact of oral health conditions among a convenience sample of Indigenous Australian adults and compare findings with nationally representative data. **Methods**. Data were obtained from the Indigenous Oral Health Literacy Project (IOHLP) based in South Australia. Nationally representative data were obtained from the National Survey of Adult Oral Health (NSAOH). The impact of oral disease was measured using the shortened form of the oral health impact profile, OHIP-14. All data were standardised by age group and sex utilising Census data. **Results**. For each OHIP-14 measure the impact was greater for IOHLP participants. There was considerable variation in the degree of difference between IOHLP and NSAOH participants for individual OHIP-14 items. **Conclusion**. High levels of effects of oral health conditions were reported by rural-dwelling Indigenous adults. This may exacerbate the health and social disadvantage experienced by this marginalised group.

Key words: Indigenous, Australia, oral health, oral disease.

Marginalised groups are known to suffer social and health disadvantage. One such group of particular importance in Australia is Indigenous Australians. Indigenous Australians include those who identify as being of Aboriginal or Torres Strait Islander descent, forming 3% of the total population in 2011.[1] Indigenous Australians have a younger age distribution than the non-Indigenous population, reflecting higher rates of fertility and earlier mortality. Despite some improvements in social outcomes for Indigenous Australians, they remain disadvantaged relative to the non-Indigenous population. Poorer self-assessed health status and higher levels of psychological distress persist, with over half the Indigenous Australians aged over 15 years having a disability or chronic health condition.[2]

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Oral health is integral to overall health and well-being. Available data indicate that Indigenous Australians suffer from poorer oral health than non-Indigenous Australians. Population-based surveys are crucial for assessing and monitoring oral health of populations and in particular, identifying oral health inequalities. However, participation of Indigenous groups in nationally-representative surveys is poor.[3] Possible reasons relate to study design (not having home telephones, rural and remote residence), issues of cultural acceptability of research, and the research tools used. Australia's National Survey of Adult Oral Health, 2004–2006 included a small proportion of Indigenous Australians, less than 1.5% of the sample. Even with the small number included, there was clear evidence of poorer oral health compared with non-Indigenous Australians.[4] Most significant were the disparities related to tooth loss, untreated dental decay, and tooth wear. In addition, Indigenous Australians rated their own oral health as poorer and reported greater experience of toothache and difficulty eating. These disparities are reinforced by other research in Australia involving both children and adults, demonstrating a clear decline over time in the oral health of Indigenous Australians with associated increases in oral health disparities.[5–9] It is likely that national surveys actually underestimate the magnitude of poor oral health through inherent selection bias, with those who do participate not accurately representing the broader Indigenous population. Appropriate and timely treatment offers a pathway to improved oral health. As Indigenous Australians are likely to have poorer access to dental services this both hinders participation in national surveys and leads to bias in estimates of oral health.[3,4]

In recent decades there has been an increasing focus on measuring and addressing the impact of oral conditions on general well-being and quality of life rather than relying solely on traditional clinical measures of oral health status. There are various measures that have been used to capture multiple dimensions of subjective well-being, with the Oral Health Impact Profile[10] in both the original and shortened forms being used internationally[11–13] and has been translated and validated in multiple languages.[14] Examining the impact of oral disease could be considered particularly important for Indigenous Australians given the existing burden of chronic disease and social disadvantage.[2] The impact of oral disease on physical, psychological, and social well-being may have quite extreme effects for Indigenous adults, such as further impaired education and employment opportunities and a reduced ability to fully participate in their community, central factors in the social and economic determinants of Indigenous health.[15]

This study provides an opportunity to analyse self-reported effects of oral health conditions among a relatively large sample of rural-dwelling Indigenous adults, and to compare the results with data from a national survey. Gaining a better understanding of the impact of oral health conditions among this group of Indigenous adults will be useful for planning tailored oral health interventions, monitoring oral health outcomes, and evaluating interventions. In addition, this study will compare data for Indigenous participants of the national survey with that for the sample of rural-dwelling Indigenous adults.

Specifically the aims of this study are:

1. to describe the prevalence, severity, and extent of effects of oral health conditions among a convenience sample of Indigenous adults;

2. to compare findings with data for non-Indigenous participants of the National Survey of Adult Oral Health 2004–2006; and
3. to compare findings with data for Indigenous participants of the National Survey of Adult Oral Health 2004–2006.

Methods

Data sources. *Indigenous Oral Health Literacy Project 2011 (IOHLP)*. Data were obtained from baseline questionnaires of the IOHLP.[16] The IOHLP is a randomised control trial involving a convenience sample of 400 Indigenous adults (age range 18–82, mean age 36 years, 67% female). Ethical approval was granted by the Aboriginal Health Council of South Australia and the Human Research Ethics Committee of the University of Adelaide. To be eligible for the IOHLP, participants were required to be aged 18 years or older, identify as Indigenous Australian, and to reside in Port Augusta, a regional town in South Australia, or nearby surrounding communities. Port Augusta, located some 300 kilometres north of the state's capital has more than 17% of its 13,000 residents reporting to be Indigenous in the national Census. Baseline questionnaires for the IOHLP were administered by Indigenous project officers and took between 20 and 45 minutes to complete.

National Survey of Adult Oral Health 2004–2006 (NSAOH). The NSAOH was a cross-sectional study of oral health among Australians aged 15 years and over living in all states and territories.[4] A three-stage stratified clustered sampling design was used to select the sample from the target population. The sampling frame was households with telephone numbers listed in an Electronic White Pages database, which was stratified into State/Territory and Metropolitan/Rest of State regions. The first stage of selection sampled postcodes with probability to size sampling where size was defined as the number of households listed in each postcode. The second stage selected a random sample of households within selected postcodes, and the third stage randomly selected one person aged 15 years and over from each sampled household. Data were collected through computer-assisted telephone interviews (49% participation rate). Dentate participants were then invited to participate in the next stage involving an epidemiological examination (44% participation rate). Analysis to assess non-participation bias was performed and reported.[4] Participants attending the examinations were invited to participate in a third round of data collection via a mailed questionnaire to be self-completed, which contained the OHIP-14 items.

Variables. The outcome of interest was the self-reported impact of oral health conditions measured using the shortened form of the Oral Health Impact Profile, OHIP-14.[10] The OHIP-14 consists of 14 items asking participants how frequently problems with their teeth, mouth, or false teeth affected them, for example having painful aching or being embarrassed. Responses were made on a five-point ordinal scale from *very often* (scored as a four) to *never* (scored as zero). Three outcome variables were formulated for comparison between IOHLP and NSAOH: a) *OHIP-14 prevalence*: the proportion with one or more items rated *fairly often* or *very often*; b) *OHIP-14 extent*: the number of items rated *fairly often* or *very often*; and c) *OHIP-14 severity score*: sum of ordinal responses. Participants with more than two missing OHIP-14 items were not given

an OHIP-14 severity score (less than one percent of participants within each group). Mean scores from the remaining items were substituted for participants with one or two missing items.[11] Socio-demographic measures included age group, sex, highest level of education and employment status. Dental visiting behaviours were measured through usual reason for visit and the time since last visit. Dental care costs were measured through reporting difficulty paying a $100 dental bill.

Data analysis. Data were analysed with SAS software version 9.3[17] and SAS-Callable procedures from SUDAAN software release 11.0.[18] Data analysis was restricted to dentate IOHLP participants (n=380) and three sub-groups of NSAOH participants aged 18–82 years; a) Indigenous NSAOH (n=44); b) non-Indigenous NSAOH (n=3983); and c) non-Indigenous South Australian participants residing in regional areas "SA Regional" (n=147). *Regional areas* refers to areas outside of capital cities not including remote areas of the state, which in this instance includes towns within South Australia comparable to the area covered by the IOHLP in terms of size, accessibility and services.

Data from NSAOH was weighted to account for different probabilities in selection and adjust for varied participation rates to ensure estimates are representative of the Australian population.[4] To enable comparisons between NSAOH and IOHLP with differing age and sex distributions (Table 1), all estimates were produced with direct standardisation of data to the 2006 Australian Bureau of Statistics Census Estimated Resident Population for 18–84 year old residents (18–24 years male 6.5%, female 6.3%; 25–34 years male 9.0%, female 9.2%; 35–49 years male 14.6, female 15.1%; 50–84 years male 19.1%, female 20.3%).[19]

Standardised estimates for each variable were produced with significant differences identified through non-overlapping 95% confidence intervals.

Table 1.

UN-STANDARDISED AGE AND SEX DISTRIBUTIONS

	Percent (95 percent confidence intervals)[a]			
	IOHLP	**NSAOH Indigenous**	**NSAOH non-Indigenous**	**NSAOH non-Indigenous SA Regional**
	n=380	*n=44*	*n=3983*	*n=147*
Age group				
18–24 years	26.8 (22.6–31.5)	3.7 (0.5–22.5)[b]	13.3 (10.8–16.4)[b]	9.0 (5.0–15.8)[b]
25–34 years	26.3 (22.1–31.0)	7.1 (2.6–18.1)[b]	20.5 (17.7–23.5)	18.5 (11.8–27.8)
35–49 years	30.0 (25.6–34.8)	43.9 (22.5–67.8)	30.7 (28.5–32.9)	37.5 (29.3–46.5)
50–82 years	16.8 (13.4–21.0)	45.3 (24.0–68.5)[b]	35.5 (33.1–37.9)[b]	35.0 (25.9–45.4)[b]
Sex				
Male	33.4 (28.8–38.3)	35.3 (15.8–61.2)	50.4 (47.8–53.1)[b]	46.4 (36.8–56.3)
Female	66.6 (61.7–71.2)	64.7 (38.8–84.2)	49.6 (46.9–52.2)	53.6 (43.7–63.2)

[a]NSAOH data is weighted in accordance with NSAOH reporting to account for differing probabilities in selection.
[b] Denotes confidence intervals not overlapping with IOHLP.

Results

There was a greater proportion of IOHLP participants with low levels of education (no schooling, primary, or high school) than both non-Indigenous NSAOH sub-groups. There were fewer IOHLP participants in paid employment compared with each NSAOH sub-group (Table 2). Nearly half as many IOHLP participants visited the dentist within the last year as each NSAOH sub-group. A far higher proportion of IOHLP participants reported difficulty paying a $100 dental bill—between three and a half and four times the proportion of each non-Indigenous NSAOH group (Table 2).

For each OHIP-14 measure the impact was greater for IOHLP participants (Table 3). The proportion of IOHLP participants reporting one or more OHIP-14 items *fairly often* or *very often* was more than three times that of each non-Indigenous NSAOH sub-group. The OHIP-14 extent score for IOHLP participants was more than five and a half times greater than the scores for the non-Indigenous sub-groups and four times greater than the Indigenous NSAOH participants. The OHIP-14 severity score for IOHLP participants was more than double that for each NSAOH group.

For each OHIP-14 item the mean score was higher for IOHLP participants than for each NSAOH group (Table 4). There was considerable variation in the degree of difference between IOHLP and NSAOH participants for different items. The greatest relative difference was for the item asking about the impact of problems on ability to function, with the IOHLP mean score more than six times that of each NSAOH group. The next greatest difference was found for the item asking about difficulty doing normal jobs, with around a five-fold difference between IOHLP and non-Indigenous NSAOH participants. The smallest relative differences were found for the items asking about painful aching, finding it uncomfortable to eat, and being self-conscious because of problems with their teeth, mouth, or false teeth.

Discussion

This study compared impacts of oral health conditions among an age and sex standardised convenience sample of rural-dwelling Indigenous Australian adults with nationally representative data. Differences between the Indigenous adults in the IOHLP and both Indigenous and non-Indigenous participants from the national survey were identified. The Indigenous adults in IOHLP were more disadvantaged according to each of the five explanatory variables and for all OHIP-14 summary measures.

A strength of this study is that both sets of data were standardised by age group and sex to the same population, enabling more meaningful interpretation of differences identified. Analysis was further restricted to a South Australian sub-population residing in regional areas in order to reduce the influence of other factors potentially associated with oral health outcomes (such as geographic location). Utilising such approaches is important to allow meaningful comparisons to be made, given the reported difficulty in obtaining a representative sample of Indigenous people in national surveys[3] further evidenced in this study by the small number of Indigenous participants completing all three stages of data collection in NSAOH. Despite the challenges of recruiting Indigenous participants for questionnaire-based data collection, the IOHLP data involved a

Table 2.

SOCIO-DEMOGRAPHIC AND DENTAL VISITING CHARACTERISTICS

	Age and sex adjusted percent (95 percent confidence intervals)			
	IOHLP	**NSAOH Indigenous**	**NSAOH non-Indigenous**	**NSAOH non-Indigenous SA Regional**
Highest level of education	*n=376*	*n=44*	*n=3975*	*n=147*
No schooling, primary or high school	75.4 (69.5–80.4)	63.1 (48.1–75.9)	32.5 (30.0–35.1)[a]	49.2 (39.7–58.8)[a]
Trade, TAFE or university	24.6 (19.6–30.5)	36.9 (24.1–51.9)	67.5 (64.9–70.0)	50.8 (41.2–60.3)
Employment status	*n=369*	*n=44*	*n=3976*	*n=147*
Employed	22.3 (17.5–27.8)	59.4 (48.6–69.5)[a]	64.0 (61.4–66.5)[a]	66.2 (58.3–73.4)[a]
Unemployed/other	77.7 (72.2–82.5)	40.6 (30.5–51.4)	36.0 (33.5–38.6)	33.8 (26.6–41.7)
Time since last dental visit	*n=365*	*n=44*	*n=3978*	*n=147*
Less than a year ago	32.7 (27.2–38.8)	60.2 (48.4–70.9)[a]	60.2 (57.5–62.8)[a]	62.4 (54.2–70.0)[a]
More than a year ago or don't know	67.3 (61.2–72.8)	39.8 (29.1–51.6)	39.8 (37.2–42.5)	37.6 (30.0 –45.8)
Usual reason for visiting a dentist	*n=363*	*n=44*	*n=3969*	*n=147*
Preventive / check-up	33.1 (27.6–39.1)	42.3 (32.5–52.6)	57.5 (54.7–60.2)[a]	45.4 (38.2–52.7)
Because of a problem	66.9 (60.9–72.4)	57.7 (47.4–67.5)	42.5 (39.8–45.3)	54.6 (47.3–61.8)
Difficulty paying a $100 dental bill	*n=376*	*n=44*	*n=3978*	*n=146*
None, hardly any or a little	43.7 (37.8–49.8)	69.3 (53.3–81.7)[a]	85.2 (83.6–86.7)[a]	85.8 (81.2–89.4)[a]
A lot of difficulty or couldn't pay	56.3 (50.2–62.2)	30.7 (18.3–46.7)	14.8 (13.3–16.4)	14.2 (10.6–18.8)

[a] Denotes confidence intervals not overlapping with IOHLP.

Table 3.

ORAL HEALTH IMPACT PROFILE

	Age and sex adjusted scores (95 percent confidence intervals)			
	IOHLP	**NSAOH Indigenous**	**NSAOH Non-Indigenous**	**NSAOH non-Indigenous SA Regional**
OHIP-14 prevalence (percent) of one or more items rated fairly often or very often	56.8 (50.6–62.7)	20.1 (10.4–35.1)[a]	17.9 (0.9–16.3)[a]	16.3 (11.4–22.8)[a]
OHIP-14 extent (mean number of items rated FO or VO)	2.8 (2.3–3.2)	0.7 (0.2–1.2)[a]	0.5 (0.4–0.6)[a]	0.5 (0.3–0.7)[a]
OHIP-14 severity (mean score)	19.5 (17.8–21.2)	9.7 (7.1–12.3)[a]	7.5 (7.1–7.9)[a]	7.6 (6.6–8.6)[a]

[a]Denotes confidence intervals not overlapping with IOHLP.

Table 4.

SEVERITY OF OHIP-14 INDIVIDUAL ITEM IMPACTS

Dimension and OHIP-14 item	Age and sex adjusted mean item scores (95 percent confidence intervals)			
	IOHLP	NSAOH Indigenous	NSAOH: non-Indigenous	NSAOH non-Indigenous SA Regional
Functional Limitation				
Trouble pronouncing words	1.19 (1.04–1.34)	0.37 (0.21–0.54)[a]	0.27 (0.24–0.31)[a]	0.22 (0.16–0.28)[a]
Taste affected	1.31 (1.15–1.47)	0.68 (0.41–0.95)[a]	0.36 (0.32–0.39)[a]	0.45 (0.35–0.54)[a]
Physical pain				
Painful aching	1.70 (1.56–1.84)	1.25 (0.98–1.51)[a]	0.97 (0.92–1.02)[a]	1.09 (0.87–1.30)[a]
Uncomfortable to eat	1.88 (1.72–2.04)	1.64 (1.35–1.93)	1.17 (1.12–1.23)[a]	1.14 (0.95–1.33)[a]
Psychological discomfort				
Been self-conscious	1.71 (1.54–1.89)	1.17 (0.82–1.52)[a]	0.97 (0.91–1.04)[a]	0.99 (0.87–1.12)[a]
Felt tense	1.64 (1.47–1.80)	0.92 (0.59–1.26)[a]	0.72 (0.66–0.77)[a]	0.84 (0.69–0.98)[a]
Physical disability				
Diet unsatisfactory	1.31 (1.16–1.47)	0.49 (0.25–0.72)[a]	0.32 (0.28–0.35)[a]	0.32 (0.21–0.42)[a]
Interrupted meals	1.30 (1.15–1.44)	0.52 (0.31–0.72)[a]	0.39 (0.53–0.42)[a]	0.36 (0.24–0.47)[a]
Psychological disability				
Difficult to relax	1.46 (1.30–1.62)	0.48 (0.23–0.74)[a]	0.47 (0.43–0.51)[a]	0.41 (0.27–0.55)[a]
Been embarrassed	1.54 (1.36–1.71)	0.67 (0.43–0.92)[a]	0.70 (0.65–0.75) [a]	0.64 (0.56–0.73)[a]
Social disability				
Been a bit irritable	1.30 (1.14–1.45)	0.49 (0.28–0.69)[a]	0.36 (0.32–0.40)[a]	0.36 (0.23–0.48)[a]
Difficulty doing jobs	1.08 (0.93–1.23)	0.32 (0.15–0.49)[a]	0.21 (0.19–0.24)[a]	0.22 (0.13–0.32)[a]
Handicap				
Life less satisfying	1.18 (1.02–1.33)	0.59 (0.34–0.84)[a]	0.42 (0.38–0.46)[a]	0.42 (0.30–0.54)[a]
Unable to function	1.02 (0.88–1.15)	0.16 (0.05–0.26)[a]	0.14 (0.12–0.17)[a]	0.14 (0.06–0.22)[a]

[a]Denotes confidence intervals not overlapping with IOHLP.

total of 400 Indigenous adults, a relatively large sample from a rural location, indicating acceptance of the IOHLP and community commitment to the project.

The limitations of this study must also be acknowledged. The different recruitment strategies used for both sets of data (one a convenience sample in a specified location and the other a probability sample of the Australian population) means that results must be interpreted with caution. The smaller sample sizes of the IOHLP and the NSAOH sub-groups are acknowledged, and in particular, the very small number of Indigenous NSAOH participants. The smaller sample sizes increased the width of the confidence intervals; however, non-overlapping confidence intervals have been identified in all items comparing IOHLP with non-Indigenous total NSAOH, all but one with non-Indigenous South Australian Regional NSAOH, and all but two comparing IOHLP with Indigenous NSAOH.

The IOHLP participants were significantly different from the non-Indigenous total NSAOH population for each explanatory variable and different from the South Australian regional subgroup of NSAOH for four of the five explanatory variables. These differences between the two groups were consistent with expectations and further demonstrate the social disadvantage experienced by Indigenous Australians. The fact that the differences were identified between IOHLP and the regional South Australian NSAOH participants indicates that the disparities between Indigenous and non-Indigenous Australians remain in regional areas.

The higher levels of impact of oral disease among IOHLP participants were very clear. The more than five-fold difference in OHIP-14 extent scores between IOHLP and both non-Indigenous NSAOH groups was quite dramatic, indicating that those who have oral health problems report multiple impacts across the 14-item scale. The high proportion of IOHLP participants (more than 40%) reporting one or more items *fairly often* or *very often* reflects how widespread oral disease and its associated effects are among this group. This is of concern given the health and social disadvantages of Indigenous Australians identified in the literature and reinforced in this study. As an example, efforts to gain employment may be hampered by the impacts of oral disease including pain and embarrassment as has been reported amongst other disadvantaged groups[20] and the ability to seek and receive dental care could be restricted by employment hours and conditions.

The variation in relative differences between IOHLP and NSAOH when examining each OHIP-14 item separately is particularly interesting and to our knowledge not been reported elsewhere for Indigenous Australians. Differences between IOHLP and NSAOH participants ranged from a 1.6-fold and 1.8-fold difference for the two items relating to physical pain, to a 7.3-fold difference for the item related to an inability to function. The items that had the greatest relative differences reflect the items that report a physical handicap or interruption to normal life events, such as those affecting speech, eating, undertaking normal jobs, and function. The smallest relative differences were identified for the two items reflecting physical pain and psychological discomfort. These differences were identified despite similar patterns within the two groups: the two items with the highest mean scores (painful aching and being self-conscious) and the two items with the lowest mean scores were also the same for all groups (being unable

to function and having difficulty doing their normal jobs). There is minimal literature examining these individual item differences between population groups. Slade et al. reported variation in relative differences in individual item impacts between residents of the United Kingdom and residents of Australia.[11] Some individual items had a two-fold difference and others less than a one quarter difference between the two populations. Another study involving homeless adults in London identified differences in the proportion of participants reporting impacts by individual item, with homeless adults reporting significantly greater impacts from oral disease than the general population, despite similar levels of disease experience.[12] Hunt et al. reported variation in impacts of oral health conditions across cultural and racial groups which persisted after controlling for oral health status variables.[21] It is probable that the findings in our study reflect the influence individual, social, and environmental factors have on the way oral disease is experienced, managed, and reported. In addition, it is likely that the high levels of oral health impact and the relative differences in types of impact reported reflect the severity of the disease experienced by the IOHLP participants and the limited access to timely, appropriate, and holistic health care for Indigenous adults in regional Australia.[13,21,22]

A secondary aim of this study was to compare self-report data from IOHLP participants with that of the Indigenous participants of NSAOH, in order to evaluate whether the Indigenous NSAOH participants were representative of the broader Indigenous Australian population. The small number of Indigenous participants in NSAOH reflects the difficulty in gaining adequate participation of Indigenous Australians in national surveys. In this instance, a three-stage data collection approach was used, and the data pertaining to this analysis was from the third stage, with the smallest proportion of Indigenous participants. The small number of participants clearly reduces the ability to draw generalizable conclusions on the oral health of Indigenous Australians. Comparisons between small samples and in this case between two groups with differing sampling methods (one a convenience sample) must be interpreted cautiously. Even so, our data demonstrated that the IOHLP participants were more disadvantaged than the Indigenous NSAOH participants according to three of the five explanatory variables and each OHIP-14 measure. These differences were identified despite the wide confidence intervals. This indicates that the Indigenous participants of NSAOH do not well represent the group of rural-dwelling Indigenous adults in the IOHLP. Nationally, more than 40% of Indigenous Australians live in regional areas and a further 20% in remote and very remote areas,[1] with patterns of health and the social and economic context of Indigenous Australians varying according to whether they live in remote, regional, or urban Australia.[15] The differences evident in our study may therefore be partially attributed to the fact that IOHLP participants lived in rural areas, a situation shared by a high proportion of Indigenous people, where participation in national surveys is unlikely to be high. This highlights the need to ensure alternative approaches to gaining Indigenous participation in national surveys are used to increase the representativeness of samples.

Conclusion. This study demonstrates that Indigenous Australians suffer from high levels of impact of oral health conditions, significantly greater than non-Indigenous Australians. The standardisation of both sets of data to eliminate the potential impact of differing age and sex distributions adds strength to this study. Of particular interest

was the finding that there was considerable variation in the degree of relative difference between the two groups for each OHIP-14 item, with the greatest difference for items reflecting handicap and disability and the least for physical pain. This indicates that there are particular effects that are felt much more severely by this group of Indigenous Australians, potentially reflecting high levels of oral disease and barriers to appropriate dental care. This highlights the need to understand better the way that oral health affects the lives of Indigenous Australians and to identity effective preventive strategies[15] in addition to provision of appropriate and holistic oral health care services. Furthermore, this study adds evidence to the assertion that national surveys underestimate the health disadvantage experienced by Indigenous Australians and that more appropriate methods of measuring and monitoring Indigenous oral health must be utilised which may include national surveys with supported recruitment.

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Chapter 5: Self-rated oral and general health

Paper published online ahead of print:

Self-rated oral and general health among Aboriginal adults in regional South Australia

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5.1 Highlights and linkage to the body of work

This paper provided an opportunity to investigate self-rated oral and general health among IOHLP participants, and compare the relative proportion of participants giving high ratings with three sub-populations from the NSAOH. Self-rated oral and general health were utilised in this thesis as key outcome measures. Describing how these outcomes for our sample of Aboriginal adults from regional South Australia compared with participants from a nationally representative survey was important to ensure the full picture of oral health burden was obtained and made available for policy makers.

For this paper we reported on the proportion of participants who rated their oral and general health as excellent, very good or good, rather than focusing on poor ratings. After original drafts of the manuscript had poor self-ratings reported, Aboriginal colleagues provided feedback on the tendency for researchers to focus on the deficits or negative issues for Aboriginal communities rather than the positive. The approach for this paper was altered to reflect this advice.

In addition, original drafts of this paper included a focus on the deficits in ratings of oral health relative to general health, with figures instead of tables to demonstrate the magnitude of the gap in ratings. Reviewer feedback on this paper led to the removal of this aim to simplify the presentations of results and ensure the findings were clear to the reader. I believe this improved the readability and clarity of the paper. However, the concept of deficits in ratings of oral health relative to general health and how the relative gap varied across sub-population groups is an area that could be pursued in a future paper.

Highlights

- Comparing self-rated general and oral health for Aboriginal adults from a regional location of South Australia with three sub-groups from nationally representative data enabled the proportion of IOHLP participants with high ratings to be appreciated by utilising Indigenous and non-Indigenous participants of NSAOH as a reference point.
- Standardising by age and sex and then stratifying by key socioeconomic factors enabled more meaningful comparison within and between population groups.
- The relative proportion of Aboriginal adults from regional South Australia with high ratings of general and oral health were lower than for each comparison group.
- More than two thirds of SA Regional Aboriginal participants rated their general health as excellent, very good or good whereas just over one half rated their oral health as excellent, very good or good.

- The highest ratings for both general and oral health were observed for non-Aboriginal Australians in the national sample.
- The proportion of Aboriginal adults from regional South Australia rating their oral health highly remained relatively stable when stratifying by level of education and employment, whereas for the sub-populations from NSAOH the proportions were not stable in the stratified analysis. This suggests that for regional Aboriginal participants, these socioeconomic factors are not as important in oral health outcomes within their community.
- The data for Aboriginal participants of NSAOH more closely resembled the non-Aboriginal groups than the regional Aboriginal group indicating that the nationally representative data currently available likely underestimates the general and oral health needs of Aboriginal adults residing outside of capital cities. Whilst it is feasible that this study actually over-estimates the oral health needs of regional communities, it remains clear that further studies with regional communities is essential to adequately quantify the needs of Aboriginal Adults in Regional South Australia.

Research and policy implications

There were proportionally fewer participants in the regional Aboriginal group with high ratings of both general and oral health than for each comparison group, likely reflecting the high degree of general and oral disease burden experienced by Aboriginal adults in regional areas of Australia. Addressing oral health inequalities requires broad social and political change to address social determinants of health. The findings in this paper reinforce the need for action to address the needs of Aboriginal adults in regional Australia.

Statement of Authorship

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Name of Principal Author (Candidate)	Eleanor J Parker		
Contribution to the Paper	Designed the study and performed analysis and interpretation of results under the guidance of co-authors. Provided the first draft of the manuscript and completed manuscript revision. Acted as corresponding author.		
Overall percentage (%)	75%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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Co-Author Contributions

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i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Self-rated oral and general health among Aboriginal adults in regional South Australia

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ABSTRACT

Background: In Australia, Aboriginal adults experience higher levels of poor oral and general health than the non-Aboriginal population. This study compared self-rated oral and general health among Aboriginal adults in regional South Australia with participants in the National Survey of Adult Oral Health (NSAOH).
Methods: Data were obtained from the Indigenous Oral Health Literacy Project (IOHLP) based in South Australia. Three sub-populations from the NSAOH were utilised for comparison: National Aboriginal, National non-Aboriginal and South Australian Regional Non-Aboriginal adults. All data were standardised by age group and sex, utilising Census data.
Results: Just over 70% of South Australian Regional Aboriginal participants gave a rating of 'excellent, very good or good' for general health, more than 17% lower than each of the other groups. Just over 50% rated their oral health highly, 20% fewer than the proportion for each other group. Stratifying by key socio-demographic factors did not account for all differences.
Conclusions: Proportionally fewer South Australian Regional Aboriginal adults had high ratings of oral and general health than the Aboriginal and non-Aboriginal adults from the national survey, indicating that national-level data might underestimate the proportion of regional Aboriginal Australians with poor oral health.

Keywords: Aboriginal, oral health, self-rated health, self-rated oral health.

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INTRODUCTION

Indigenous populations internationally experience social, political and health disadvantages, with disparities in oral health clearly established.[1] Health and oral health disparities are also well-documented in Australia. Aboriginal and Torres Strait Islander Australians, hereafter referred to as Aboriginal to acknowledge that Aboriginal people were the original inhabitants of South Australia where this study is based, comprised over 3% of the total Australian population in 2016. Aboriginal people are more likely to suffer from chronic health conditions including diabetes and cardiovascular disease as well as experience a greater burden of oral disease and social impacts of oral conditions than non-Aboriginal Australians.[2–4] In Australia, chronic health conditions occur less frequently amongst people residing in major cities,[5] with poorer self-rated health in areas of more disadvantage.[6] There is evidence of oral health disparities by residential location, with greater tooth loss, greater levels of untreated and more severe dental decay and more severe tooth wear for those residing outside of capital cities.[2] With more Aboriginal people residing in regional and remote Australia,[7] including one regional centre in South Australia having more than 19% of their resident population identifying as Aboriginal,[8] it is likely that Aboriginal Australians living in remote and regional locations might face multiple forms of disadvantage that combine to create an excess vulnerability to poorer general and oral health.

Global measures of self-rated health and oral health have been used extensively in the international literature.[9–11] These global questions enable the respondents to take into account perspectives that are not easily measured in clinical evaluations.[10] Self-rated general health is a predictor of mortality and functional limitation.[11,12] Associations between self-rated oral health and clinical measures of oral disease, home hygiene habits, dental attendance, oral symptoms, dysfunction or disability have all been documented.[13] The clinical validity of self-rated oral health has been shown in an Australian adult population, with ratings of oral health associated with tooth loss and caries experience.[14] Self-rated oral health and general health

have been shown to vary across population groups and across key social determinants including education, income, ethnicity and race.[13,15–17]

One important limitation in previous studies investigating ratings of general and oral health among Aboriginal Australians living in regional areas is that these populations are often underrepresented in national surveys and subsequently are present in low numbers, with potential bias towards those living in the more advantaged areas of the community. An understanding of the specific needs of regional communities and their needs relative to the broader population is important for policymakers to develop and implement relevant and context-specific interventions to improve outcomes for these communities. This study aimed to overcome these limitations by characterising self-reported general and oral health in a comprehensive sample of Aboriginal people living in a regional centre in South Australia. Furthermore, we aimed to compare these estimates with the general and oral health ratings from Aboriginal and non-Aboriginal participants from the 2004 to 06 National Survey of Adult Oral Health. If we can better understand the oral and general health ratings patterns of South Australian Aboriginal people living in regional locations in relation to other population groups, further investments can be made to ensure that this population have the best possible general and oral health.

The specific aims were to:

(1) Estimate the prevalence of high (excellent, very good or good) ratings of general and oral health among Aboriginal adults in regional South Australia;
(2) Compare the prevalence of high ratings of general and oral health with both Aboriginal and non-Aboriginal participants from the National Survey of Adult Oral Health 2004–06;
(3) Investigate whether the differences varied according to key socioeconomic characteristics (education level and employment).

METHODS

Data sources

Data for Aboriginal adults residing in regional South Australia were obtained from the Indigenous Oral Health Literacy Project 2011 (IOHLP). The IOHLP was a randomised control trial involving a convenience sample of 400 Aboriginal adults residing in and approximately a regional centre in South Australia.[18] Participants were aged 18–82 years with mean age of 36 years and 67% were female. Data reported in this paper were obtained from a baseline questionnaire administered by Aboriginal project officers in 2011. Ethical approval was granted by the Aboriginal Health Council of South Australia and the Human Research Ethics Committee of the University of Adelaide. Data analysis was restricted to dentate and partially dentate IOHLP participants (n = 380) referred to hereafter as 'SA Regional Aboriginal'. Data for comparison groups were obtained from the National Survey of Adult Oral Health 2004–06 (NSAOH).[2] The NSAOH was a cross-sectional survey of Australians collecting information on self-reported oral health status and associated characteristics by telephone interview, followed by a dental examination undertaken at a designated clinic to collect clinical oral health data. A three-stage, stratified clustered design was used to select survey participants. The sampling frame was listed telephone numbers recorded in an 'electronic white pages database' which was stratified into state/territory and metropolitan/non-metropolitan regions. Postcodes represented the geographic clustering and were selected with probability proportional to size within each stratum. Subsequent stages of selection sampled households within each selected postcode and one person aged 15 years and over per household. Data reported in this paper refers to information collected in the telephone interview and was restricted to self-reported dentate and partially dentate participants aged 18–82 years. Data analysis focussed on three sub-populations of interest: a) Aboriginal Australians (n = 190) referred to hereafter as 'National Aboriginal'; b) non-Aboriginal Australians (n = 11990) referred to hereafter as 'National non-Aboriginal'; and, c) non-Aboriginal South Australians from non-metropolitan areas of the state excluding remote regions, referred to hereafter as 'SA regional non-Aboriginal' (n = 319).

Variables

The outcome variables of interest were self-rated general and oral health. The same single global questions were utilised in both studies asking participants 'How would you rate your general health?' and 'How would you rate your dental (or oral) health?'. Participants selected one of five response options from 'excellent', 'very good', 'good', 'fair' and 'poor'. For the purposes of analysis responses were dichotomised to 'excellent, very good and good' and 'fair and poor'.

Self-rated general health and oral health have been shown to differ by socio-economic status. We therefore utilised two measures of socio-economic status: (i) self-reported level of education completed with primary school and high school referred to as 'lower' and a trade, TAFE (vocational education and training) or University education referred to as 'higher' and (ii) employment status referred to as 'not employed' or 'employed'.

Data analysis

All estimates were produced with direct standardisation of data by age group and sex to enable

comparisons between the IOHLP and NSAOH studies that accounted for the different age and sex distributions. The reference population was the 2006 Australian Bureau of Statistics Census Place of Usual Residence Population[19] for 18–84-year-olds (18–24 years male 6.5%, female 6.3%; 25–34 years male 9.0%, female 9.2%; 35–49 years male 14.6, female 15.1%; 50–84 years male 19.1%, female 20.3%).

Data were analysed with SAS version 9.3 and SAS-Callable SUDAAN version 11.0. Standardised estimates were produced for each outcome variable. Non-overlapping 95% confidence intervals were taken to indicate statistically significant differences between comparison groups.

RESULTS

Proportionally fewer of the National Aboriginal, National non-Aboriginal and SA Regional non-Aboriginal groups had lower levels of education and proportionally fewer were unemployed than the SA Regional Aboriginal group (Table 1).

The proportion of the SA Regional Aboriginal group rating their general health as 'excellent, very good or good' was just over 70%, significantly lower than the proportion for each of the other groups (Table 2). Just over half the SA Regional Aboriginal group rated their oral health as 'excellent, very good or good', lower than each of the other groups.

Table 3 shows the oral and general health ratings stratified by level of education. For those with lower levels of education, the proportion of the SA Regional Aboriginal group rating their general health as 'excellent, very good or good' was lower than both the National and SA Regional non-Aboriginal groups. For self-rated oral health, the proportion of the SA Regional Aboriginal group with a rating of 'excellent very good or good' was lower than only the National non-Aboriginal group. Among those with lower levels of education, there was no longer a difference in proportions rating their general or oral health as 'excellent, very good or good' between the SA Regional and National Aboriginal groups. Among those with higher levels of education, the proportion of the SA Regional Aboriginal group rating their general health as 'excellent, very good or good' was lower than only the National non-Aboriginal group. There was no longer a difference between the Regional Aboriginal and National Aboriginal or SA Regional non-Aboriginal groups. Among those with higher levels of education, the proportion of the SA Regional Aboriginal group rating their oral health as 'excellent, very good or good' remained lower than each other group.

Table 4 shows the oral and general health ratings stratified by employment status. Among those who were employed the proportion of the SA Regional Aboriginal group rating their general health as 'excellent, very good or good' was lower than each other group. The proportion of the SA Regional Aboriginal group rating their oral health as 'excellent, very good or good' remained lower than both the National and SA Regional non-Aboriginal groups. Amongst those who were not employed, just over 70% of the SA Regional Aboriginal group rated their general health as 'excellent, very good or good', significantly fewer than only the National non-Aboriginal group. There was no difference when comparing the SA Regional Aboriginal group with National Aboriginal or SA Regional non-Aboriginal groups. Proportionally fewer of the SA Regional Aboriginal group who were not employed rated their oral health as 'excellent, very good or good' than both National and SA Regional non-Aboriginal groups.

DISCUSSION

This paper quantified and described ratings of general and oral health among a regional population of Aboriginal adults and compared the ratings with Aboriginal and non-Aboriginal participants from a national survey. More than two-thirds of SA Regional Aboriginal participants rated their general health as excellent, very good or good whereas just over one half rated their oral health as 'excellent, very good or good'. The proportion of SA Regional Aboriginal participants rating general and oral health as 'excellent, very good or good' was lower than for each other

Table 1. Age and sex standardised socio-demographic characteristics

	Age- and sex-adjusted percent (95% confidence intervals)			
	S.A. Regional Aboriginal n = 380	National Aboriginal n = 190	National non-Aboriginal n = 11990	S.A. Regional non-Aboriginal n = 319
Highest level of education				
Lower	75.4 (69.5–80.4)	47.4 (38.0–56.9)†	37.0 (35.7–38.3)†	49.5 (43.4–55.6)†
Higher	24.6 (19.6–30.5)	52.6 (43.1–62.0)	63.0 (61.7–64.3)	50.5 (44.4–56.6)
Employment status				
Not employed	77.7 (72.2–82.5)	37.4 (29.1–46.5)†	32.4 (31.4–33.5)†	31.0 (25.1–37.5)†
Employed	22.3 (17.5–27.8)	62.6 (53.5–46.5)	67.6 (66.5–68.6)	69.0 (62.5–74.9)

†Confidence intervals not overlapping with SA Regional Aboriginal participants.

Table 2. Age and sex standardised self-rated general and oral health

	Percent (95% confidence intervals)			
	S.A. Regional Aboriginal n = 379	National Aboriginal n = 190	National non-Aboriginal n = 11990	S.A. Regional non-Aboriginal n = 319
Self-rated general health				
Excellent, very good or good	71.3 (65.2–76.7)	88.7 (80.3–93.7)†	90.1 (89.4–90.7)†	89.1 (86.4–97.3)†
Self-rated oral health				
Excellent, very good or good	52.4 (46.3–58.5)	73.5 (65.1–80.5)†	83.0 (82.1–84.0)†	80.3 (76.8–83.4)†

†Confidence intervals not overlapping with S.A. Regional Aboriginal participants.

Table 3. Age and sex standardised self-rated general and oral health stratified by level of education

	Percent (95% confidence intervals)			
	S.A. Regional Aboriginal	National Aboriginal	National non-Aboriginal	S.A. Regional non-Aboriginal
Level of education: lower	n = 285	n = 84	n = 4294	n = 152
Self-rated general health				
Excellent, very good or good	71.8 (64.6–78.1)	86.9 (76.7–93.0)	87.7 (86.5–88.8)†	90.1 (87.4–92.4)†
Self-rated oral health				
Excellent, very good or good	55.5 (48.1–62.5)	67.9 (56.7–77.4)	80.0 (78.4–81.6)†	77.4 (70.6–83.0)
Level of education: higher	n = 90	n = 105	n = 7658	n = 167
Self-rated general health				
Excellent, very good or good	71.5 (58.6–81.6)	90.6 (76.4–96.6)	91.4 (90.5–92.3)†	88.2 (80.3–93.3)
Self-rated oral health				
Excellent, very good or good	47.9 (36.7–59.3)	80.7 (69.7–88.3)†	84.4 (83.2–85.5)†	83.3 (78.5–87.2)†

†Confidence intervals not overlapping with S.A. Regional Aboriginal participants.

Table 4. Age and sex standardised self-rated general and oral health stratified by employment status

	Percent (95% confidence intervals)			
	S.A. Regional Aboriginal	National Aboriginal	National non-Aboriginal	S.A. Regional non-Aboriginal
Not employed	n = 285	n = 68	n = 4278	n = 120
Self-rated general health				
Excellent, very good or good	72.1 (65.1–78.1)	81.6 (67.2–90.6)	81.8 (79.6–83.8)†	80.0 (74.6–84.6)
Self-rated oral health				
Excellent, very good or good	52.5 (45.4–59.5)	67.2 (49.8–80.9)	76.3 (73.6–78.8)†	71.7 (62.6–79.3)†
Employed	n = 83	n = 121	n = 7674	n = 199
Self-rated general health				
Excellent, very good or good	67.4 (55.2–77.7)	96.3 (91.2–98.5)†	93.8 (93.1–94.5)†	93.3 (90.2–95.5)†
Self-rated oral health				
Excellent, very good or good	49.5 (37.8–61.3)	72.5 (60.2–82.2)	85.1 (84.0–86.2)†	83.1 (77.9–87.2)†

†Confidence intervals not overlapping with S.A. Regional Aboriginal participants.

population group. The best ratings for both general and oral health were observed for non-Aboriginal people in the national sample. Interestingly, the proportion of SA Regional Aboriginal participants rating their general health and oral health highly remained relatively stable when stratified by level of education and employment.

The comparison of a group of regional Aboriginal Australians with Aboriginal participants in the National study revealed interesting findings. For both socio-demographic indicators utilised in this study, the National Aboriginal group more closely reflected the SA Regional and National non-Aboriginal groups than they did the SA Regional Aboriginal group. The ability to make conclusions from the data is limited by the sample size and the wide confidence intervals. However, the findings when comparing the two Aboriginal groups and the patterns that seem to be emerging in the stratified analysis suggest that the difference in socio-demographic factors between the National and SA Regional Aboriginal groups could be a key contributing factor in the differences observed in ratings of oral health. These findings also indicate that the National Aboriginal participants do not represent the SA Regional Aboriginal participants well. This is not surprising given the different recruitment

strategies. Participants of the national survey had to be contactable via telephone and willing to complete a telephone interview, a requirement likely to have excluded many in the Indigenous Oral Health Literacy Project from which the SA Regional Aboriginal data for this paper were drawn.

The comparison between regional and national-level Aboriginal participants is important to consider as a broader issue for Aboriginal oral health research and policy development. Advocacy and policy development at a state and national level largely relies on the most representative data available. The findings in this study show that the characteristics of Aboriginal participants in the national survey do not closely align with the socio-demographic characteristics or self-reported oral health and general health of Aboriginal participants in the regional location. It is possible that the national data we have available are not reflecting the disease experience and perceptions of oral health of Aboriginal Australians in other regional areas. This supports the need for a review of the most appropriate strategies to accurately quantify and describe the oral health needs of Aboriginal Australians in all residential locations. Although oral health surveys would ideally be able to accurately describe the oral health needs of all Australians, with Aboriginal and Torres Strait Islander people forming only 3% of the population, developing regional surveys that collaborate with Aboriginal communities might be more appropriate in order to engage and support Aboriginal and Torres Strait Islander participants in a culturally safe manner at the local level.

For each variable reported in this paper, regional SA Aboriginal participants had higher proportions in the more disadvantaged category than non-Aboriginal participants at a national level. While the differences mostly remained when comparing with SA Regional non-Aboriginal participants, they were not evident in some of the stratified analyses. This might be affected by the wider confidence intervals and small number of participants in these groups meaning that true differences might exist but were not able to be identified within this study. These findings do reflect the poor oral health of Aboriginal Australians and affirm the need for immediate and long term political and social change to address the social determinants of health to improve both health and oral health outcomes of Aboriginal Australians. In addition, these findings indicate that locally developed, culturally safe preventive programmes and service delivery strategies are needed to provide for the current oral health needs of Aboriginal communities in regional areas.

A strength of this study was the relatively large group of Aboriginal adults in the regional location. The standardisation methods utilised and the use of sub-populations from the national survey meant that comparisons could be made between more closely related groups (by Aboriginal status and residential location). Study limitations need to be considered when drawing conclusions from the data presented. The first key limitation is the differing methods of recruitment and age and sex distributions between the regional and national-level surveys. However, standardising by age and sex to the Australian population addresses some of the differences. The second limitation relates to sample size and in particular the small sample sizes for the National Aboriginal and the Regional non-Aboriginal groups in stratified analysis resulting in very large confidence intervals. This could result in differences not being identified where a true difference exists. Another potential factor that impacts on the study findings is the potential for the Aboriginal and non-Aboriginal participants to be drawing upon varied frames of reference when rating their oral health. There are indications in the literature that the criteria people refer to when rating their general or oral health vary across age groups, race or ethnicity and level of education.[20,21] With the high levels of oral disease experienced by Aboriginal people in regional areas, it is quite feasible that it might have an impact on how they view their own oral health. Despite the potential social and cultural factors that impact of self-ratings of general and oral health, the magnitude of the differences between Aboriginal and non-Aboriginal groups in this study are clear and further add to the developing body of literature that shows that this group of Aboriginal Australians continue to be disadvantaged across many social, health and oral health measures.

CONCLUSION

South Australian Regional Aboriginal Australians in this study have lower levels of self-rated general health and oral health than National Aboriginal Australians, National non-Aboriginal Australians and South Australian Regional non-Aboriginal Australians. Stratified analyses further showed the differences between Regional Aboriginal Australians and the other groups. In addition, this study highlighted that national-level data might underestimate the proportion of regional Aboriginal Australians with poor oral health, an important consideration when planning for prevention and intervention strategies.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

ETHICAL APPROVAL

Ethical approval was granted by the Aboriginal Health Council of South Australia and the Human Research Ethics Committee of the University of Adelaide.

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Chapter 6: Validation of oral health-related self-efficacy and fatalism instruments

Published paper:

Oral health-related self-efficacy and fatalism in a regional South Australian Aboriginal population

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6.1 Highlights and linkage to the body of work

This paper described the adaptation of an oral health-specific self-efficacy instrument and the development of an oral health-related fatalism instrument for use in an Aboriginal adult population and tested acceptability and validity of these instruments.

The oral health-related self-efficacy instrument was based on a validated instrument for mothers of young children. The oral health-related fatalism instrument was based on statements used to measure fatalistic views of mothers of young children, and adapted to include a statement for each key oral condition or disease likely to be known to Aboriginal adults. As part of the consultative phase of study design and testing of face and content validity, feedback from expert and Aboriginal advisory groups indicated that additional items should be added to give participants the option of answering "I don't know" or "I never feel like this" to acknowledge individual variation and decease the potential for participants to feel judged by their responses. Whilst this likely improved acceptability of the instruments, we needed to treat these options as missing responses, and to therefore manage a large amount of missing data. This decreased the sample size for data analysis.

This highlights a challenge for use of these instruments moving forwards. After utilising these instruments in a subsequent paper in this thesis and further critical review of the literature and approaches to instrument development, my recommendation would be to remove these additional response options that give the participants an "opt out" for each item and then conduct validity assessments again in a similar population. A participant can choose to not respond to one of the items, giving missing data, however, this is likely to be a lower proportion than with the current response options, and we can use standard approaches to managing missing data rather than having to determine how the "opt out" response is treated.

Highlights

- To the best of our knowledge these instruments had not been specifically tested and validated in an Australian Aboriginal population previously.
- Aboriginal and expert advisory groups had input into the instrument design.
- Validity of the instruments were assessed through face and content validity, structural validity, construct validity in the form of known-groups validity and criterion validity.
- Participants generally had high levels of oral health-related self-efficacy indicating confidence in their ability to maintain oral hygiene in the face of impediments.
- Participants also had high levels of fatalism indicating they generally agreed that all people would develop oral health problems at some stage in their lives.

- These oral health-related self-efficacy and fatalism measures demonstrated community acceptability, acceptable face, content, structural, known-groups and criterion validity, and internal reliability.

Research and policy implications

Research with populations experiencing health disadvantage, and more specifically Aboriginal communities, must be carried out in culturally safe and respectful ways. This includes working in true partnership with Aboriginal researchers and advisory groups and adapting study approaches based on their feedback. This was critical in this study and helped support the use of these instruments in this community. The use of standard instruments used in health and oral health research internationally may not be appropriate, as instruments must be both acceptable and valid for the communities in which they are used. This paper provided an example of how established instruments can be adapted for use with Aboriginal communities and provided initial evidence for their acceptability and validity for use with Aboriginal adults. The finding that participants had high levels of self-efficacy as well as high levels of fatalism presents a challenge for health promotion programs, with the concept of oral health conditions being largely preventable at their core. We hypothesise that within a community with high rates of oral disease, a fatalistic view may be seen as a realistic one. This does not preclude individuals from believing they can prevent their own oral disease, supporting the finding of high self-efficacy. We would recommend this concept be explored through qualitative study with this community to enable context-specific health promotion programs to acknowledge and address this key concept appropriately.

Statement of Authorship

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Principal Author

Name of Principal Author (Candidate)	Eleanor Parker		
Contribution to the Paper	Designed the study and performed analysis under the guidance of L Jamieson, J Spencer and K Roberts-Thomson. Provided the first draft of the manuscript and completed manuscript revision. Acted as corresponding author.		
Overall percentage (%)	80%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	10/12/2021

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Contribution to the Paper	Provided guidance on study design, statistical analysis and contributed to manuscript revision.		
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Name of Co-Author	Helen Mills		
Contribution to the Paper	Contributed data collection and manuscript revision.		
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Oral health-related self-efficacy and fatalism in a regional South Australian Aboriginal population

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Objectives: To assess the psychometric properties, including face, content, criterion and known-groups validity and reliability, of scales to measure oral health-related self-efficacy and fatalism in a regional Aboriginal adult population in Australia. ***Methods***: Four hundred Aboriginal adults (aged 18-82 years, 67% female) completed a self-report questionnaire including items pertaining to oral health-related self-efficacy and fatalism. Structural validity was determined in exploratory factor analysis (EFA) with principal components analysis for each scale. Criterion validity was assessed between the instruments and theoretically related variables. Known-groups validity was investigated by comparing the scores in different population groups according to age, sex, education and employment. Reliability of the scales was assessed through internal consistency. ***Results***: The EFA confirmed a single factor structure for self-efficacy and fatalism scales, with Cronbach's alphas of 0.93 and 0.89 respectively. The two scales were not correlated. Oral health-related self-efficacy was associated with toothbrush ownership and brushing the previous day supporting criterion validity. Oral health-related fatalism was associated with previous extractions and perceived need for extractions also supporting criterion validity. Both measures were associated with social impact of oral health as measured by the OHIP-14, supporting their criterion validity. Mixed findings were observed in terms of known-groups validity. ***Conclusions***: There was initial evidence that measures of oral health-related self-efficacy and fatalism displayed adequate psychometric properties in this Aboriginal community. These constructs could have implications for approaches for improving oral health among Aboriginal people.

Keywords*: Oral health, self-efficacy, Aboriginal Australians, Social Cognitive Theory*

Indigenous Australians include people who identify as being of Aboriginal or Torres Strait Islander descent, representing three percent of the Australian population in 2014 (Australian Institute of Health and Welfare, 2015). Collectively, Indigenous Australians, hereafter referred to as Aboriginal to recognise the original inhabitants of the land on which this research was conducted, demonstrate a younger age structure with higher proportions living in rural and remote areas than the non-Indigenous population. They are a diverse population, representing many different language and cultural groups. Complex historical and political factors, including the Stolen Generations, impact on the health of Aboriginal Australians today, with Aboriginal Australians experiencing higher rates of unemployment, inadequate housing and greater burden of chronic disease than non-Aboriginal Australians. Although traditionally Aboriginal Australians experienced low levels of oral disease, it is well-documented that Aboriginal adults now experience poorer oral health than non-Aboriginal Australians, including greater rates of edentulousness and toothache (Brennan and Carter, 1998).

Widely used in health behaviour research, the Social Cognitive Theory (SCT) identifies a core set of determinants that are associated with health behaviours, specifically perceived self-efficacy and fatalism (Bandura, 2004). The SCT describes the mechanisms through which these core determinants relate to outcome expectations and perceived facilitators and impediments, and how they act and are translated into health behaviour (Bandura, 2004).

Research focussed on self-efficacy is diverse in methodological and analytic approaches and uses a variety of instruments. However, meta-analyses have demonstrated that efficacy beliefs are consistently associated with an individual's level of motivation and performance (Bandura and Locke, 2003). Self-efficacy beliefs can predict differences between individuals as well as within an individual at different points in time (Bandura and Locke, 2003). In the general health realm, self-efficacy is an important predictor of self-care, health outcomes and quality of life for patients with chronic disease (Joekes *et el.,* 2007; Syrjala *et al*., 2004).

There is evidence that self-efficacy may have an impact on both oral health behaviours and outcomes, although not all findings are consistent. In adults internationally, dental and oral-hygiene specific self-efficacy has been associated with both oral health behaviours and clinical oral health measures including plaque and gingival bleeding levels (Kneckt *et al*., 1999; Woebler *et al*., 2015). In the United States, Finlayson and colleagues (2005; 2007a; 2007b) have focussed on the beliefs of mothers and the impact on oral health behaviours and outcomes in their children. Although the role of self-efficacy was less convincing in relation to health outcomes, they associated a mother's higher knowledge of oral hygiene with the child's better caries status and that a mother endorsing a fatalistic belief about children's oral health nearly tripled the child's odds of disease (Finlayson *et al*., 2005; 2007b). These findings are supported by Australian research

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whereby paternal self-efficacy has been associated with both tooth brushing and dental visiting frequency (de Silva-Sanigorski *et al.,* 2013).

The literature relating to oral health-related self-efficacy and fatalism among disadvantaged groups in Australia is sparse. Understanding the factors that contribute to poorer oral health amongst Aboriginal adults may assist in identifying appropriate pathways for intervention. Understanding the role of oral health-related self-efficacy and fatalism in Aboriginal oral health may therefore provide evidence for more comprehensive and tailored oral health promotion strategies to address the oral health disparities that exist for this disadvantaged group.

The aim of this paper is to assess the validity of oral health-related self-efficacy and fatalism scales in a regional Aboriginal adult population in Australia.

Methods

Data were drawn from the Indigenous Oral Health Literacy Project (IOHLP), a randomised control trial based in regional South Australia. Baseline data from the initial cross-sectional study were utilised for this analysis (Parker *et al*., 2012).

Participants in the IOHLP were recruited from within Port Augusta, a regional centre in South Australia. Eligibility criteria included being Aboriginal or Torres Strait Islander, aged 18 years and above and planning to reside in Port Augusta or a nearby community for two years. Participants were recruited using a variety of methods previously used successfully with this community, including self-nomination, home visits, word of mouth, visits to community centres and referrals. Written and verbal information about the study was provided to each participant before gaining consent. In acknowledgement of their time commitment, participants received a $20 supermarket gift voucher upon completion of the questionnaire.

Ethical approval was granted by the Aboriginal Health Council of South Australia and the Human Research Ethics Committee of the University of Adelaide. The Board of Management of the Pika Wiya Health Service (PWHS), the local community controlled Aboriginal health service, also gave approval for the study. Comprised of representatives from the local Aboriginal community, the Board of Management is the peak body which governs the delivery of PWHS services and programs.

Two advisory groups were formed and consulted during the development and implementation of this study. Firstly, an expert advisory group consisting of researchers with extensive experience in developing and conducting surveys with disadvantaged groups in Australia and Internationally. This group had input into the study design and reviewed the format and content of the questionnaire. Secondly, an Aboriginal advisory group comprising seven Aboriginal community representatives. This group provided essential cultural input and guidance for researchers during the planning and promotion of the study, format and content of the questionnaire and recruitment methods.

The questionnaires, which took around 30 minutes to complete, were administered by Aboriginal project officers, being completed either as an interview or self-completed, or a combination of interview and self-complete as determined by the needs of participants. The project officers were provided with a scripted method of introducing and administering the questionnaire.

The focal measures of the study were developed based on the core components of Social Cognitive Theory (SCT) (Figure 1) whereby self-efficacy impacts health behaviours directly and through its impact on outcome expectations and perceptions of facilitators and impediments (Bandura, 2004). Items to assess oral health-related self-efficacy and fatalism were generated based on reviews of the SCT and oral health literature. Refinement of the items was informed by previous research with this community and other disadvantaged groups in South Australia and through consultation with the study's expert and Aboriginal advisory groups.

Oral health-related self-efficacy was measured using six items adapted from a self-efficacy scale developed by Finlayson and colleagues (2005). The six items asked participants to rate how confident they felt about their ability to brush their teeth at night when they were: (1) under a lot of stress; (2) depressed; (3) anxious; (4) feeling like they did not have the time; (5) tired and (6) worried about other things in their life. Responses were on a Likert

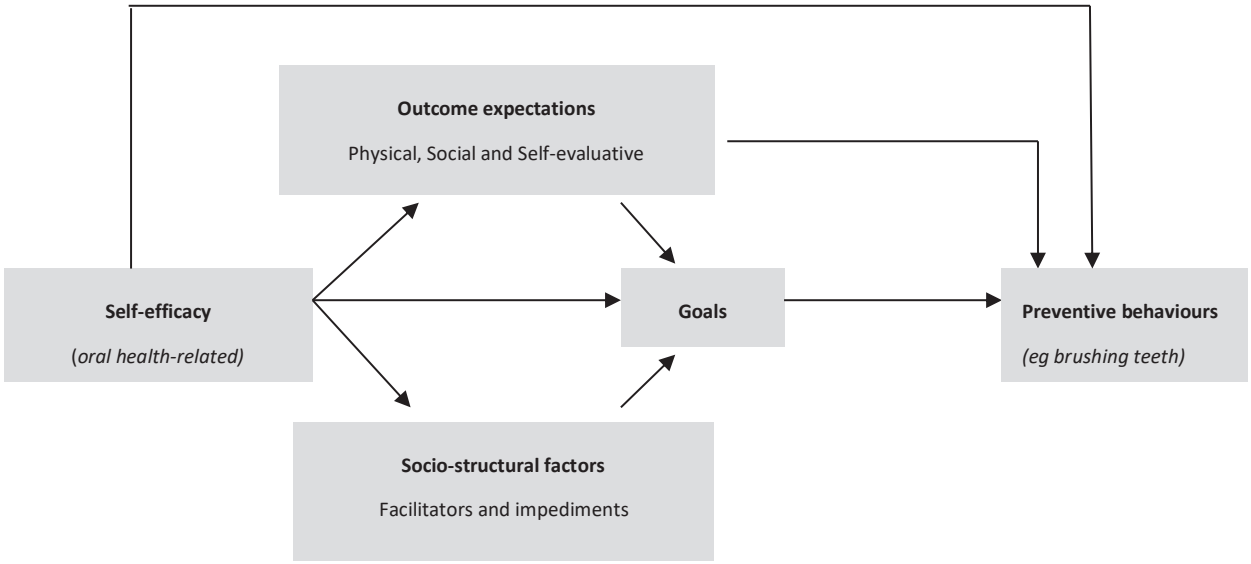

Figure 1. Self-efficacy impacts directly and indirectly on health behaviours (Bandura, 2004).

scale scored with 1= not at all confident, 2= hardly ever confident, 3= occasionally confident, 4= fairly confident, and =5 very confident, so that higher scores reflected greater self-efficacy. Based on feedback from expert and advisory groups an additional response option of "I never feel like this" was added and treated as a missing response.

Oral health-related fatalism was measured using a five-item scale, asking participants to indicate their level of agreement with the following statements, generated to reflect the range of oral health conditions prevalent in this community: most people will .....(1) eventually develop problems with their teeth; (2) need to have their teeth pulled out; (3) eventually get a toothache; (4) have bleeding gums; and (5) get wobbly teeth. Response options were on a Likert scale scored from 1 (strongly disagree) to 5 (strongly agree), so that high scores reflected highly fatalistic views. Based on feedback from expert and advisory groups an additional response option of "I don't know" was added and treated as a missing response.

Demographic measures included age, sex, highest level of education and employment status. Items to assess the criterion validity of OH-SE included ownership of a toothbrush and brushing the previous day. Items to assess criterion validity of OH-F included (for dentate participants) having previous extractions by a dentist and perceiving a need for extractions. Items to further assess criterion validity for both scales included the social impact of oral health (OHIP-14) (Slade., 1997*)* and self-rated general and oral health.

Summary scores were calculated for each measure. Where participants had two or fewer missing items for self-efficacy a mean score of their responses for the remaining items within the scale were imputed. For fatalism if a participant had only one missing item, the mean score of their responses for the remaining items in the scale was imputed. Participants with more than the specified missing items were considered to have a missing score for that scale and excluded from further analysis pertaining to that scale. Chi-square analyses were used to determine if there were differences according to demographic characteristics of those with and without scale scores. Pair-wise exclusion was used to manage missing data. All analyses were conducted in IBM SPSS Statistics Package version 20.

To investigate the validity of the instruments, we evaluated the following types of validity:

1. *Face and content validity* were assessed through consultation with expert and Aboriginal advisory groups.
2. *Structural validity* was determined by exploratory factor analysis (EFA) with principal components analysis for each scale. The correlation between the OH-SE and OH-F continuous scale scores was assessed using Spearman's Rho.
3. *Construct validity* in the form of Known-groups validity was investigated by comparing the scores according to sex, age and education. Known-groups validity compares scale scores across different groups (e.g., older vs younger people) and informs whether the instrument is able to differentiate between two groups that are known to be different regarding the construct (Davidson, 2014); in this case, individuals with higher levels of education or current employment having higher OH-SE and lower OH-F respectively.
4. *Criterion validity*, the extent to which the instruments were associated with theoretically associated outcomes (Taherdoost., 2016), including self-rated oral and general health, the social impact of oral health (OHIP-14) and oral-health related variables of toothbrush ownership and tooth brushing the previous day for OH-SE; previous extraction and perceived need for extraction for OH-F. Given the skewed distribution of scale scores, the Kruskal Wallis or Mann-Whitney U test was used to determine associations between the continuous outcome variables and categorical explanatory variables.

Reliability of the scales was assessed through internal consistency, as measured by Cronbach's alpha with item-by-item analyses and item-total correlations for each scale.

Results

A total of 400 Aboriginal adults completed the questionnaire, aged 18–82 years, with a mean age of 36 and a median age of 33 years. Around 67% were female. The highest educational attainment for 64% of participants was high school, with 12% having no schooling or primary school only. Around 22% of participants received their main source of income through paid employment. Four percent of participants were edentulous.

For the oral health-related self-efficacy items (Table 1), participants generally indicated that they felt confident about their ability to brush their teeth at night, with 33–44% of participants indicating they were either fairly

Table 1. Oral health-related self-efficacy (OH-SE) responses.

How confident do you feel about your ability to brush your teeth at night when you are	*Percent of valid responses*					
	Very confident	*Fairly confident*	*Occasionally confident*	*Hardly ever confident*	*Not at all confident*	*I never feel like this*
Under a lot of stress (n=397)	25.4	18.4	18.6	7.6	9.6	20.4
Depressed (n=394)	22.8	16.8	17.0	9.6	11.9	21.8
Anxious (n=399)	21.6	18.0	16.3	9.3	9.3	25.6
Feeling like you do not have time (too busy) (n=398)	16.3	17.3	23.1	10.3	12.1	20.9
Tired (n=399)	17.0	17.8	22.3	10.0	15.0	17.8
Worried about other things in your life (n=398)	15.8	17.6	20.9	8.3	14.1	23.4

or very confident for each item. For each item, 18–26% of participants selected "I never feel like this", with the highest proportion (26%) selecting this response for the item asking about feeling anxious, and the least (18%) for the item related to tiredness. Exploratory factor analysis revealed the presence of one factor for self-efficacy, consisting of the 6 items with an Eigenvalue = 4.31, explaining 71.8% of variance (Table 3). Internal consistency was high (Cronbach's alpha=0.926; n=256), with corrected item-total correlations ranging from 0.72 to 0.86. There was no improvement in Cronbach's alpha with deletion of items, indicating that all 6 items should be retained in the scale. The mean item to item correlation was 0.68 (range from 0.52 to 0.76).

With more than two responses of "I never feel like this" treated as a missing response, nearly 25% of participants (98 participants) did not have an OH-SE score. There were differences between those with versus those without an OH-SE score by age (Chi-square $p<0.05$), with the highest proportion not having a score being in the 25–34-year group (31.4%) and the lowest in the 50–82-year group (9.7%). There were no differences by sex, employment status or level of education between those who did and did not have an OH-SE score.

For oral health-related fatalism, participants generally agreed with each statement (Table 2), with between 70–85% either moderately or strongly agreeing. For each item, between 6 and 12 % of participants selected the response of "don't know". With more than one response of "I don't know" treated as a missing response, nearly 14% of participants (54 participants) did not have an OH-F score. Exploratory factor analysis extracted one factor, consisting of the 5 items, with an Eigenvalue of 3.40, explaining 68.0% of the variance (Table 3). Internal consistency was high (Cronbach's alpha 0.882; n=325), with corrected item-total correlations ranging from 0.61

Table 2. Oral health-related fatalism (OH-F) responses.

How much do you agree with the following statements?	*Percent of valid responses*					
	Strongly agree	*Moderately agree*	*Neither agree nor disagree*	*Moderately disagree*	*Strongly agree*	*Don't know*
Most people develop problems with their teeth (n=396)	50.5	26.5	8.1	2.0	2.0	10.9
Most people will need to have their teeth pulled out (n=398)	44.5	25.5	13.8	2.8	2.0	11.6
Most people will eventually get a toothache (n=400)	63.5	21.3	7.0	1.0	1.0	6.3
Most people will have bleeding gums (n=400)	46.3	25.0	14.3	3.0	3.0	8.5
Most people will eventually get wobbly teeth (n=400)	46.3	23.8	14.8	2.3	1.8	11.3

Table 3. Exploratory factor analysis for self-efficacy and fatalism items.

	EFA 1: self-efficacy	*EFA 2: fatalism*
Oral health-related self-efficacy	*One factor*	*One factor*
How confident do you feel about your ability to brush your teeth at night when you are		
.....under a lot of stress	0.812	
.....depressed	0.851	
.....anxious	0.890	
.....feeling like you do not have the time (too busy)	0.868	
.....tired	0.836	
.....worried about other things in your life	0.826	
Oral health-related fatalism		
How much do you agree with the following statements?		
.....most people will eventually develop problems with their teeth		0.744
.....most people will need to have their teeth pulled out		0.812
.....most people will eventually get a toothache		0.853
.....most people will have bleeding gums		0.856
.....most people will get wobbly teeth		0.853
Eigan Value	4.31	3.40
Variance accounted for (percent)	71.8	68.0
Cronbach's alpha for boxed items (n)	0.93 (256)	0.88 (325)

to 0.78. There was no improvement in Cronbach's alpha with deletion of items, confirming that all 5 items should be retained in the scale. The mean item to item correlation was 0.61 (range from 0.49 to 0.74). There were no differences between those with and without a fatalism score by age group, sex, level of education nor employment status (Chi-square $p > 0.05$).

Oral health-related self-efficacy scale scores ranged from 6–30, with a mean of 20.0, median score of 20.0 and mode of 30. Fatalism scale scores ranged from 5–25 with a mean of 21.7, median score of 23 and mode of 25. Testing for normal distribution (Shapiro-wilk and Kolmogorov-Smirov) confirmed that both the OH-SE and OH-F scales were not normally distributed, being highly negatively skewed. Self-efficacy and fatalism scores were not significantly correlated with each other.

Higher OH-F scores were associated with being in the higher age groups, lower levels of education and not being employed (Table 4). Self-efficacy scores were not associated with socio-demographic factors. Higher oral OH-SE was associated with owning a toothbrush, brushing the previous day, rating general and oral health as excellent, very good or good, and having no OHIP-14 items rated fairly often or very often (Table 5). Higher OH-F scores were associated with having previous extractions by a dentist, a perceived need for extractions and with having one or more OHIP-14 items rate fairly often or very often.

Discussion

This study assessed the validity of scales adapted from those previously reported in the literature, to measure oral health-related self-efficacy and fatalism amongst Aboriginal adults in regional South Australia. The feasibility and acceptability of the instruments in the current form was supported by the willingness of participants to complete them. Face and content validity of the OH-SE and OH-F scales were verified by expert and Aboriginal advisory groups. A single factor structure was confirmed for both scales with exploratory factor analysis and high internal reliability with Cronbach's alpha.

Participants generally had both high self-efficacy and high fatalism scores. The finding that overall scores for both OH-SE and OH-F were high is somewhat counter-intuitive, although it supports the concept that the scales are measuring different constructs. This was consistent with the findings of Finlayson and colleagues (2005), where mothers had high levels of self-efficacy, but nearly 80% held fatalistic beliefs. It is important to note that the self-efficacy items asked participants about how they feel as an individual, whereas the fatalism statements relate to others or "most" people. Given the high rates of oral disease for Aboriginal adults, highly fatalistic views could be considered realistic views. Consistent with this is that fatalism scores were not associated with the individual health behaviours of tooth brushing the previous day and tooth-brush ownership, whereas self-efficacy was associated with these health behaviours. In contrast to this finding, Finlayson and colleagues (2005) found that children of mothers with fatalistic beliefs brushed less frequently.

The relationship between self-efficacy and toothbrush ownership and tooth brushing the previous day is expected, considering the item statements relate specifically to tooth brushing, and confirms criterion validity. This is also consistent with literature linking self-efficacy beliefs with specific health behaviours (Kneck *et al*., 1999: Syrjala *et al.,* 2004; Finlayson *et al.,* 2007a; Stewart *et al.,* 1996; Johnston-Brooks *et al*., 2002). Self-efficacy is considered an important element of self-management of chronic disease. One self-management program for people with arthritis was successful in increasing efficacy beliefs (O'Leary *et al.,* 1988). Those with higher self-efficacy beliefs about their ability to exert control over their symptoms were less affected by the symptoms of their condition. The benefits

Table 4. Known-groups validity: Associations between OH-SE and OH-F and demographic characteristics.

Characteristic	*OH-SE*		*OH-F*	
	N	*Mean (95%CI)*	*N*	*Mean (95%CI)*
All	302	20.0 (0.4)	346	21.7 (0.2)
Age group				
18-24	74	20.7 (19.4–22.1)	91	21.2 (20.5–21.9)*
25-34	70	19.5 (18.0–21.0)	87	22.3 (20.4–22.0)
35-49	93	19.0 (17.5–20.4)	104	22.3 (21.6–23.0)
50-82	65	21.3 (19.5–23.1)	64	21.9 (21.0–22.8)
Sex				
male	91	20.2 (18.9–21.5)	117	22.0 (21.4–22.6)
female	211	20.0 (19.0–20.9)	229	21.5 (21.0–22.0)
Highest level of education				
no schooling, primary or high school	227	20.4 (19.5–21.2)	257	22.0 (21.6–22.4)*
trade, TAFE or university	71	19.1(17.6–20.7)	85	20.8 (19.9–21.7)
Employment status				
employed	69	20.7 (18.9–21.5)	75	20.6 (19.8–21.5)*
unemployed/other	227	19.8 (19.0–20.7)	263	22.0 (21.6–22.4)

*$p<0.05$ Kruskal-Wallis or Mann-Whitney U test (testing for distribution across groups).

Table 5. Criterion Validity: Associations between OH-SE and OH-F scales and oral-health, self-reported oral and general health, and social impact of oral disease.

Characteristic	*OH-SE*		*OH-F*	
	N	*Mean (95%CI)*	*N*	*Mean (95%CI)*
Ownership of a toothbrush				
Yes	279	20.3 (19.5–21.1)*	312	21.7 (21.3–22.1)
No	19	16.9 (14.0–19.8)	29	21.9 (20.9–22.7)
If yes, brushed the previous day				
Yes	210	21.3 (20.4–22.2)*	237	21.6 (21.1–22.1)
No	57	17.6 (15.9–19.3)	68	21.8 (20.9–22.7)
If own teeth remaining, had teeth extracted by a dentist previously				
Yes	22	20.0 (19.1–21.0)	260	21.9 (21.4–22.3)*
No	54	20.6 (19.2–22.1)	63	20.9 (19.9–21.8)
Perceived need for extractions				
Yes	155	19.3 (19.8–21.9)	174	22.2 (21.7–22.6)*
No or don't know	144	20.9 (19.8–21.9)	169	21.2 (20.6–21.8)
Self-rated oral health				
Excellent, very good or good	162	21.3 (20.2–22.4)*	186	21.6 (21.1–22.2)
Fair or poor	139	18.6 (17.5–19.7)	159	21.7 (21.2–22.3)
Self-rated general health				
Excellent, very good or good	223	20.6 (19.7–21.4)*	260	21.6 (21.2–22.0)
Fair or poor	78	18.5 (16.9–20.1)	85	21.9 (20.9–22.8)
OHIP-14				
No items rated fairly or very often	126	21.5 (20.4–22.7)*		21.3 (20.6–21.9)*
One or more items rated fairly or very often	176	19.0 (17.9–20.0)		22.0 (21.5–22.5)

*$p<0.05$ Mann-Whitney U Test.

were long-lasting. An important consideration for use in health promotion is that improvements in one health-specific self-efficacy may lead to improved self-efficacy in other areas of health (Syrjala *et al.,* 2004). These factors, together with our findings suggest that programs to improve oral and general health self-efficacy among this community may lead to improved and sustained oral health behaviours, which in turn may contribute to improved oral health or even general health outcomes.

Higher fatalism scores were associated with demographic factors. As expected, OH-F scores were associated with a history of previous extractions, perceived need for extractions and greater social impact of oral disease; all findings that support the validity of this OH-F instrument. This may reflect the poor state of health and social disadvantage experienced by Aboriginal Australians, including reduced life expectancy, higher rates of and earlier onset of chronic disease, high levels of psychological distress and discrimination (Australian Institute of Health and Welfare, 2015). There was no association between OH-F and self-ratings of general or oral health. This may also reflect the items within the OH-F scale being about "most people" and the self-ratings being about their perception of their own current health status. Conceptually, an individual could rate their own oral health and health quite independently of their perception of the inevitability of oral disease.

It is important to recognise the study's limitations. Firstly, it uses a convenience sample of Aboriginal adults and may not therefore be transferable to the wider Aboriginal population. Secondly, there were many participants without a scale score. The high proportion of participant's missing an OH-SE or OH-F score is a direct result of the inclusion of the "never feel like this" or "don't know" responses for each scale respectively. The scales on which the present study based the OH-SE and OH-F instrument did not provide this option (Finlayson *et al.,* 2005). The decision was made to include this option during our consultation, when people felt that the self-efficacy items assumed all people felt that way at some stage. This is supported by the variation in proportions of participants selecting the "never feel like this" option: 26% for feeling anxious and 18% for tiredness. Interestingly, the only demographic characteristic differing between those with and without scale scores (due to missing items) was the age category. Those in the second youngest age group were less likely to have a missing scale score, indicating this age groups was less likely to choose "I never feel like this" for two or more items. Possible reasons for this could be associated with literacy levels and social stigma around reporting feelings of and conditions of depression and anxiety, or perceptions of what may constitute a more socially desirable response.

Strategies to improve the oral health of Aboriginal Australians are needed. One powerful mechanism explaining the poorer health status of Aboriginal people is socioeconomic disadvantage. Addressing social inequalities is critical in order to enable improvements in health and oral health (Marmot, 2011), as is identifying the protective factors which have enabled Aboriginal Australian communities to survive significant and repeated adverse events (Zubrick *et al.,* 2010). Watt (2012) has written of the importance of developing and building people's ability to promote and protect their health through context-specific and supportive interventions as an important component of working towards reducing oral health inequalities. Although the SCT has traditionally focussed on an individual's perception of personal self-efficacy, Bandura (2004) has also written about the importance of social support and a sense of collective efficacy. Stating that people work together to improve the quality of their lives, he highlights the importance of a sense of collective efficacy in health promotion and disease prevention strategies (Bandura, 2004). This concept may be of relevance to Aboriginal health promotion in Australia and internationally, given the focus on strong interpersonal relationships and collective support that exist in Indigenous cultures. It is therefore possible that improving both individual and community-level efficacy beliefs may prove to be a fundamental component of addressing Aboriginal oral health disparities through culturally and community specific strategies.

In conclusion, measures of oral health-related self-efficacy and fatalism demonstrated community acceptability, acceptable face, content, criterion and known-groups validity, and internal reliability. Greater understanding of self-efficacy and fatalism may help to inform the development of more targeted and holistic health promotion programs, supporting improved self-efficacy and addressing fatalistic views of oral health as a core component of oral health and chronic disease self-management.

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Chapter 7: Perceived stress and oral health outcomes

Submitted paper:

Perceived stress is associated with poorer self-rated oral health and greater oral health impact in a regional Australian Aboriginal population

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7.1 Highlights and linkage to the body of work

This paper utilised the outcome measures examined in this thesis; self-rated general; self-rated oral health; and, the impact of oral conditions measured with OHIP-14. We deemed it appropriate to include self-rated general health as an outcome measure given that the exposures, perceived stress and perceived coping, are general psychosocial measures, not oral-health specific. Inclusion of self-rated general health enabled assessment of the importance of these psychosocial measures in perceptions of general as well as oral health.

Recent work by colleagues (and co-authors of this paper) validated these measures of perceived stress and coping in a sample of pregnant Aboriginal women in South Australia, which enabled us to utilise these measures with confidence of their acceptability and validity for Aboriginal adults.

For this paper we also considered the role of self-efficacy and whether this should be included as a confounder in the analysis. The relationship between self-efficacy and perceived stress is a difficult one to disentangle, with self-efficacy assessing an individual's belief that they can continue to carry out self-care behaviours despite impediments, such as when they are feeling stressed. However, in our conceptual model, stress could cause high or low efficacy beliefs, but efficacy beliefs do not cause stress and therefore was not a confounder in this analysis. Self-efficacy beliefs may be protective in the relationship between stress and health outcomes, an area for further research discussed in later chapters of this thesis. The approach utilised in this paper has therefore proceeded without use of the oral health-related self-efficacy or fatalism measures presented in this thesis for a number of key reasons:

a) they are oral health-specific measures and we are using general psychosocial measures (perceived stress and coping) and both oral and general health outcomes,

b) in our conceptual model they are not true confounders,

c) the inclusion of these factors significantly reduced the number of complete cases due to missing data and therefore reduces the power of the analysis, and

d) mediation analyses are beyond the scope of this paper and are identified as an area for further research.

Highlights

- Higher levels of perceived stress were associated with a greater prevalence of poor self-rated oral health, poor self-rated general health and higher OHIP-14 severity, whereas perceived coping was not.
- A gradient of increasing oral health impacts and increasing prevalence of poor ratings of oral and general health across levels of perceived stress was identified.
- Associations between levels of stress and oral health impacts persisted despite controlling for multiple socioeconomic measures.

Research and policy implications

These findings indicate that psychosocial factors, specifically perceived stress, cannot be overlooked when considering the determinants of health and oral health in this Aboriginal community, and even more importantly, cannot be dismissed when designing oral health interventions. These warrant further investigation to better understand this relationship between perceived stress and oral and general health outcomes for Aboriginal Australians, including identifying what factors mediate the relationship between stress and oral health and therefore identify potential opportunities for tailored interventions.

Statement of Authorship

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Principal Author

Name of Principal Author (Candidate)	Eleanor Parker		
Contribution to the Paper	Designed the study and performed analysis and interpreted results under the guidance of co-authors. . Provided the first draft of the manuscript and completed manuscript revision. Acting as corresponding author.		
Overall percentage (%)	75%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	10/12/2021

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Title: Perceived stress is associated with poorer self-rated oral health and greater oral health impact in a regional Australian Aboriginal population

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Abstract

Objectives

Understanding the role that psychosocial factors play in poor oral health among disadvantaged populations may serve to assist in developing broader strategies to address oral health inequalities, however, the literature assessing the impact of stress on oral health outcomes for Aboriginal people in Australia is scarce. This study aimed to quantify levels of coping and stress amongst Aboriginal adults living in a regional location of South Australia and to determine associations with self-rated oral and general health and the impact of oral health.

Methods

Data were obtained from the baseline questionnaire of The Indigenous Oral Health Literacy Project involving 400 Aboriginal adults in a regional centre in South Australia. Perceived Stress and Perceived Coping were measured using the adapted form of the Perceived Stress Scale, recently validated for Aboriginal populations in Australia. . The scales were split into tertiles, indicating high, moderate and low levels for both coping and distress. Outcome measures were self-rated oral health, self-rated general health and the shortened form of the oral health impact profile (OHIP-14). Generalized linear models were used to estimate Prevalence Ratios (PR) for poor self-rated general health and oral health and multivariable linear regressions were used to estimate the association between psychosocial factors and OHIP severity scores.

Results

Participants had a mean OHIP-14 score of 19.3 (95% CI 17.9, 20.7). The prevalence of poor self-rated health was 24.3 percent (95% CI 20.3, 28.8) and the prevalence of poor self-rated oral health was 44.4 percent (95% CI 39.5, 49.3). OHIP-14 severity increased as levels of perceived stress increased, with mean OHIP-14 scores amongst those with high perceived stress nearly double that of those with low perceived stress. A greater proportion of participants reporting high levels of perceived stress rated their oral health and general health poorly. These associations remained after adjusting for sociodemographic factors. No associations were observed between perceived coping and oral and general health outcomes.

Conclusion

Higher levels of perceived stress were associated with a greater prevalence of poor self-rated oral health, poor self-rated general health and higher OHIP-14 severity scores, whereas perceived coping was not. Associations remained after controlling for sociodemographic characteristics. These findings indicate that experiences of stress may be an important determinant of oral health in this Aboriginal community.

Key words

Perceived Stress, Perceived Coping, Oral Health, Self-rated health, Aboriginal, Indigenous

Introduction

The psychosocial determinants of oral health have gained more attention in recent decades, now potentially considered a crucial factor contributing to poor health and oral health [1].Understanding the role that psychosocial factors play in poor oral health among disadvantaged populations may serve to assist in developing broader strategies to address oral health inequalities. Perceived stress has been associated with oral health outcomes in the Australian population [2,3] and more recently amongst women pregnant with Aboriginal children in South Australia [4]. Given the holistic view of health of Aboriginal Australians, psychosocial factors may be particularly important to further explore in the oral health context.

Indigenous Australians include people identifying as being of Aboriginal and/or Torres Strait Islander descent, making up three percent of Australia's population [5]. Hereafter, Indigenous Australians will be referred to as Aboriginal to acknowledge the original inhabitants of South Australia where this study was based. Extreme inequalities exist in health and oral health outcomes in Australia, with Aboriginal people suffering from a greater burden of a multitude of health impacts including reduced life expectancy, infection, infant morbidity, and mortality [5,6]. In terms of oral health, although traditionally virtually free of oral disease, adults now have higher rates of edentulousness, toothache, problem-orientated visiting and greater caries experience [7-9].

An Aboriginal view of health encompasses the social, emotional and cultural well-being of the community as well as the physical and emotional health of the individual [10]. The whole-of-life view and integration of health into all aspects of life emphasises why intervention strategies focussed on one aspect of health in the absence of addressing broader self-management are prone to failure. In addressing contemporary health inequalities, it is important to also consider the ongoing impact of grief and trauma experienced by Aboriginal Australians as a consequence of colonisation, including separation from families and communities, loss of land and culture.

Perceived stress has been associated with both health and oral health outcomes as well as the experience of symptoms of poor health, health behaviours and utilisation of health services [3,11,12]. High levels of psychological stress have been reported among Aboriginal Australian adults [5]. In recent years, high or very high levels of psychological stress have been reported by over thirty percent of Indigenous people aged over 18 years [13]. Consistent with the international literature, Aboriginal Australians reporting high or very high levels of stress were more likely to also report fair or poor health and were less likely to report excellent or very good health [14]. For Aboriginal Australians, those reporting higher levels of stress were more likely to smoke, consume alcohol at higher levels and have used illicit substances [14]. Previous research among Aboriginal mothers in South Australia indicated that mothers with high perceived stress had a 24% higher risk of smoking [4] and that high perceived stress was associated with poorer social support from the community [15]. Despite this recent study the literature regarding the effects of perceived stress specifically on the oral health of Aboriginal and/or Torres Strait Islander people is scarce. Further understanding the relationship between psychosocial factors such as perceived stress and health/oral health outcomes specifically for Aboriginal people is important to enable improvements in health and oral health. Failing to

appreciate the impact of psychological factors on oral health could limit the impact of any preventive or intervention strategies for Aboriginal communities.

Aims

This study aimed to quantify levels of the two dimensions of the Perceived Stress Scale, Perceived Stress and Perceived Coping, amongst Aboriginal adults living in a regional location of South Australia and to determine associations with key measures of self-reported oral health and general health. Specifically, this study aimed to;

a) describe the prevalence of levels of perceived stress and perceived coping according to sociodemographic characteristics,

b) investigate whether perceived stress and perceived coping are associated with self-reported oral health outcomes and self-rated general health, and

c) determine if associations between perceived stress and perceived coping and outcomes measures remain after controlling for sociodemographic characteristics.

Methods

Data were obtained from the baseline questionnaire of The Indigenous Oral Health Literacy Project (IOHLP). The IOHLP was a randomised control trial based in rural South Australia, involving a convenience sample of Aboriginal adults [16]. Participants were eligible if they identified as Indigenous, were aged over 18 years, living in the study's regional location or nearby communities and planning to remain in the region for two years. In acknowledgement of the time taken to complete the questionnaire, participants were given a $20 supermarket voucher. The relevant tertiary education institution and the state's Aboriginal Health Council granted ethical approval. The self-report questionnaire was either administered by Aboriginal project officers as an interview or completed by the participant, or in combination, as determined by the needs and comfort of the participant.

The exposure, perceived stress, was measured with the Perceived Stress Scale (PSS), the instrument most used worldwide to measure perceived stress and developed by Cohen and colleagues [11]. The PSS aims to measure the degree to which individuals perceive life situations as stressful. The scale consists of 14 items, 7 reflecting perceived stress, negatively worded, and the remaining 7 positively worded to reflect perceived coping. For the purposes of this study, each item asked participants to reflect on how they have felt during the last year, for example, "how often in the last year have you felt either nervous or stressed?" reflecting perceived stress, and "how often in the last year have you felt you were on top of things" reflecting perceived coping. Responses to all items were on a five-point scale ranging from (0) not at all, to (4) very often. The original authors of the PSS reverse scored the items reflecting perceived coping, and created one score for the 14-item scale. However, the conceptualisation and measurement of stress as a unidimensional variable has been criticised and more recent literature suggests that

perceived stress and perceived coping have quite different roles in their relationship with oral health outcomes in Australia and in particular, the Aboriginal health context [4,17].The psychometric properties of the PSS have been examined in Australia [17] and the instrument has recently been validated specifically for Aboriginal and/or Torres Strait Islander populations [4]. The validation indicated that an adapted version (a-PSS13) was culturally appropriate for Aboriginal and/or Torres Strait Islander populations after the exclusion of one item ("How often during the LAST YEAR have you dealt well with life hassles?"). The findings also indicated that the correlation between the Perceived Stress and Perceived Coping subscales was weak compared to strong correlations observed in Western cultures. Santiago, Roberts, Smithers, Jamieson [4] concluded that perceived stress and perceived coping might not be so closely associated in Aboriginal and/or Torres Strait Islander cultures as in Western cultures. In the current study, given the similarities with our population, we employed the adapted Perceived Stress Scale (a-PSS13) for Aboriginal and/or Torres Strait Islander people.

Responses for each sub-scale were summed, with possible scores ranging from 0–28 for Perceived Stress, so that high scores reflected higher levels of perceived stress, and possible scores for Perceived Coping ranging from 0-24 with higher scores reflecting higher levels of perceived coping. The scales were split into tertiles, indicating high, moderate and low levels for both perceived coping and perceived stress.

Oral health outcomes included oral health impacts and self-rated general and oral health. The shortened form of the Oral Health Impact Profile, OHIP-14 [18] was used to measure the self-reported impact of oral health conditions. The OHIP-14 consists of 14 items asking participants how frequently problems with their teeth, mouth, or false teeth affected them, with responses made on a five-point ordinal scale from *very often* (scored as a four) to *never* (scored as zero). As described by Slade[18], responses to each item were summed to create an *OHIP-14 severity score.* Higher scores indicate more oral health impacts. Where participants had one or two missing items, mean scores from the remaining items were imputed. Participants with two or more missing OHIP-14 items were not given an OHIP-14 severity score.

Self-rated general (SRGH) and oral health (SROH) were measured with the single global question asking participants "How would you rate your general health?" and "How would you rate your dental (oral) health?", with five response options: "excellent", "very good", "good", "fair" and "poor". Responses were dichotomised to "excellent, very good and good" and "fair and poor", with those as "fair and poor" classified as having "poor oral health/general".

Confounding factors included a range of variables that share a causal association with both exposures and outcomes. Variables included level of education attained (dichotomised to include "no schooling, primary or high school" and "trade, TAFE or University"), employment status ("unemployed or other" and "paid employment"), holding a Government Concession Card ("yes" and "no"), and number of people staying in the house the previous night (dichotomised to "5 or more" and "4 or less").

Descriptive analyses were performed to characterize the sample, and included the distribution of participants according to exposures (psychosocial factors), confounding factors (listed above) and outcomes (oral and general health). Generalized linear models with a log-Poisson link function and robust standard errors were used to estimate Prevalence Ratios (PR) and their 95% confidence intervals (CI) poor SROH and poor SRGH according to levels of psychosocial factors. Next, adjusted PRs and their respective 95% CIs were assessed after the inclusion of the abovementioned confounding variables in the models. Unadjusted and adjusted multivariable linear regressions were used to estimate the association between psychosocial factors and OHIP severity. Analyses were carried out using STATA 15.0.

Results

Four hundred participants completed a questionnaire with age range of 18 to 82 years and mean age of 36 years. Table 1 shows the characteristics of the sample. Approximately two thirds of participants were female, one quarter had above a high school education, just over one fifth were in paid employment, over 85 percent had a government benefits card and 44 percent had five or more people living in their house. Participants had a mean OHIP-14 severity score of 19.3 (95 percent CI 17.9, 20.7). One quarter (24.3 percent 95% CI 20.3, 28.8) of the sample rated their health as *fair or poor* and almost half (44.4 percent 95% CI 39.5, 49.3) rated their oral health as *fair or poor*.

Table 2 shows the distribution of oral health outcomes according to sociodemographic characteristics. The OHIP-14 severity varied by sex and age. Individuals aged 35-49 years-old had a higher OHIP-14 severity (24.6), than those aged 18 to 24 years-old (13.2). Similarly, the highest prevalence of poor SROH was observed among individuals aged 35 to 49 years-old (55.7 percent) and lowest (25.2 percent) among individuals aged18 to 24 years-old. The prevalence of poor SRGH was three times higher among individuals aged 50 to 82 years-old (38.9 percent) than those aged 18-24 years (12.6 percent).

Table 3 shows the distribution of perceived stress and perceived coping according to sociodemographic characteristics. Amongst females, there were 10 percent more with high levels of perceived coping than for those with moderate or low perceived coping. Amongst those in paid employment, there were over 15 percent more with high perceived coping than with moderate or low perceived coping. A gradient was observed for those without a Government benefits card with 44 percent, 30 percent and 26 percent having high, moderate and low perceived coping respectively. For perceived stress, a gradient from low to high perceived stress was observed for males, those in the youngest age group and those without a benefits card. For those in the youngest age group, there were over half reporting low levels of perceived stress. The proportion with low perceived stress was double that with high perceived stress amongst those without a Government benefits card.

There was little variation of OHIP-14 severity scores across categories of perceived coping (Table 4). The proportion of participants with poor self-rated oral health and poor self-rated general health also showed little variation across categories of perceived coping. OHIP-14 severity increased as levels of perceived stress increased, with mean OHIP-14 scores amongst those with high perceived stress nearly double that of those with low perceived stress (13.4 vs

26.6). A greater proportion of participants reporting high levels of perceived stress rated their oral health and general health as poor, with a more than 2.5 fold difference in the proportion of participants with high perceived stress rating their health poorly compared with those with low perceived stress (14.9 vs 38.5 percent) (Table 4).

Table 5 and Figure 1 show the adjusted associations between perceived coping and perceived stress with oral and general health outcomes. A graded association between levels of perceived stress and oral and general health outcomes was observed. In comparison with individuals with low levels of perceived stress, adjusted models showed higher OHIP severity scores among those with moderate (B=4.6 95% CI 1.2, 8.0) and high (B=11.3 95% CI 7.9, 14.6) levels of perceived stress. Higher levels of perceived stress were associated with a higher prevalence of poor SROH (PR=1.4 95% CI 1.0, 1.8). The prevalence of poor SRGH was 2.1 times higher among highly stressed individuals than for those with low levels of perceived stress (PR=2.1 95% CI 1.3, 3.3). No associations were observed between perceived coping with oral and general health outcomes.

Discussion

This study quantified the levels of perceived coping and perceived stress amongst a convenience sample of 400 Aboriginal adults living in a rural location, demonstrating that levels of both perceived coping and perceived stress varied with sociodemographic characteristics. Higher perceived stress was associated with higher oral health impact. For those with high perceived stress, the mean OHIP-14 severity score was over 11 units higher than those with low levels of perceived stress. The prevalence of both poor self-rated oral health and poor self-rated general health was more than 20 percent higher amongst those with high perceived stress versus than among those with low perceived stress. These associations between perceived stress and each outcome measure remained after controlling for sociodemographic characteristics. Perceived coping showed no associations with oral health impacts, self-rated oral health and self-rated general health.

The differing results for perceived coping and perceived stress, although in contrast to the original development and use of the Perceived Stress Scale, is a finding that has support in the literature. This finding also supports the use of Perceived Coping and Perceived Stress as two distinct scales representing two discrete sub-scales for this population, rather than one combined scale. The approach of using Perceived Stress and Perceived Coping as two distinct sub-scales is consistent with that of Sanders and colleagues[19], who examined the Perceived Stress Scale as a uni-dimensional scale and then with the two dimensions separately, concluding that within the Australian population the bi-dimensional nature of stress should be assessed. Importantly, our finding is consistent with the work of Santiago and colleagues [4], who developed an adapted version of the PSS (a-PSS13) amongst South Australian Aboriginal and/or Torres Strait Islander pregnant women. Their work suggested that the perceived stress was mostly independent of perceived coping in this population; that is, even the Aboriginal and/or Torres Strait Islander mothers who experienced high perceived coping, also experienced high perceived stress. This suggests that the effects of stress exist for this population above and beyond the protective effects of coping, and the protective health effects of perceived coping are potentially diminished (since even those mothers who had high perceived coping were not

immune to experiencing high perceived stress and its deleterious effects on health outcomes). The lack of association between perceived stress and perceived coping within the Aboriginal community is a potential consequence of the social, political and health disadvantages that Aboriginal Australians face. Hence, *person*al coping strategies, as measured by the Perceived Coping items (e.g., "How often during the LAST YEAR have you felt able to control irritations in your life?"), are not enough to overcome the stress experienced due to disadvantages at a *structural* level. Although perceived coping did not show the same associations with oral health outcome measures in our study as perceived stress, there were differences for perceived coping according to socio-demographic characteristics. For example, amongst females, ten percent more reported high levels of perceived coping, whereas the proportions reporting low, moderate and high perceived stress showed minimal variation. The reverse was true amongst males: the proportion of males in each tertile for perceived coping had negligible variation, whereas 20 percent more males were in the group with low levels of perceived stress than in the high perceived stress group. The proportion with high versus moderate or low perceived coping also varied amongst those with paid employment and without a Government benefits card. This indicates that the association of perceived coping with broader health outcomes examined in our study, such as self-reported oral and general health, was not evident, although other studies had reported associations with specific health outcomes. For instance, Sanders and Slade identified gender differences in the protective influence of perceived coping on orofacial pain symptoms [2]. In summary, the role of perceived coping on health outcomes and overall wellbeing for Aboriginal and/or Torres Strait Islander people requires further examination in partnership with Aboriginal peoples.

Although the prevalence of good/poor self-rated oral health was around double that of good/poor self-rated general health, the patterns of associations with variables evaluated in the study were similar. Both measures varied across age groups, and although by a lesser degree, varied by level of education. Both self-rated oral health and self-rated general health were associated with levels of perceived stress. The prevalence of poor self-rated oral health and general health was 1.7 and more than 2.5 times respectively than amongst those with high versus low perceived stress. The adjusted associations remained, with the prevalence of poor self-rated general health amongst more stressed individuals more than double that for those with low levels of perceived stress. This association of perceived distress with both poor self-reported oral and general health is consistent with the literature [12,20]. In the Australian context, levels of perceived stress demonstrated an even stronger relationship with poor self-rated oral health than with tooth loss [3], demonstrating the importance of this measure of psychosocial wellbeing in understanding individual perceptions of oral health.

The relationship between stress, socioeconomic factors and oral health outcomes is important when assessing oral health inequalities. There is evidence that socioeconomic factors mediate the effect between stress and oral health outcomes [21], and that stress moderates the effect of income on self-rated oral health [3]. Watson and colleagues [12] reported that stress accounted for a substantial amount of the variance by socioeconomic status across ethnic and racial groups for both oral and general health. In this present study for Aboriginal adults, we adjusted for a broad range of socioeconomic conditions, so the potential for unmeasured socioeconomic confounding is minimal. We

found the effect of stress on outcomes persisted despite adjusting for socioeconomic inequalities, a finding particularly important given the clear socioeconomic disadvantage experienced by many Aboriginal Australians.

There are limitations of this study which must be acknowledged. Firstly, this was a convenience sample within a rural location in South Australia and as such, caution must be exercised when extrapolating results to the broader Aboriginal population. This is also a cross-sectional study and although we are theorising that perceived stress and perceived coping are exposures in a potential casual pathway, causation cannot be determined.

A key strength of this study is the involvement of 400 Aboriginal Australian adults in a rural location with data relating to psychosocial as well as oral health factors, rarely found in the literature. Another strength is that the instruments used were validated specifically for Aboriginal and/or Torres Strait Islander populations. In addition, despite the relative homogeneity of the sample, the magnitude of the difference between groups (for example, those with high stress having an OHIP severity score more than 13 units higher than those with low stress) indicates that this study has identified meaningful differences. These are important to consider when assessing the health and wellbeing of this community, and in particular, highlighting that psychosocial factors cannot be ignored when planning intervention strategies to reduce the oral health burden.

This study has successfully addressed a gap in the literature pertaining to psychosocial factors and oral health and general health outcomes among Aboriginal adults in regional South Australia. The completion of the baseline questionnaire by 400 Aboriginal adults supports the cultural acceptability of this study and successful engagement with the community by the Aboriginal advisory group and the Aboriginal project officers. The differing pattern of associations with outcomes for stress and coping are important findings, build on recent work by Santiago and colleagues, and indicate that this may be unique to Aboriginal groups and may relate to the high levels of stressful events experienced [4]. The finding that the association between levels of stress and oral health impacts persisted despite controlling for multiple socioeconomic measures is an important addition to the literature and warrants further investigation to better understand this relationship for Aboriginal Australians.

Conclusion

A high levels of perceived stress was associated with oral health and general health outcomes, whereas perceived coping showed no association with health and oral health outcomes measured. This suggested that high levels of stress existed in this population even among those who experience high perceived coping. The gradient of increasing severity of oral health impacts and prevalence of poor self-rated general and oral health across the levels of perceived stress indicated that experience of stress was an important determinant of health and oral health in this Aboriginal community.

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Table 1: Sociodemographic characteristics of the sample

	n	% (95% CI)
Age group	400	
18-24	104	26.0 (21.9, 30.5)
25-34	102	25.5 (21.5, 30.0)
35-49	122	30.5 (26.2, 35.2)
50-82	72	18.0 (14.5, 22.1)
Sex	400	
male	131	32.8 (28.3, 37.5)
female	269	67.3 (62.5, 71.7)
Highest level of education	396	
none, primary or high school	301	76.0 (71.5, 80.0)
Trade, TAFE or university	95	24.0 (20.0, 28.5)
Employment status	388	
paid employment	85	21.9 (18.1, 26.3)
unemployed/other	303	78.1 (73.7, 81.9)
Government benefits card	391	
yes	341	87.2 (83.5, 90.2)
no	50	12.8 (9.8, 16.5)
Number of people in the house	375	
4 or less	210	56.0 (50.9, 60.9)
5 or more	165	44.0 (39.0, 49.1)

Table 2: Distribution of outcome variables according to sociodemographic characteristics

	OHIP severity Mean (95% CI)	**Poor SROH** row % (95% CI)	**Poor SRGH** row % (95% CI)
Sex			
Male	16.2 (13.8, 18.6)	41.2 (33.1, 49.9)	22.1 (15.8, 30.1)
Female	20.9 (19.2, 22.6)	45.9 (40.0, 51.9)	25.4 (20.5, 30.9)
Age			
18-24	13.2 (10.9, 14.5)	25.2 (17.8, 34.5)	12.6 (7.5, 20.1)
25-34	19.3 (16.7, 21.8)	46.1 (36.6, 55.8)	16.7 (10.6, 25.2)
35-49	24.6 (21.8, 27.4)	55.7 (46.8, 64.3)	32.0 (24.3, 40.8)
50-82	19.5 (16.5, 22.5)	50.0 (38.6, 61.4)	38.9 (28..3, 50.6)
Highest level of education			
None, primary or high school	19.2 (17.6, 20.8)	41.7 (36.2, 47.3)	23.0 (18.6, 28.1)
Trade, TAFE or university	19.4 (16.5, 22.3)	51.6 (41.6, 61.5)	27.4 (19.3, 37.2)
Employment status			
unemployed/other	19.8 (18.2, 21.4)	43.7 (38.2, 49.4)	24.5 (20.0, 29.7)
paid employment	17.3 (14.4, 20.2)	48.2 (37.8, 58.8)	23.5 (15.7, 33.7)
Government benefits card			
yes	19.6 (18.1, 21.4)	44.7 (39.5, 50.0)	24.4 (20.1, 29.3)
no	17.6 (13.4, 21.8)	42.0 (29.2, 56.0)	20.0 (11.1, 33.4)
Number of people in the house			
5 or more	19.6 (17.5, 21.8)	47.9 (40.3, 55.5)	28.5 (22.1, 35.9)
4 or less	19.4 (17.5, 21.4)	44.3 (37.7, 51.1)	22.4 (17.2, 28.5)

Table 3: Prevalence of levels of stress and coping by sociodemographic factors

	Perceived Coping row % (95% CI)			Perceived Stress row % (95% CI)		
	High	**Moderate**	**Low**	**Low**	**Moderate**	**High**
Sex						
male	32.1 (24.6, 40.5)	30.5 (23.2, 39.0)	37.4 (29.5, 46.0)	44.6 (36.3, 53.3)	30.8 (23.4, 39.2)	24.6 (18.0, 32.8)
female	40.4 (34.7, 46.5)	29.2 (24.1, 35.0)	30.3 (25.1, 36.1)	34.0 (28.5, 39.9)	29.5 (24.3, 35.2)	36.6 (31.0 (42.5)
Age						
18-24	25.0 (17.6, 34.2)	33.7 (25.2, 43.3)	41.3 (32.3, 51.0)	51.9 (42.3, 61.4)	24.0 (16.8, 33.2)	24.0 (16.8, 33.2)
25-34	37.3 (28.4, 47.0)	30.4 (22.2, 40.0)	32.4 (24.0, 42.0)	34.7 (26.0, 44.4)	32.7 (24.2, 42.4)	32.7 (24.2, 42.4)
35-49	44.2 (35.5, 53.2)	30.0 (22.5, 38.8)	25.8 (18.8, 34.4)	28.9 (21.5, 37.6)	35.5 (27.5, 44.5)	35.5 (27.5, 44.5)
50-82	45.8 (34.7, 57.4)	22.2 (14.1, 33.3)	31.9 (22.2, 43.6)	34.7 (24.6, 46.4)	25.0 (16.3, 36.3)	40.3 (29.6, 52.0)
Highest level of education						
None, primary or high school	35.8 (30.5, 41.4)	31.4 (26.4, 36.9)	32.8 (27.7, 38.3)	39.8 (34.4, 45.5)	28.4 (23.6, 33.8)	31.8 (26.7, 37.3))
Trade, TAFE or university	44.2 (34.6, 54.3)	24.2 (16.6, 33.8)	31.6 (23.0, 41.6)	30.5 (22.1, 40.5)	34.7 (25.8, 44.8)	34.7 (25.8, 44.8)
Employment status						
unemployed/other	36.2 (31.0, 41.8)	30.2 (25.3, 35.7)	33.6 (28.4, 39.1)	38.2 (32.9, 43.8)	27.6 (22.8, 32.9)	25.9 (17.7, 36.2)
paid employment	44.7 (34.5, 55.4)	25.9 (17.7, 36.2)	29.4 (20.7, 40.0)	35.3 (25.9, 46.0)	38.8 (29.1, 49.6)	34.2 (29.1, 39.8)
Government benefits card						
yes	36.3 (31.3, 41.2)	30.1 (25.4, 35.2)	33.6 (28.8, 38.8)	37.2 (32.2, 42.5)	28.3 (23.8, 33.4)	34.5 (29.6, 39.8)
no	44.0 (31.0, 57.9)	30.0 (18.9, 44.0)	26.0 (15.7, 39.8)	44.0 (31.0, 57.9)	36.0 (24.0, 50.1)	20.0 (11.1, 33.4)
Number of people in the house the previous night						
5 or more	37.4 (30.3, 45.1)	33.1 (26.3, 40.7)	29.4 (22.9, 36.9)	32.3 (25.6, 39.9)	32.3 (25.6, 39.9)	35.4 (28.4, 4
4 or less	40.5 (34.0, 47.3)	24.8 (19.4, 31.1)	34.8 (28.6, 41.5)	41.1 (34.7, 48.0)	27.3 (21.6, 33.7)	31.6 (25.6, 38.2)

Table 4: Unadjusted means and prevalence of oral and general health outcomes according to levels of stress and coping (n=353).

	OHIP severity Mean (95% CI)	Poor SROH row % (95% CI)	Poor SRGH row % (95% CI)
Perceived Coping			
High	20.2 (17.9, 22.4)	46.0 (38.0, 54.0)	26.7 (19.6, 33.8)
Moderate	20.4 (17.8, 23.0)	45.3 (36.3, 54.3)	21.4 (13.9, 28.8)
Low	17.5 (15.0, 19.9)	42.3 (33.8, 50.8)	24.6 (17.2, 32.0)
Perceived Stress			
Low	13.4 (11.3, 15.5)	33.1 (25.5, 40.7)	14.9 (9.1, 20.6)
Moderate	18.6 (16.2, 20.9)	45.4 (36.4, 54.3)	20.2 (12.9, 27.4)
High	26.6 (24.4, 28.9)	56.2 (47.6, 64.7)	38.5 (30.1, 46.8)

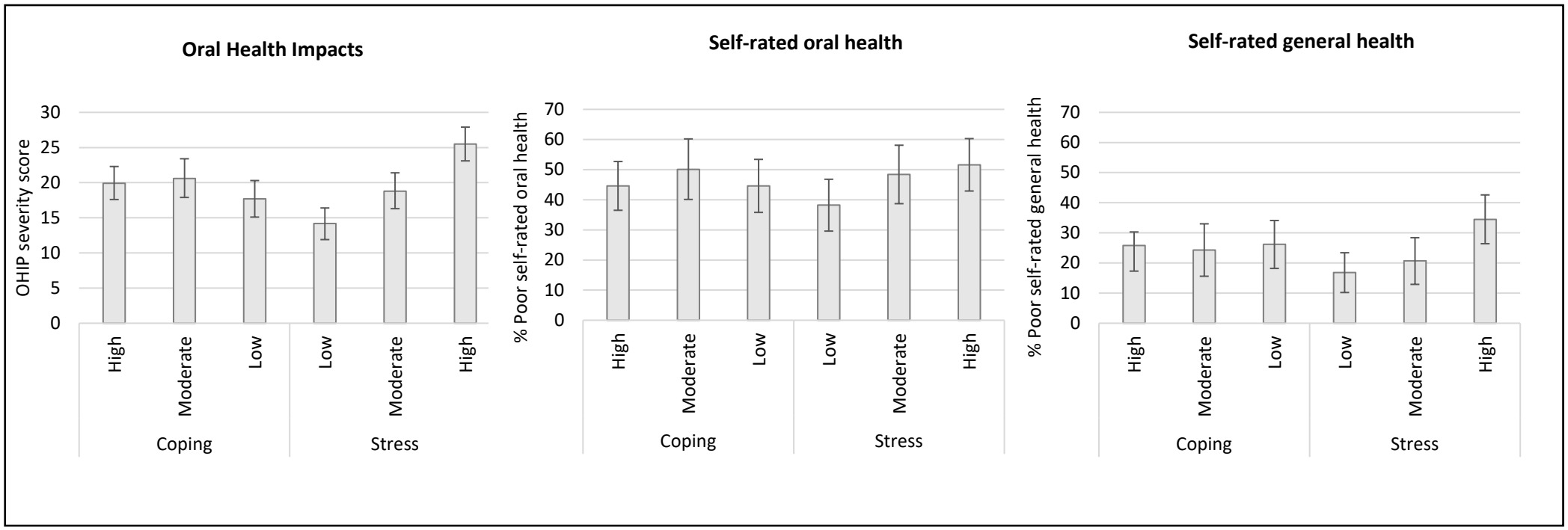
Table 5. Adjustedˆ associations between psychosocial factors and oral health outcomes (n=353)

	OHIP severity B (95% CI)	Poor SROH PR (95% CI)	Poor SRGH PR (95% CI)
Perceived Coping			
High	Ref	Ref	Ref
Moderate	0.7 (-2.9, 4.3)	1.1 (0.9, 1.5)	1.0 (0.7, 1.6)
Low	-2.2 (-5.7, 1.3)	1.0 (0.8, 1.3)	1.1 (0.7, 1.7)
Perceived Stress			
Low	Ref	Ref	Ref
Moderate	4.6 (1.2, 8.0)	1.3 (0.9, 1.7)	1.2 (0.8, 2.1)
High	11.3 (7.9, 14.6)	1.4 (1.0, 1.8)	2.1 (1.3, 3.3)

^B coefficients and Prevalence Ratios (PR) adjusted by: sex, age, level of education, employment status, government concession card and number of people in the household.

Figure 1. Adjusted^ associations between coping, stress and self-rated general and oral health and oral health impacts

^means and prevalence for oral and general health outcomes adjusted by sex, age, level of education, employment status, government concession card and number of people in the household.



Chapter 8: Self-efficacy and oral health outcomes

Submitted paper:

Self-efficacy and oral health outcomes in a regional Australian Aboriginal population

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8.1 Highlights and linkage to the body of work

This chapter contains the final paper in this thesis and brings together the oral health outcome measures described in Chapters 4 and 5, and oral health-related self-efficacy validated in Chapter 6 as the exposure of interest. We adjusted for general psychosocial confounders of perceived stress and coping, described in chapter 7, and the oral health-specific psychosocial factor of oral health-related fatalism also validated in Chapter 6.

Highlights

- The mean OHIP-14 severity score was six units higher among those with low efficacy than for those with high efficacy.
- Oral health-related self-efficacy was associated with poor self-rated oral health, with over 40 percent greater prevalence of poor self-rated oral health among those with low self-efficacy.
- The addition of perceived stress into multivariable models resulted in the most substantial attenuation in the association of oral health-related self-efficacy and oral health outcomes.
- The association between oral health-related self-efficacy and both self-rated oral health and oral health impacts remained after controlling for sociodemographic, general and oral-health specific confounders.

Research and policy implications

The findings of this study demonstrate that oral health-related self-efficacy was associated with oral health outcomes even after controlling for socio-demographic and psychosocial confounders. The findings also supported the premise that for Aboriginal adults, experiences of stress were an important contributor to poor oral health. One area worthy of further research includes examining the role of self-efficacy in mediating or modifying the relationship between stress and oral health, using a larger data set to enable more reliable mediation analyses. In addition, self-efficacy may provide an opportunity for intervention and therefore developing culturally safe programs with Aboriginal communities. Planning for long term evaluation may be an important component of community-based oral health interventions.

Reflection on the methodology

The analytic approach utilised could have taken a range of approaches in investigating the relationship between oral health-related self-efficacy and oral health outcomes. As previously stated, the relationship between self-efficacy and other psychosocial factors, including stress, is a complex one and not simple to disentangle. Although this study is cross-sectional and cannot therefore demonstrate a causal relationship, given the complex relationship between these psychosocial factors and varied approaches used in the literature, we generated a theoretical causal pathway to assist in determining the most appropriate analytic approach to utilise for this present study. Our Direct Acyclic Graph shows how we conceptualise each of the other general and oral health-specific psychosocial factors having an effect on both self-efficacy and directly on oral health outcomes, and we have therefore treated them as confounders in the analysis. Conceptually, self-efficacy does not cause stress, rather, is a measure of an individual's ability to overcome the potential impacts of stress. There are examples in the literature of self-efficacy mediating the effect of stress on health, and this is an area for further research.

The issue of missing data, largely a result of the response options of "I don't know" for oral health-related fatalism items and "I never feel like this" for oral health-related self-efficacy items, presented an issue for this analysis, with a complete case sample of 252 out of the original sample of 400. In order to ensure appropriate interpretation of findings from the multivariable analyses, all data was presented for only the complete case sample. Despite this small number of participants, results presented do demonstrate that oral health-related self-efficacy is associated with oral health outcomes and that perceived stress should be considered a key determinant of oral health for this Aboriginal population.

Statement of Authorship

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Principal Author

Name of Principal Author (Candidate)	Eleanor J Parker		
Contribution to the Paper	Designed the study and performed analysis and interpretation of results under the guidance of co-authors. Provided the first draft of the manuscript and completed manuscript revision. Acting as corresponding author.		
Overall percentage (%)	75%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	10/12/2021

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Contribution to the Paper	Contributed to the design of the study and manuscript revision.		
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Self-efficacy and oral health outcomes in a regional Australian Aboriginal population

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Abstract

Background

Perceived self-efficacy has been associated with psychological well-being, health behaviours and health outcomes. Little is known about the influence of self-efficacy on oral health outcomes for Aboriginal adults in Australia, a population experiencing high levels of oral health conditions. This study examines associations between oral health-related self-efficacy and oral health outcomes in a regional Aboriginal Australian population and investigates whether the associations persist after adjusting for sociodemographic characteristics and other general and oral health-related psychosocial factors.

Methods

Data were obtained from the baseline questionnaire of the Indigenous Oral Heath Literacy Project based in regional South Australia. Oral health-related self-efficacy was measured using a six item scale, with total sum scores dichotomised into high/low self-efficacy. Oral health outcomes included self-rated oral health and oral health impacts, measured using the Oral Health Impact Profile (OHIP-14). Generalized linear models with a log-Poisson link function were used to estimate Prevalence Ratios (PR) of poor self-rated oral health according to levels of oral health-related self-efficacy. Multivariable linear regressions were used to estimate the association between oral health-related self-efficacy and OHIP-14 scores. Blocks of confounders were subsequently added into the models, with the final model including all factors.

Results

Complete data were available for 252 participants (63%) aged 18 to 82 years (mean age of 37.6 years). Oral health-related self-efficacy was associated with poor self-rated oral health, with a 43 percent (PR= 1.43 (95% CI 1.09, 1.88) grater prevalence of poor self-rated oral health among those with low self-efficacy. Oral health-related self-efficacy was associated with OHIP-14 severity scores, with a score over six points higher for those with low self-efficacy (B= 6.27 95% CI 2.71, 9.83). Although addition of perceived stress into the models attenuated the relationship, associations remained in the final models.

Conclusion

Lower levels of oral health-related self-efficacy were associated with a higher prevalence of poor self-rated oral health and greater impacts of oral health among Aboriginal adults in regional South Australia. These associations persisted after controlling for sociodemographic and psychosocial confounders, suggesting that increasing self-efficacy may provide an opportunity for improving oral health outcomes for Aboriginal adults.

Key words: Aboriginal, oral health, self-efficacy, psychosocial, perceived stress

Background

Oral health is fundamental to overall health and wellbeing. Oral conditions affect quality of life, with physical, social, psychological as well as economic consequences for individuals and communities [1]. In Australia, disparities in oral health exist, with Aboriginal and Torres Strait Islander Australians suffering a greater burden of oral disease and impacts of oral health than non-Aboriginal Australians [2, 3]. Aboriginal and Torres Strait Islander Australians, hereafter referred to as Aboriginal to identify with the traditional owners of the lands on which this study was conducted, make up three percent of the Australian population [4]. Improving oral health outcomes for Aboriginal adults is essential to improving overall health and wellbeing. Achieving this requires a more in-depth understanding of the issues impacting on the oral health of Aboriginal adults to enable more specific and culturally safe interventions to be developed. One area warranting further investigation is the relationship of psychosocial factors and oral health outcomes. Psychosocial factors are considered a crucial factor contributing to poor health and oral health and may be critical in understanding the oral health needs of more vulnerable populations.

A key psychosocial dimension related to health and oral health outcomes reported extensively in the literature is perceived self-efficacy, with an individual's perceived self-efficacy shown to influence a broad range of health-related behaviours [5]. Self-efficacy is a core element of Bandura's Social Cognitive Theory [6] and a key feature of the Health Belief Model [7], with self-efficacy acting directly and indirectly on health behaviours and therefore health outcomes. In terms of general health, self-efficacy has been associated with psychological well-being, self-management, predicts self- care and health-related quality of life for people with chronic health conditions included cardiovascular disease, diabetes, multiple sclerosis and arthritis [8-12].

Perceived self-efficacy assesses an individual's belief in to have control over their own behaviours and therefore their ability to engage in healthy behaviours irrespective of other external and internal factors. For example, a common approach to evaluating an individual's perceived self-efficacy involves asking how confident they are that they will perform a certain behaviour when they are stressed, busy or tired [13, 14]. This suggests that the association between self-efficacy and oral health outcomes may still persist after other psychosocial factors are accounted for. Furthermore, a number of studies have suggested that factors such as perceived stress play an important role in shaping the general and oral health at a population level in Australia [15-17]. To the best of our knowledge there is only one study that investigated the association between self-efficacy and oral health outcomes for Aboriginal Australians, accounting for general psychosocial confounders. The study included a sample of women pregnant with and Aboriginal baby, and showed that self-efficacy persisted as a risk indicator for poor self-rated oral health after adjusting for a range of general and oral health-specific psychosocial factors [18].

We therefore aimed to address this gap in the literature pertaining to self-efficacy and oral health outcomes for Aboriginal adults specifically in regional South Australia. Understanding the relationship between self-efficacy and oral health outcomes can be used to develop a deeper understanding of the precursors of oral health among Aboriginal Australians, enabling improved design and targeting of preventative interventions. We sought to examine associations between oral health-related self-efficacy and oral health outcomes in a regional Aboriginal Australian

population and investigate whether the associations persist after adjusting for sociodemographic characteristics and other and oral-health specific psychosocial factors.

Specifically this study aimed to:

a) describe the prevalence of high/low oral health-related self-efficacy according to sociodemographic characteristics;

b) investigate whether oral health-related self-efficacy is associated with oral health impacts and self-rated oral health;

c) if the association in (b) was supported, determine if associations between oral health related self-efficacy and oral health outcomes persisted after controlling for sociodemographic and other psychosocial characteristics of perceived stress, perceived coping and oral health-related fatalism.

Methods

Data were obtained from the baseline questionnaire of the Indigenous Oral Health Literacy Project (IOHLP). The IOHLP involved a convenience sample of 400 Aboriginal adults based in South Australia [19]. Eligibility criteria consisted of being Aboriginal or Torres Strait Islander, over 18 years of age, and living in Port Augusta or nearby communities. Questionnaires were completed as an interview, self-complete or a combination of both, as determined by the participant.

The exposure of interest, oral health-related self-efficacy (OH-SE), was measured using six items adapted from a self-efficacy scale developed by Finlayson and colleagues [14].The six items asked participants to rate how confident they felt about their ability to brush their teeth at night when they were: a)under a lot of stress; b) depressed; c) anxious; d) feeling like they did not have the time; e) tired and f) worried about other things in their life. Responses were on a Likert scale scored with 1=not at all confident, 2=hardly ever confident, 3= occasionally confident, 4=fairly confident, and 5= very confident. Based on feedback from expert and Aboriginal advisory groups, an additional response option of "I never feel like this" was added, and treated as a missing response. Internal consistency was high (Cronbach's alpha=0.93). Responses were summed to give a possible scale score of 6-30, so that higher scores indicate higher OH-SE. Scores were dichotomised into high (above the median) and low (at the median or lower) OH-SE.

Oral health outcomes included 1) the self-reported impact of oral health conditions using the shortened form of the Oral Health Impact Profile (OHIP-14) [20] and 2) self-rated oral health. For OHIP-14, responses to each item were summed to create an OHIP-14 severity score, with high scores representing higher reported impacts. For self-rated oral health, participants were asked to rate their dental (or oral) health with response options of "excellent", "very good", "good", "fair" and "poor". Responses were dichotomised to "excellent, very good and good" and "fair and poor", with those as "fair and poor" classified as having poor self-rated oral health.

Confounding factors were identified based on the literature and theoretical associations with both exposures (OH-SE) and oral health outcomes, as depicted on the Direct Acyclic Graph (DAG) Figure 1. These confounders were

grouped according to a) demographic characteristics (age and sex) b) socioeconomic factors (level of education attained (dichotomised to include “no schooling, primary or high school” and “trade, TAFE or University”), employment status (“unemployed or other” and “paid employment”), ownership of a Government Concession Card (“yes” or “no”), and number of people staying in the house on the previous night (dichotomised to “5 or more” and “4 or less”)) c) psychosocial factors of perceived stress and coping, and oral health-related fatalism (OH-F).

Perceived stress and coping were measured using an adapted Perceived Stress Scale (PSS), developed by Cohen and colleagues [21] and used extensively in the international literature. The PSS aims to measure the degree to which individuals perceive life situations as stressful, with 7 items reflecting distress and 7 items reflecting coping. For the purposes of this study, each item asked participants to reflect on how they have felt during the last year, for example, “how often in the last year have you felt either nervous or stressed?” reflecting distress, and “how often in the last year have you felt you were on top of things” reflecting coping. Responses to all items were on a five-point scale ranging from (0) not at all, to (4) very often. The psychometric properties of the PSS have been assessed among Aboriginal and/or Torres Strait Islander people [22]. Their study indicated that an adapted version (a-PSS13) was culturally appropriate for Aboriginal and/or Torres Strait Islander populations after the exclusion of one item (“How often during the LAST YEAR have you dealt well with life hassles). For this current study we therefore utilised the adapted Perceived Stress Scale (a-PSS13). Responses for each sub-scale were summed, with possible scores ranging from 0–28 for perceived stress, so that high scores reflected higher levels of distress, and possible scores for perceived coping ranging from 0-24 with higher scores reflecting higher levels of coping.

Oral health-related fatalism (OH-F) was based on a single item used by Finlayson and colleagues [14]. In this current study, five items were generated based on the range of health conditions prevalent in this community, and asked participants to indicate their level of agreement: most people will .....(1) eventually develop problems with their teeth; (2) need to have their teeth pulled out; (3) eventually get a toothache; (4) have bleeding gums; and (5) get wobbly teeth. Response options were on a Likert scale scored from 1 (strongly disagree) to 5 (strongly agree). Based on feedback from expert and Aboriginal advisory groups an additional response option of “I don’t know” was added, treated as a missing response. Internal consistency was high (Cronbach’s alpha 0.88). Responses were summed to give a scale score ranging from 5-25, with high scores reflecting high oral health-related fatalism.

Analytic methods

All analyses were conducted for a complete case sample. Descriptive analyses were performed, including distribution of participants according to the exposure, confounding factors and outcomes.

Generalized linear models with a log-Poisson link function and robust standard errors were used to estimate Prevalence Ratios (PR) and their 95% confidence intervals (CI) of poor SROH according to levels of OH-SE. Adjusted PRs and their respective 95% CIs were assessed after blocks of confounders were added into the models. The final model included all factors.

Multivariable linear regressions were used to estimate the association between OH-SE and OHIP-14 scores, using Beta coefficients and their 95% confidence intervals (CI). Blocks of confounders were subsequently added into the models, with the final model including all factors.

Sensitivity analysis was conducted to identify if including those with the median score in the high or low OH-SE group impacted on the results. The sensitivity analysis confirmed that patterns of associations remained for both approaches. Analyses were carried out using STATA 15.0.

Results

Complete data were available for 252 participants (63 percent) aged 18 to 82 years and a mean age of 37.6 years (95%CI 35.7, 39.4). Table 1 shows the sociodemographic characteristics of the sample. More than two thirds were female, one quarter had a level of education including a trade, TAFE or university, less than one quarter were in paid employment and just over 85 percent owned a government benefits card. The mean OH-SE score (range 6-30) was 20.2 (95% CI 19.3, 21.1). The mean OH-F score was 21. 7 (95% CI 21.3, 22.1). Perceived stress scores ranged from 0-28, with a mean of 14.2 (95% CI 13.5, 14.9). Perceived Coping ranged from 0-24 with a mean of 11.9 (95% CI11.3, 12.4). The mean OHIP-14 severity score was 21.4 (95% CI 19.6, 23.2), and almost half the participants (47.2% 95% CI 31.1, 53.4) rated their oral health as *fair or poor* (hereafter referred to as poor self-rated oral health).

Table 2 shows the distribution of high and low efficacy according to sociodemographic characteristics. The proportion of participants with low OH-SE did not vary by sex. Among those in the oldest age group, 40 percent had low self-efficacy, compared with just over 57 percent in the 35-49 year age group. Among those in paid employment there were nearly 20 percent less participants with low OH-SE. One third of participants without a benefits card had low OH-SE. Table 2 also shows the mean scores for perceived stress, perceived coping, and OH-F for those with high and low OH-SE. For those with low OH-SE, the mean stress score was just over three units higher than those with high efficacy. Mean scores for perceived coping and OH-F did not vary across high and low efficacy groups. The mean OHIP-14 severity score was six units higher among those with low efficacy than for those with high efficacy.

Table 3 shows the distribution of oral health outcomes according to sociodemographic characteristics and by levels of OH-SE. The mean OHIP-14 severity score varied by age and sex, with females having a score nearly five units higher than males, and participants in the second highest age group having a score 12 units higher than those in the youngest age group. Those without paid employment reported more oral health impacts, with a score over five units higher than those in paid employment. The prevalence of poor self-rated oral health was lowest among the youngest participants, with 18.5 percent and 30.4 percent less participants rating their oral health poorly than the 25-34 year age group and 35-49 year age group respectively. Those with low self-efficacy had higher OHIP-14 severity scores. Among those with low efficacy, 55.5 percent had poor self-rated oral health, around 17 percent relatively more than for those with high efficacy.

Oral health-related self-efficacy was associated with poor self-rated oral health, with over 40 percent (PR= 1.43 (95% CI 1.09, 1.88) greater prevalence of poor self-rated oral health among those with low self-efficacy (Table 4). When

sociodemographic characteristics were added into the model, low oral health-related self-efficacy was associated with 1.49 higher prevalence of poor self-rated oral health (PR= 1.49 (95% CI 1.14, 1.96) than those with high OH-SE. When perceived stress was added into the model, the prevalence of poor self-rated oral health was 1.40 times higher among those with low oral health-related self-efficacy than among those with high self-efficacy (PR= 1.40 (95% CI 1.06, 1.86). Adding perceived coping and oral health-related fatalism (models 4 and 5 respectively) had little reduction on the prevalence ratio for poor self-rated oral health.

Oral health-related self-efficacy was associated with OHIP-14 severity scores, with a score over 6 units higher for those with low OH-SE (B= 6.27 95% CI 2.71, 9.83) (Table 5). Addition of demographic characteristics into model 1 and socioeconomic factors into model 2 had little impact on the association between low OH-SE and oral health impacts (model 2: B=6.22 95% CI 2.68, 9.77). When perceived stress was added in model 3, the Beta coefficient reduced from 6.22 to 4.03, an absolute attenuation in the OHIP-14 score of 2.24 units (B=4.03 95% CI 0.52, 7.53). This corresponds to a 35 percent decrease in the strength of association between low OH-SE and oral health impacts. Addition of perceived coping and oral health-related fatalism resulted in no real further reduction.

Discussion

This study assessed associations between OH-SE and subjective measures of oral health among a regional Aboriginal population is South Australia. Levels of OH-SE varied by age and some, but not all key socioeconomic variables. The prevalence of poor self-rated oral health was greater among those with lower OH-SE. Adjusting for confounders attenuated the relationship. Perceived stress had the most notable impact on the relationship between OH-SE and OHIP-14 scores, however, in the final model higher levels of oral health impacts remained for those with lower efficacy beliefs.

The association between levels of self-efficacy and oral health outcomes is an important finding adding to the developing body of literature demonstrating the importance of psychosocial determinants of oral health for Aboriginal Australian populations This finding is consistent with that among pregnant Aboriginal women in South Australia, whereby low self-efficacy persisted as a risk indicator for poor self-rated oral health after controlling for a range of sociodemographic and psychosocial confounders [18]. The OH-SE items used in both studies asked only about a participant's confidence that they would brush their teeth at night when feeling a range of emotions and in various psychological states, and not about any other health behaviours or health beliefs. Despite the focus on tooth brushing, the association with oral health outcomes is important to further develop our understanding of the role of efficacy beliefs in oral health specifically for the Aboriginal population. Higher levels of self-efficacy can increase the likelihood of oral health promoting behaviours [23, 24], with some evidence that self-efficacy can be improved with focussed intervention and support for chronic disease self-management as well as preventive health behaviours [25] [26-28]. Interventions to improve self-efficacy may improve oral health outcomes for populations at high risk of poor oral health.

For both outcome measures, the addition of perceived stress into multivariable models resulted in the most substantial attenuation in the association with OH-SE. While this was modest for the prevalence of poor self-rated oral health, the reduction in the association with the OHIP severity score was 2.24 units, a relative attenuation of 35 percent. This indicates that perceived stress is an important psychosocial factor to consider when investigating determinants of oral health for Aboriginal people. Despite this role of perceived stress, OH-SE remained significant in all models, indicating that even among more highly stressed individuals, self-efficacy is likely to be an important factor in evaluating oral health outcomes. This is consistent with the findings for pregnant Aboriginal women in South Australia, with a group of psychosocial factors including perceived stress, attenuating the odds of poor self-rated oral health by 17 percent [18]. This is an area that warrants further study to determine the impact that oral health specific self-efficacy has on the relationship between perceived stress, a general psychosocial measure, and oral health outcomes. If oral health-related self-efficacy has a protective effect in modifying the relationship between stress and oral health outcomes, interventions that improve an individual's perceived self-efficacy may conceivably have the most impact for those who experience higher levels of stress.

The weaknesses of this study must be acknowledged and interpretation of findings assessed in light of the small sample size and, in particular, the high proportion of study participants excluded from this analysis due to missing data. Nearly one third of the original sample had missing data for the OH-SE. This was a result of the response option of "I never feel like this", treated as a missing response. The original scale from which ours was derived did not include this option. It was added in our study based on feedback from the expert and Aboriginal advisory groups. The second reason for missing data was the OH-F scale, as an option of "I don't know", also treated as a missing response, was added on the advice of the expert and Aboriginal reference groups. Validation of the OH-SE scale (article in press) involved assessing sociodemographic differences between those with and without scale scores. There were differences by age group, but no differences were identified for other sociodemographic variables. The decision was made to proceed for this study with a complete case sample for all analyses to reduce the risk of misinterpreting the results of multivariable analyses with different number of participants depending on the confounders used in each model. Despite the small sample size, clear associations between OH-SE and both measures of oral health were identified, suggesting that OH-SE is an important factor to future investigate for this community. This study involved a convenience sample of Aboriginal adults in a regional location, so extrapolation of results to the broader Australian population needs to be made with caution. Although we hypothesised causal pathways between OH-SE and oral health outcomes to drive analysis, this is a cross-sectional study and causation cannot be inferred.

Despite these weaknesses, this study has key strengths and is an important addition to the sparse literature investigating psychosocial factors and oral health outcomes for Aboriginal people in Australia. The fact that 400 Aboriginal adults in a regional location completed baseline questionnaires involving questions pertaining to psychosocial factors, with a complete data set for over 250 participants, is a successful study outcome. This indicates the cultural acceptability of the survey instruments and study design. The inclusion of a broad range of

sociodemographic variables known to be associated with general and oral health outcomes for Aboriginal people ensured these factors were not explaining the association between OH-SE and oral health outcomes.

Conclusion

Lower levels of oral-health related self-efficacy were associated with a higher prevalence of poor self-rated oral health and greater impacts of oral health among Aboriginal adults in regional South Australia. These associations persisted after controlling for sociodemographic and general and oral health-specific psychosocial confounders. Perceived stress resulted in the most significant attenuation in the association between OH-SE and oral health outcomes. The findings indicate that self-efficacy beliefs may provide an opportunity for intervention to improve oral health outcomes for Aboriginal adults in regional South Australia.

Table 1: Distribution of sample characteristics, confounders and outcomes

	Percent (95% CI) or Mean (95% CI)
Age group	
18-24	23.8 (18.9, 29.5)
25-34	24.6 (19.7, 30.3)
35-49	29.8 (24.4, 35.7)
50-82	21.8 (17.1, 27.4)
Sex	
male	30.6 (25.2, 36.5)
female	69.4 (63.5, 74.8)
Highest level of education	
Trade, TAFE or university	24.2 (19.3, 29.9)
none, primary or high school	75.8 (70.1, 80.7)
Employment status	
paid employment	23.4 (18.6, 29.1)
unemployed/other	76.6 (70.9, 81.4)
Government benefits card	
no	14.3 (10.5, 19.2)
yes	85.7 (80.8, 89.5)
Number of people in the house on previous night	
4 or less	55.6 (49.3, 61.6)
5 or more	44.4 (38.4, 50.7)
Perceived stress (Mean, 95% CI)	14.2 (13.5, 14.9
Perceived coping (Mean, 95% CI)	11.9 (11.3, 12.4)
Oral health fatalism (Mean, 95% CI)	21. 7 (21.3, 22.1).
OHIP-14 severity (Mean, 95% CI)	21.4 (19.6, 23.2)
Poor self-rated oral health (prevalence, 95% CI)	47.2 (31.1, 53.4)

Table 2: Oral health-related self-efficacy according to sociodemographic characteristics and psychosocial confounders

	Oral health self-efficacy Row % (95% CI) or Mean (95% CI)	
	High OH-SE	**Low OH-SE**
Sex		
male	48.1 (37.1, 59.2)	51.9 (40.8, 57.7)
female	49.7 (42.3, 57.1)	50.3 (42.9, 57.7)
Age		
18-24	51.7 (39.1, 64.0)	48.3 (36.0, 60.9)
25-34	45.2 (33.3, 57.7)	54.8 (42.3, 66.7)
35-49	42.7 (32.0, 54.1)	57.3 (45.9, 68.0)
50-82	60.0 (46.6, 72.1)	40.0 (27.9, 53.4)
Highest level of education		
trade, TAFE or university	42.6 (30.8, 55.3)	57.4 (44.7, 69.2)
none, primary or high school	51.3 (44.2, 58.4)	48.7 (41.6, 55.8)
Employment status		
paid employment	59.3 (46.4, 71.2)	40.7 (28.9, 53.6)
unemployed/other	46.1 (39.2, 53.2)	53.9 (46.8, 60.8)
Government benefits card		
no	66.7 (49.9, 80.1)	33.3 (19.9, 50.1)
yes	46.3 (39.7, 53.0)	53.7 (47.0, 60.3)
Number of people in the house		
4 or less	55.0 (46.7, 63.1)	45.0 (36.9, 53.3)
5 or more	42.0 (33.2, 51.3)	58.0 (48.7, 66.8)
Perceived stress (Mean, 95%CI)	12.6 (11.7, 13.6)	15.7 (14.7, 16.6)
Perceived coping (Mean, 95%CI)	12.0 (11.2, 12.9)	11.7 (11.0, 12.5)
Oral health-related fatalism (Mean, 95%CI)	21.8 (21.2, 22.4)	21.6 (21.0, 22.2)

Table 3: Distribution of oral health outcomes according to sociodemographic characteristics and levels of self-efficacy

	OHIP severity Mean (95% CI)	**Poor SROH** Row % (95% CI)
Sex		
male	18.1 (14.8, 21.3)	42.9 (32.3, 54.1)
female	22.9 (20.7, 25.0)	49.1 (41.8, 56.5)
Age		
18-24	14.6 (11.5, 17.7)	28.3 (18.4, 41.0)
25-34	22.1 (18.9, 25.2)	46.8 (34.7, 59.2)
35-49	27.1 (23.4, 30.9)	58.7 (47.2, 69.3)
50-82	20.3 (16.6, 24.0)	52.7 (39.6, 65.5)
Highest level of education		
trade, TAFE or university	20.5 (16.9, 24.1)	52.5 (40.0, 64.6)
none, primary or high school	21.7 (19.6, 23.8)	45.5 (38.6, 52.7)
Employment status		
paid employment	17.2 (13.5, 21.0)	52.5 (39.9, 64.9)
unemployed/other	22.7 (20.6, 24.7)	45.6 (38.7, 52.7)
Government benefits card		
no	18.8 (13.2, 24.3)	47.2 (31.7, 63.3)
yes	21.9 (19.9, 23.8)	47.2 (40.6, 53.9)
Number of people in the house the previous night		
4 or less	21.4 (18.9, 23.9)	47.1 (39.0, 55.5)
5 or more	21.4 (18.7, 24.1)	47.3 (38.2, 56.6)
Oral health-related self-efficacy		
high	18.2 (15.7, 20.8)	38.7 (30.5, 47.6)
low	24.5 (22.1, 27.0)	55.5 (46.7, 63.9)

Table 4: Unadjusted and adjusted prevalence ratios for poor self-rated oral health

	Prevalence ratios for poor self-rated oral health (95% CI)					
	Unadjusted	Model 1	Model 2	Model 3	Model 4	Model 5
Self-efficacy						
High	Ref	Ref	Ref	Ref	Ref	Ref
Low	1.43 (1.09, 1.88)*	1.47 (1.13, 1.92)*	1.49 (1.14, 1.96)*	1.40 (1.06, 1.86)*	1.39 (1.05, 1.84)*	1.38 (1.04, 1.84)*

*p<0.05

Model 1: age and sex
Model 2: Model 1 + socioeconomic factors (level of education, employment status, government concession card and number of people in the household)
Model 3: Model 2 + Perceived Distress
Model 4: Model 3 + Perceived Coping
Model 5: Model 4 + oral health-related fatalism

Table 5: Unadjusted and adjusted associations for oral health-related self-efficacy with OHIP severity

	Beta coefficient (95% CI)					
	Unadjusted	Model 1	Model 2	Model 3	Model 4	Model 5
Self-efficacy						
High	Ref	Ref	Ref	Ref	Ref	Ref
Low	6.27 (2.71, 9.83)*	6.56 (3.09, 10.03)*	6.22 (2.68, 9.77)*	4.03 (0.52, 7.53)*	3.73 (0.20, 7.25)*	3.96 (0.45, 7.47)*

*p<0.05

Model 1: age and sex
Model 2: Model 1 + socioeconomic factors (level of education, employment status, government concession card and number of people in the household)
Model 3: Model 2 + Perceived Distress
Model 4: Model 3 + Perceived Coping
Model 5: Model 4 + Oral health-related fatalism

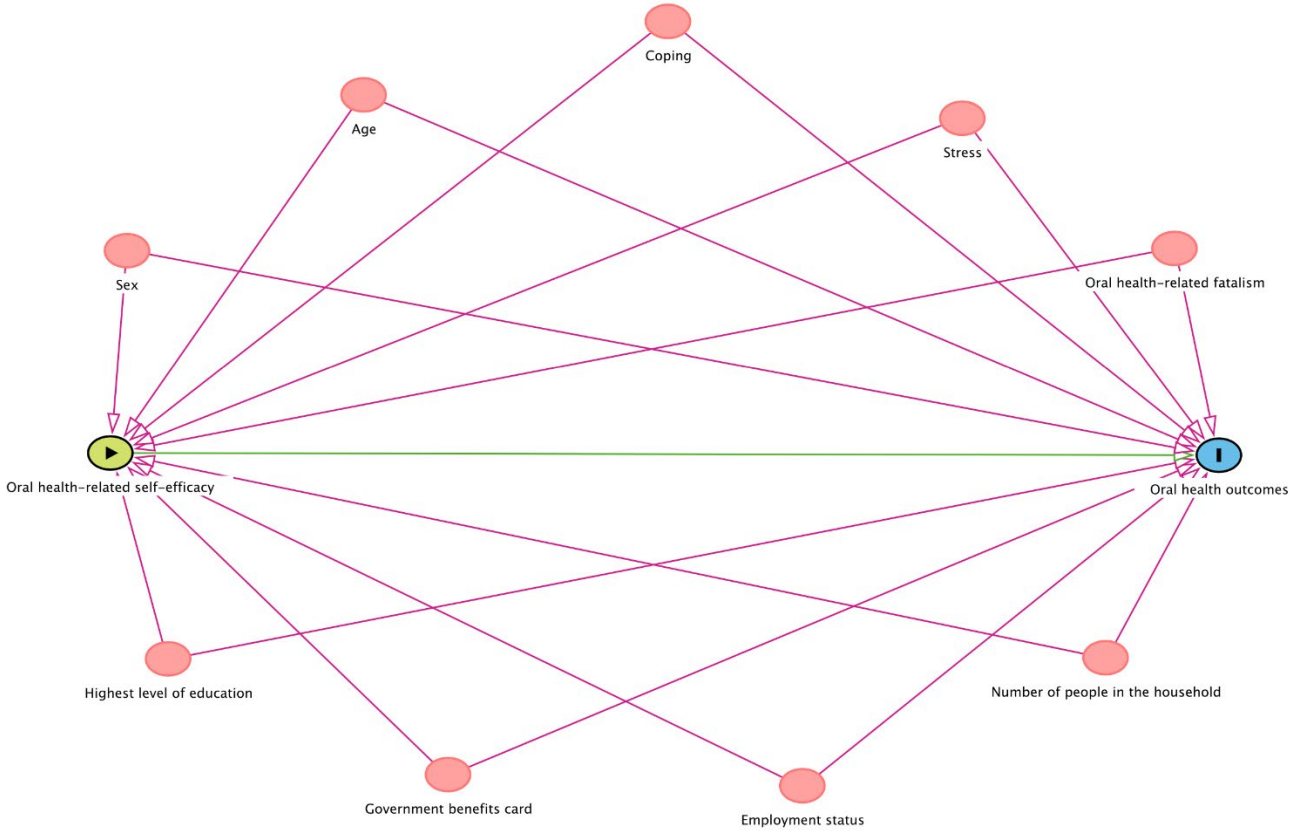

Figure 1 Direct Acyclic Graph (DAG) for the association between oral health-related self-efficacy and oral health outcomes

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Chapter 9: Final Considerations

This chapter presents a discussion of the results presented in Chapters 4 – 8, a discussion of strengths and limitations of this research, implications for policy, recommendations for future research and final conclusions.

The methodology for the primary study, the Indigenous Oral Health Literacy Project (IOHLP) was presented in Chapter 3. The methodology utilised for this study was based on principles fundamental to conducting culturally safe research with Aboriginal communities, including community involvement and guidance in project development, recruiting through word of mouth and family recommendations, and employment of Aboriginal research officers [1]. The completion of the baseline questionnaire by 400 Aboriginal adults indicated that the processes adopted supported the cultural acceptability of the questionnaire, individual instruments and methods of completion, i.e., could be completed as an interview or self-complete. The methodology can be used as an example to other researchers looking for models of successful research partnerships with Aboriginal communities.

9.1 Summary of research findings

Chapter 4 reported on the oral health impacts reported by IOHLP participants and compared these with Aboriginal and non-Aboriginal sub-populations from the National Survey of Adult Oral Health, 2004-2006 (NSAOH)[2]. For each Oral Health Impact Profile (OHIP-14)[3] item as well as each summary measure, the impact reported by IOHLP participants was greater than for the national Aboriginal, national non-Aboriginal and regional non-Aboriginal groups. Examining each item as well as each summary measure was important in demonstrating variations that are usually missed in analyses using OHIP-14 summary scores. For example, there was over a six-fold difference for the item pertaining to being unable to function, but only a 2.6 fold difference for the item pertaining to being a bit irritable. The relative difference between items was important to appreciate given the social and economic disadvantage also demonstrated among the IOHLP participants. Being unable to function because of problems from oral conditions may have long-lasting effects on employment, education, social interaction and overall wellbeing. In addition, the finding that IOHLP participants reported multiple impacts across the 14-item scale further demonstrates the potential impact of oral conditions on an individual's ability to carry out their normal daily activities, family roles and responsibilities, actively participate in the community and have general life satisfaction and wellbeing. These impacts will not only affect the individual, but add to the socioeconomic disadvantage of the family and community with long lasting deleterious impacts. It is likely that poor access to appropriate dental services increases the degree of oral health impacts. However, analysing this was beyond the scope of this current work.

Chapter 5 described the proportion of IOHLP participants with high ratings of oral and general health and compared these with the same sub-populations from the NSAOH as described in Chapter 4. In this paper the analysis was stratified by level of education and employment status to enable comparison across groups with the same socioeconomic factors. Proportionally fewer IOHLP participants had high ratings of both oral and general health than each group from NSAOH. With the stratified analysis, for those with lower levels of education, the proportion of national Aboriginal participants with high ratings of oral health was no longer significantly different to the proportion of IOHLP participants. The same occurred when stratifying by employment status; for those who were not employed, the national Aboriginal group were not significantly different from the IOHLP participants. This suggested that among the national Aboriginal sample from NSAOH, those who were not as advantaged from a socioeconomic perspective (i.e. were not employed and had lower levels of education), were not so different to the IOHLP participants, whereas those who were

employed or had higher levels of education, more closely resembled the oral health outcomes for the non-Aboriginal group. This reinforces the importance of social determinants of health and oral health[4] in Australia and specifically for Aboriginal Australians. For the IOHLP participants, the data demonstrated there where high proportions who were not employed and had lower levels of education, but in addition, had added pressures from residing in a regional or rural location, and as such, may be experiencing a cumulative effect on their oral health. The intersectionality of factors such as access to care and perceived racism affecting health has been demonstrated in Australia[5]. This suggestion is supported by some of the comparisons with the regional non-Aboriginal participants of NSAOH, whereby in the stratified analyses differences between population groups were not statistically significant for ratings of oral health among those with lower levels of education. This was complicated by the small sample sizes and wide confidence intervals, so a true difference may still exist but is not identifiable with our data. Further investigating the role of the socioeconomic factors and impacts of residing in a regional location on the ratings of oral health were beyond the scope of this research with the current sample size.

Comparing the IOHLP findings with Aboriginal adults from the NSAOH (in Chapters 4 and 5) collectively highlights a key issue for the standard approach to national surveys both in Australia and internationally [6], potentially leading to an underestimation of the disease experience for the more disadvantaged Aboriginal adults across Australia and in particular, those in regional and rural areas. Whilst the approaches in national studies do capture a sample of Aboriginal adults that reflect the proportion of the broader population in Australia [2], those participating Aboriginal adults more closely resembled the non-Aboriginal participants of NSAOH than they did the IOHLP participants across socioeconomic measures as well as the indicators of health and oral health. It would be difficult to adapt a national survey to utilise the recruitment methods, sampling techniques and study methodology to appropriately account for Aboriginal adults in regional areas in order to comply with current guidelines for research with Aboriginal communities [1], when Aboriginal adults in regional areas would make up a very small proportion of the total Australian population. It may be more appropriate for policy makers to accept that data collection needs to include regional surveys and pooling of data across smaller community based projects to more accurately record the needs in regional areas of Australia.

Chapter 6 described the development and assessment of the psychometric properties of oral health-specific measures of self-efficacy and fatalism. The oral health self-efficacy instrument was adapted

from that used by Finlayson and colleagues among mothers of young children [7] and used within a homeless population is South Australia [8]. The oral health-related fatalism instrument was developed specifically for this study. In the consultation and development phase of the questionnaire it was suggested that additional response options be added. Whilst these additional options may have contributed to the cultural acceptability of the instruments, they caused issues with data management and subsequent analysis. It was deemed most appropriate to treat these as missing items which significantly reduced the number of participants with a score for each of the scales. This had an impact on the number of participants that could be included in the analysis described in subsequent analyses including those described in Chapter 8. Despite this, the findings provide initial evidence for the psychometric properties of these instruments for use with Aboriginal adults. Both instruments had evidence for criterion validity, whereas the evidence was no so strong for known-groups validity. The need for the additional response items should be reviewed and further evaluation of the psychometric properties of the instruments conducted before widespread use of the instruments with Aboriginal communities.

In Chapter 7 level of perceived stress and perceived coping are quantified among participants of the IOHLP and associations with oral health outcomes identified. The mean OHIP-14 scores amongst those with high perceived stress were nearly double that of those with low perceived stress. A greater proportion of participants reporting high levels of perceived stress rated their oral health and general health poorly. These associations persisted after adjusting for sociodemographic factors. No associations were observed between perceived coping and oral and general health outcomes. These findings supported the work of Santiago and colleagues, suggesting that for Aboriginal women, stress persisted beyond coping abilities [9]. A gradient of increasing oral health impacts, and an increasing prevalence of poor self-rated health and oral health across levels of perceived stress were identified. The findings indicated that experiences of stress for Aboriginal people, particularly in this regional location, could be important determinants of health and oral health.

Chapter 8 described the associations of oral health-related self-efficacy with self-rated oral health and oral health impacts, measure by OHIP-14. Lower levels of oral health-related self-efficacy were associated with poor self-rated oral health and OHIP-14 severity scores. These associations remained after controlling for demographic and socioeconomic characteristics as well as general psychosocial and oral health-specific psychosocial confounders. For this paper, the complete case sample of 252 participants was a result largely of the missing data for the oral health-related self-efficacy and

fatalism scales. Interestingly, the addition of perceived stress into the models had the most notable impact on the relationship of self-efficacy with the oral health outcomes. When perceived stress was added to the model for OHIP severity scores, there was a relative attenuation of 35 percent in the strength of the relationship between lower self-efficacy and OHIP scores. This further indicated that perceived stress was an important psychosocial factor to consider when investigating determinants of oral health for Aboriginal people. There was some evidence that health interventions can improve self-efficacy in the general and oral health realm [10-13], so for Aboriginal populations where self-efficacy is associated with oral health outcomes, improvements in oral health-self efficacy through culturally safe programs may have a positive impact on oral health.

9.2 Strengths and limitations

Strengths

A key strength of this research was the culturally safe approach used in developing the IOHLP, the questionnaire and throughout implementation of the project. We worked in partnership with local Aboriginal community representatives, local service providers and employed local Aboriginal project officers and a project manager already working with the local Aboriginal community to deliver oral health services. Throughout the work presented in this thesis consideration was been given to ensure the instruments used and approaches to reporting were appropriate for this community. Psychosocial instruments used have either been developed in consultation with the Aboriginal advisory group and then validated, have been previously used and shown to be reliable, or have had psychometric analysis reported specifically for Aboriginal groups. Validation of the oral health-related self-efficacy instrument and the oral health-related fatalism instruments were an important step in this body of research because they had not been validated for Aboriginal communities previously, and where they had been utilised with disadvantaged groups such as a homeless population [8, 14], the addition of other response options for the IOHLP and additional fatalism items from a two item to a five item scale meant psychometric assessment and validation was imperative before proceeding with their use in further research.

Throughout the research presented in this thesis consideration has been given to the role of sociodemographic and socioeconomic factors, important as Aboriginal populations have a well-documented disadvantage. In Chapter 5, stratifying by education and employment status enabled comparisons across sub-populations from the NSAOH who were in the same socioeconomic category. In Chapters 7 and 8 socioeconomic factors were included in multivariable analyses to ensure their impact on the outcome was taken into account.

This research was able to identify two key psychosocial factors that were significant for this Aboriginal community; the general psychosocial factor of perceived stress and the oral health-specific measure of oral health-related self-efficacy. The important role of stress in health and oral health for IOHLP participants was consistent with recent literature on the role of stress for Aboriginal women [9].

Another strength of this research was comparing the subjective measures of oral and general health, used as outcome measures for this research, with population level data. This was important in establishing these as important measures of oral health for this community and enabled the level of poor self-rated oral health and oral health impacts to be quantified relative to national benchmarks. This approach also enabled us to demonstrate the importance of considering the likely underestimation of disease experience and burden for regional Aboriginal groups from nationally surveys, an extremely important finding for oral health policy development.

Limitations

The limitations of this work do need to be acknowledged.

The IOHLP was a cross-sectional study involving a convenience sample of 400 Aboriginal adults in a regional centre of South Australia. This therefore created three key methodological limitations. Being cross-sectional means analyses were looking at associations. Although the analyses were based on a theoretical model with underlying assumptions around possible casual pathways, this research was not assessing nor showing causation. The sample size, although large for a group of Aboriginal adults completing a questionnaire with questions pertaining to psychosocial characteristics, it was small for conducting some analyses. In addition, the self-efficacy instrument having the option of "I never feel like this" added, reduced the sample by approximately one quarter. The complete case sample of 252 participants utilised in Chapter 8 is significantly reduced and caution should be exercised when applying findings to the broader population.

The recruitment methods used in the IOHLP are both effective and culturally acceptable for this community, but need to be taken into account when interpreting the findings of this research and applying to other Aboriginal adults and those in different locations. Specifically, as this is a convenience sample, there is likely to be some underlying selection bias and therefore not necessarily representing the whole community. This demonstrates the challenge in conducting research in partnership with Aboriginal communities in culturally safe ways. We need to acknowledge that there may be limitations as a result of the techniques employed and determine how best to manage these without undermining the partnerships formed with Aboriginal communities and study participants. Another limitation of the current research is the inability to disentangle and further investigate the relationship between perceived stress and oral health-related self-efficacy. In Chapter 8 we have treated perceived stress as a confounder in our analysis. While we are confident that stress is a confounder, we are aware that the relationship is not that simple both at a theoretical level and in

life, particularly for Aboriginal adults experiencing high levels of stress. The size of the complete case sample is not sufficient to have adequate power for robust mediation analyses or to assess effect measure modification. Schonfield and colleagues have reported on the role of general self-efficacy in mediating the effect of daily stressors on both positive and negative mental health across different cultures [15]. The findings for the mediating effects of general self-efficacy on positive mental health differed for that of negative mental health measures. Stress-management self-efficacy, in contract to general self-efficacy, has been shown to mediate the effects of stress on depression amongst University students [16]. Although some studies have suggested a mediating relationship of self-efficacy on treatment outcomes [17], to our knowledge the literature is devoid of studies investigating the role of oral health specific self-efficacy in the relationship between perceived stress and oral health outcomes. This indicates that further investigation into the potentially protective effects of perceived self-efficacy for those with higher stress is warranted.

This research also relied solely on self-report measures of health and oral health and did not include any clinical measures. The OHIP-14 has been validated in an Aboriginal population [18] and used extensively among Aboriginal and other disadvantaged groups in Australia. Self-ratings of general and oral health are widely used internationally and are used in population based data collection and previous oral health research with Aboriginal communities in South Australia [19-21]. Although self-rated oral health has been associated with clinical measures of oral health [22] and we are confident that they are acceptable and reliable instruments for use with Aboriginal adults, we have not specifically assessed the relationship between self-rated oral health and clinical measures of disease experience for this population of regional-dwelling Aboriginal adults.

Another limitation is the time between data collection and presentation of the findings. This is a direct result of personal and professional interruptions to my PhD candidature. It has had an impact on some of the approaches utilised because of developments in the field during this time, other relevant research that has occurred and the ever developing body of relevant literature that exists at the time of writing but not at the time of research planning.

9.3 Implications for policy and future research

This research has relevance for policy makers and for informing future research with Aboriginal adults.

1. An important outcome from the work presented in Chapters 4 and 5 is that data from national surveys underestimates the burden of disease and impacts experienced by participants of the IOHLP. This suggests that national estimates, which already demonstrate that Aboriginal adults have greater oral disease experience and oral health impacts [2, 23], likely underestimate the disease burden for the more disadvantaged Aboriginal communities across regional and remote Australia. Acknowledging this is important. Then, appropriate planning for broader Aboriginal oral health surveys can occur, or, we acknowledge that community based data collection is both culturally acceptable and more accurately determines the level of need in regional Australia and plan future studies accordingly.

2. An important outcome that impacts on future research (presented in Chapters 6 and 8) is demonstration of the culturally acceptability and initial evidence for the validity of measures of oral health-related self-efficacy and fatalism for Aboriginal adults. This research has demonstrated that oral health-related self-efficacy remains associated with oral health outcomes after controlling for sociodemographic and socioeconomic confounders. This suggests that oral health-related self-efficacy may provide an opportunity for intervention to improve oral health for Aboriginal adults.

3. The finding that perceived stress was associated with both general and oral health outcomes and had the greatest impact on the association of self-efficacy with oral health outcomes, indicates that perceived stress was an important determinant of oral health for Aboriginal people in regional and rural South Australia. Stress as a determinant of health and oral health must be considered in future work that both investigates and attempts to address oral health inequalities for Aboriginal communities.

Next steps based on the findings from the research and learning from the broader work presented in this thesis include:

- Conducting similar studies with larger groups of Aboriginal adults and for those in an urban environment
- Longitudinal research with this community to assess causal pathways for both perceived stress and oral health-related self-efficacy with oral health outcomes
- Incorporating clinical assessment in addition to subjective measures of oral health to evaluate the relationship between subjective and clinical measures of oral health specifically for Aboriginal adults in Australia
- Investigating the role of oral health-related self-efficacy in mediating or modifying the relationship between perceived stress and oral health outcomes
- Evaluating interventions specifically focussed on oral health-related self-efficacy and combining these interventions with established programs for chronic disease, such as those that already function within community controlled health services for patients with diabetes

9.4 Final conclusions

This research provides important additions to the literature related to the oral health of Aboriginal adults in regional South Australia. Comparing oral health impacts and self-rated oral and general health with Aboriginal and non-Aboriginal participants of the NSAOH further demonstrates the greater burden of oral and general health conditions experienced by Aboriginal adults in regional South Australia. Importantly, the findings demonstrated that data from national surveys were likely to underestimate the oral health needs of Aboriginal adults in regional areas.

This research provides evidence for the psychometric properties of instruments to measure oral health-related self-efficacy and fatalism for Aboriginal adults. Oral health-related self-efficacy was associated with higher rates of poor self-rated oral health and greater oral health impacts, and these associations remained after controlling for sociodemographic factors, perceived stress and coping and oral health-related fatalism. Perceived stress had the greatest effect on the attenuating relationship between self-efficacy and oral health outcomes. Perceived stress appears to be an important determinant of oral and general health for this group of Aboriginal adults.

The research presented demonstrates that these psychosocial determinants of health, specifically perceived stress and oral health-related self-efficacy, are important to consider when developing culturally safe specific interventions to improve oral health outcomes for Aboriginal adults. Focusing on enhancing oral health-related self-efficacy may provide a pathway to improve oral health outcomes for Aboriginal adults in regional South Australia.

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Appendices

1. Indigenous Oral Health Literacy Project: Letter of Support from Pika Wiya Health Service

2. Indigenous Oral Health Literacy Project: University of Adelaide Ethics Approval

3. Indigenous Oral Health Literacy Project: Aboriginal Health Council of SA Ethics Approval

4. Guidelines for Survey Administrators “Teeth Talk Project”

5. Participant Information Sheet “Teeth Talk Project”

6. Participant Consent Form “Teeth Talk Project”

7. Questionnaire “Teeth Talk Project”

8. Co-authored publication: *Efficacy of an oral health literacy intervention among Indigenous Australian adults*

Appendix 1: Letter of support for the IOHLP from Pika Wiya Health Service

Pika Wiya Health Service Inc.

All mail to:
P.O. Box 2021
Port Augusta S.A. 5700

05 November, 2009

TO WHOM IT MAY CONCERN

On behalf of the Pika Wiya Health Service I would like to endorse our support of the study entitled "An Oral Health Literacy Intervention Among Rural Indigenous Adults" to be based in Port Augusta from Jan 2010 until Dec 2012.

The research outcomes of the previously-funded oral health literacy project have been presented to the Pika Wiya Health Service Health Advisory Council and various staff, and all parties agree they are prepared to offer guidance and support for the oral health literacy intervention project as there are clear benefits to be had for people of this community.

As with the previous study, the Health Advisory Council ask that regular updates of the oral health literacy intervention project be provided so that progress might be monitored.

Thanking you in anticipation

Yours sincerely

Charles Jackson

Charles Jackson
Director

Administration
Phone: 08 8642 9904
Fax: 08 8642 6621

Community Health Centre
Phone: 08 8642 9999
Fax: 08 8642 4456

Davenport Health Centre
Phone: 08 8642 2556
Fax: 08 8641 0258

40-46 Dartmouth Street
PORT AUGUSTA

Simmons Street
DAVENPORT

Appendix 2: Ethical approval for the IOHLP from the University of Adelaide

THE UNIVERSITY
OF ADELAIDE
AUSTRALIA

RESEARCH BRANCH
RESEARCH ETHICS AND COMPLIANCE UNIT

SABINE SCHREIBER
SECRETARY
HUMAN RESEARCH ETHICS COMMITTEE
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SA 5005
AUSTRALIA
TELEPHONE +61 8 8303 6028
FACSIMILE +61 8 8303 7325
email: sabine.schreiber@adelaide.edu.au
CRICOS Provider Number 00123M

25 November 2009

Dr LM Jamieson
Dentistry

Dear Dr Jamieson

PROJECT NO: *An oral health literacy intervention among rural Indigenous adults*
H-180-2009

I write to advise you that I have approved the above project on behalf of the the Human Research Ethics Committee. Please refer to the enclosed endorsement sheet for further details and conditions that may be applicable to this approval.

Approval is current for one year. The expiry date for this project is: 30 November 2010

Where possible, participants taking part in the study should be given a copy of the Information Sheet and the signed Consent Form to retain.

Please note that any changes to the project which might affect its continued ethical acceptability will invalidate the project's approval. In such cases an amended protocol must be submitted to the Committee for further approval. It is a condition of approval that you immediately report anything which might warrant review of ethical approval including (a) serious or unexpected adverse effects on participants (b) proposed changes in the protocol; and (c) unforeseen events that might affect continued ethical acceptability of the project. It is also a condition of approval that you inform the Committee, giving reasons, if the project is discontinued before the expected date of completion.

A reporting form is available from the Committee's website. This may be used to renew ethical approval or report on project status including completion.

Yours sincerely

pp Professor Garrett Cullity
Convenor
Human Research Ethics Committee

Appendix 3: Ethical Approval for the IOHLP from the Aboriginal Health Council of SA

ABORIGINAL HEALTH
RESEARCH ETHICS COMMITTEE

7th December 2009

Dr Lisa Jamieson
Australian Research Centre for Population Oral Health
School of Dentistry
University of Adelaide
122 Frome Road
Adelaide SA
5005

Reference No: **04-09-312**

Dear Lisa

Thank you for submitting your research project, *An oral health literacy intervention among rural Indigenous adults*, on the 16th November 2009 for ethical consideration.

At our last meeting your application was assessed and I am pleased to inform you that this proposal has met with support and that the committee has decided that your application be recommended on the condition that:

- A Letter of Support from Pika Wiya Health Service is submitted to this committee.

In accordance with the NH&MRC guidelines, *National Statement on Ethical Conduct in Research Involving Humans*, we require at regular periods, at least annually, reports from principle researchers.

If you require any further information please do not hesitate to contact the Executive Officer or myself.

We wish you well with the project and look forward to receiving a copy of your report.

Sincerely y[redacted]

MS LUCY EVANS
ACTING CHAIRPERSON
Ref: Proposal/Approval/7December2009

Aboriginal Health Council
of South Australia Inc.

AHREC is a sub-committee of AHCSA

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8273 7200

Appendix 4: Guidelines for Survey Administrators

Teeth Talk Oral Health Literacy Project

We acknowledge and respect the traditional owners of the land and their deep feelings of attachment and relationship to this country. We pay respect to the past and the present.

Guidelines for questionnaire administrators

Paper work required (to be kept in an administrator folder)	1. Information sheet 2. Consent form 3. Questionnaires (with participant ID already entered) 4. Gift Cards 6. Record sheet for refusals 7. Record sheet for vouchers 8. Pens and pencils 9. Folders for keeping completed questionnaires and consent forms.
Recruiting participants	Participants must be - 18 years or older and - Aboriginal or Torres Strait Islander - able to communicate in spoken English - likely to live in Port Augusta, Davenport or Stirling North for the next two years - able to explain back to you what they believe they are consenting to (if people are unable to do this, for example being under the influence of drugs or alcohol, do not proceed with the consent or questionnaire – say that you will catch them another day).
Getting consent	1. Each participant needs to have the project explained to them and be given the information sheet (they can read this or you can read it to them). 2. Ask if they would like to have a relative or friend present while they give consent and have the project explained to them 3. You should ask the participant to briefly explain back to you what they understand they are consenting to. 4. If they understand and are happy to be involved, ask them to sign the consent form. 5. The participants ID number should be recorded on the consent form. The ID number should be pre-recorded on the questionnaire – this is their ID number. 6. Each participant needs to be given a copy of the information sheet and complaints sheet to keep.
Introducing the questionnaire	Using the attached script, introduce the questionnaire to the participant. If they want to complete some or all of it of it themselves, that is ok. After they have finished, you still need to check that they have completed all sections.
Gift Card	Once you have checked that the questionnaire is completed, ask the participant to sign the consent form, saying that they have received their Gift Card. Record the number of the Gift Card on the consent form. If a section or questions have been missed, check if the participant is happy to answer them. Please remember it is voluntary and they can decide/refuse to answer some questions.
Recording names and ID number	After a session completing questionnaires, all participant names and ID numbers (from their consent form) need to be recorded on one Master Sheet. On this sheet it needs to be "ticked" when the questionnaires and consent have been scanned and sent to Adelaide.

Teeth Talk Oral Health Literacy Project

We acknowledge and respect the traditional owners of the land and their deep feelings of attachment and relationship to this country. We pay respect to the past and the present.

Outline for recruiting participants and filling in questionnaire

Introduce yourself	I am ..... and am working with the Teeth Talk Project. We would like you to be part of this project. This is a project for Aboriginal adults in Pt Augusta, Davenport and Stirling North. Are you happy for me to talk to you about it now? Have you already completed one of these questionnaires or enrolled in the project?
Explain very briefly what the project is about.	This project aims to improve Aboriginal people's understanding about their oral health – the health of the teeth, gums and whole mouth - and build their confidence in managing their own oral health. This questionnaire may seem very similar to one you might have done a few years ago. The results from that one helped get funding to run this program over the next 2 years.
Ask the participant if they are likely to be in Pt Augusta/Davenport for two years.	Explain that we need people to be available for the whole project, so for two years. If they are not likely to be around, then it is best not to start in the project. *Record their name, M/F, age and the reason for not participating on the "refusal record sheet". Only record what they are happy for you to record.*
Introduce the project by reading out or giving the participant the information sheet to read.	They key information that they need to understand is: - The project goes for 2 years - They will be asked to complete a questionnaire today again in one year and another in 2 years. The questionnaire will take about 30 minutes to complete. - You are asked to complete the questionnaire more than once so that we can see if the program we runs actually works. We hope that this would then help in the future to get funding for more programs. - Each time they complete a questionnaire they will get a $20 gift card - All people in the study will be split into family groups of about 10 people. - Early next year they will be told if their group is going to get the program next year, or if they will get it the year after. - The program involves 5 group education sessions or workshops - At each session they will receive a $10 gift card - At each session you will be given morning or afternoon tea and oral health information and products - They can pull out of the study if they want to - The information they provide will be kept confidential - The questionnaire looks long, but the print has been made larger so it is easier to read, and there are only a few questions on each page.

Teeth Talk Oral Health Literacy Project

We acknowledge and respect the traditional owners of the land and their deep feelings of attachment and relationship to this country. We pay respect to the past and the present.

Ask the participant to explain to you what they think they are consenting to.	Before we get you to sign the consent form, can you please tell me what you believe you are saying yes to? They do not have to explain every detail but enough to make sure they know what they are signing for. *If the participant cannot explain, you can discuss it further, and ask again. If you think there is a reason that they cannot understand, then we cannot get consent. Say that you will catch up with them about this on another day.*
Sign the consent form	Ask the participant to sign the consent form. You need to record the ID number from the questionnaire on the consent form.
Introduce the questionnaire.	The questionnaire will take about 30 minutes to complete. I can read it out for you, or if you want to you can do most of it yourself. There are some questions that might feel a bit personal. We are asking these questions because we think it is important to look at how problems with people's mouths affects the way that they feel. If people are feeling stressed, it can be pretty hard to look after their teeth. We want to understand this better so we can help people. There are no right or wrong answers. We really need to know what you believe, think and feel about your teeth, gums and mouth, so please answer as best you can and don't worry about your responses. Your information will be kept confidential.
Administering the questionnaire	If you are reading out the questionnaire for the participant, it is important to only say what is on the questionnaire. If you say extra things, it might push the person towards one answer, or they might try and answer what they think you want them to say. It is important that people answer with their own responses. For example, other family members cannot fill out the survey for someone else. If a participant needs help, then you should be the one to help them. If the participant is filling it out themselves (so not needing or wanting you to read it), then you still need to check that they have completed it before providing the gift card. However, they can refuse to complete some questions – we cannot force them to!
Completing the questionnaire	If the participant has filled out the questionnaire themselves, you need to look through it to make sure all questions have a response. Once the questionnaire is complete, give the participant their $20 gift card and ask them to sign that they have received it on the consent form.

	Remind the participant that they will be contacted early next year to advise them of which group they are in for the project sessions.

Appendix 5: IOHLP Participant Information Sheet

Teeth Talk Oral Health Literacy Project

Postal: PO Box 2210, Port Augusta, 5700 **Email: teethtalk@unisa.edu.au**
Phone: 08 8842 9911 (Mon-Wed) **Mobile: 0428 267 208 (local project manager)**

We acknowledge and respect the traditional owners of the land and their deep feelings of attachment and relationship to this country. We pay respect to the past and the present.

Information Sheet

Chief investigator: Lisa Jamieson
Australian Research Centre for Population Oral Health
The University of Adelaide
Ph 08 8303 4611
Email: lisa.jamieson@adelaide.edu.au

What is this project about?	This project aims to understand the links between people's understanding about their oral health – the health of the teeth and gums- their beliefs, their feelings and their confidence, to oral health outcomes and use of dental services. Understanding these links may help community workers and policy decision makers to make sure programs to improve people's oral health are suitable for Aboriginal people.
What will the project achieve?	This project aims to help develop people's understanding about the health of their teeth, mouth and gums, and build their confidence in managing their own oral health and that of their families.
What will I be asked to do?	You will be asked to • Fill out a questionnaire • Come to 5 group workshop sessions • Half of the project participants will go to the workshops next year (2011), and the other half the year after (2012). • Fill out two more questionnaires – one in 12 months and the last one in 2 years
How might it affect me?	You will learn the best way to care for your teeth and gums at home, how to get help when you have problems and to feel confident talking to the dentist and asking them questions. This information might be helpful for your whole family.
Will there be any risks to me?	We believe that this project does not present any risk to the participant. We believe there will be many benefits from receiving information that makes people more confident and in control of their oral health.
Who will lead the sessions?	The education sessions will be led by Lynnette Stuart and Roz Karger from Pt Augusta and Helen Mills from Whyalla.

Teeth Talk Oral Health Literacy Project

Postal: PO Box 2210, Port Augusta, 5700 **Email: teethtalk@unisa.edu.au**
Phone: 08 8842 9911 (Mon-Wed) **Mobile: 0428 267 208 (local project manager)**

We acknowledge and respect the traditional owners of the land and their deep feelings of attachment and relationship to this country. We pay respect to the past and the present.

What will I get out of it?	Lots of information in the education sessions plus toothbrush, toothpaste, water bottle etc. You will also receive a $20.00 gift card for each questionnaire you do. This is in thanks for giving up your time. Each workshop session will have morning or afternoon tea provided and you will be offered transport. You will also receive a $10.00 gift card for each session you attend.
What if I change my mind?	Being part of the project is voluntary. If you change your mind about being part of the project you can pull out at any stage. This will not affect your access to dental services or any future dental care. You do not have to give a reason for pulling out of the project.
Will this be confidential?	Yes, all the information you give us will be recorded under a number, not your name, so no-one will know the information came from you. Information from the questionnaires will be analysed by the principal investigator at the University of Adelaide. Your names will not be used in any reports.
Where will this information be stored?	The information will be stored securely. During the project it will be stored in a locked filing cabinet at Pika Wiya Health Service, Port Augusta and at the University of Adelaide. All records must be stored by law for 5 years. Paper and electronic records will be safely stored at sites owned by the University of Adelaide. The questionnaires will not have your name on them.
Will I get the results?	We will invite you to hear the research results after the project has finished. If you would like to have a copy of results sent to you, please write your name in the space provided on the consent form.
Ethical Issues	This project has received approval from the Aboriginal Health Council, the Human Research Ethics Committees of the University of Adelaide. It has approval from the Pika Wiya Health Service Advisory Board and the Teeth Talk Port Augusta Committee.
Questions	If you have questions, you can ask any member of the project team, or contact the Chief Investigator, Lisa Jamieson. Ph: 8303 4611
Complaints	You will be given a form that advises you of who you can contact if you wish to make a complaint.

Appendix 6: IOHLP Participant Consent Sheet

Teeth Talk Oral Health Literacy Project

THE UNIVERSITY OF ADELAIDE HUMAN RESEARCH ETHICS COMMITTEE

STANDARD CONSENT FORM

FOR PEOPLE WHO ARE PARTICIPANTS IN A RESEARCH PROJECT

1. I, …… *(please print name)* consent to take part in the research project entitled: **'An oral health literacy intervention among rural Indigenous adults' (Teeth Talk)**

2. I acknowledge that I have read the attached Information Sheet entitled: **'An oral health literacy intervention among rural Indigenous adults' (Teeth Talk)**

3. I have had the project, so far as it affects me, fully explained to my satisfaction by the research worker. My consent is given freely.

4. Although I understand that the purpose of this research project is to improve the quality of medical care, it has also been explained that my involvement may not be of any benefit to me.

5. I have been given the opportunity to have a member of my family or a friend present while the project was explained to me.

6. I have been informed that, while information gained during the study may be published, I will not be identified and my personal results will not be divulged.

7. I understand that I am free to withdraw from the project at any time and that this will not affect medical advice in the management of my health, now or in the future.

8. I am aware that I should retain a copy of this Consent Form, when completed, and the attached Information Sheet.

……..
(signature) *(date)*

WITNESS

I have described to …….. *(name of subject)*

the nature of the research to be carried out. In my opinion she/he understood the explanation.

Status in Project**:** …….

Name: …….

……..
(signature) *(date)*

Appendix 7: Baseline Questionnaire of the IOHLP or "Teeth Talk"

Teeth Talk Project Questionnaire

Participant ID: _____ Group Number: _____
Date: _____ Administrator: _____/self

When answering the questions, please select the response that feels like it is the best one for you.

There are no right or wrong answers.

We really need to know what you believe, think and feel about your teeth, gums and mouth, so please answer as best you can and don't worry about your responses.

Your information will be kept confidential.

A. This section asks about your health.

A1. Have you ever been told by a doctor that you have, or had, any of the following:

[ ]$_1$ rheumatic fever
[ ]$_2$ kidney disease
[ ]$_3$ heart condition
[ ]$_4$ diabetes
[ ]$_5$ other_____
[ ]$_6$ don't know

A2. Which of the following best describes your cigarette smoking status?

[ ]1 I currently smoke
[ ]2 I don't smoke now but I used to
[ ]3 I have never smoked

A3. Which of the following best describes your alcohol drinking status?

[ ]1 I currently drink alcohol
[ ]2 I don't drink alcohol now but I used to
[ ]3 I have never drunk alcohol

B. This section asks about your dental health.

B1. Do you have any of your own teeth left?

[ ]1 yes *(go to question B2)*
[ ]2 no *(go to question B6)*

B2. Have you seen a dentist before? [ ]1 yes
[ ]2 no *(go to question B13)*

B3. When did you last see a dentist?
[ ]1 less than one year ago
[ ]2 more than one year ago
[ ]3 don't know

B4. Have you ever had any teeth pulled out by a dentist?
[ ]1 yes
[ ]2 no

B5. If yes, how many teeth have you had pulled out? _____

B6. If you have none of your own teeth left, do you have false teeth?

[ ]1 yes
[ ]2 no *(go to question B8)*

B7. If yes, do you wear your false teeth?

[ ]1 yes
[ ]2 no

B8. Where did you last see a dentist?

[ ]1 Pika Wiya Dentist
[ ]2 SADS Flinders Terrace Dentist
[ ]3 Private dentist: organised yourself
[ ]4 Private dentist: organised by Pika Wiya
[ ]5 Other

B9. What is your usual reason for seeing a dentist?

[ ]1 check-up
[ ]2 cleaning
[ ]3 because of a problem

The next 3 questions ask you about when you are actually <u>in the dental chair.</u> For each statement, please indicate if you agree that this is how you feel.

B10. I don't feel in control when I am in the dental chair.

[ ]1 strongly agree
[ ]2 agree
[ ]3 neither agree or disagree
[ ]4 disagree
[ ]5 strongly disagree

B11. I don't feel like I know what is going to happen next when I'm in the dental chair.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree or disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

B12. I believe I will be hurt when I am in the dental chair.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree or disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

B13. Do you think you need to see a dentist at the moment?

[ ]$_1$ yes
[ ]$_2$ no
[ ]$_3$ I don't know

B14. Would you feel scared about going to the dentist?

[ ]$_1$ no
[ ]$_2$ a little bit
[ ]$_3$ a fair bit
[ ]$_4$ a lot

These next questions ask you about things that have helped you or prevented you from going to the dentist in the last year.

B15. During the last year, have you avoided or delayed going to the dentist because of cost?

[ ]$_1$ yes [ ]$_2$ no [ ]$_3$ don't know

B16. During the last year, have you avoided or delayed going to the dentist because of a waiting list?

[ ]$_1$ yes [ ]$_2$ no [ ]$_3$ don't know

B17. During the last year, have you avoided or delayed going to the dentist because of problems with transport?

[ ]$_1$ yes [ ]$_2$ no [ ]$_3$ don't know

B18. During the last year, are there any other things that have made you avoid or delay going to the dentist?

[ ]$_1$ yes [ ]$_2$ no

If yes, what were they? _____

_____

_____

B19. Select the **one** which has **most** helped you visit the dentist during the last year.

[ ]$_1$ having a dentist at Pika Wiya
[ ]$_2$ having a health worker to help arrange appointments
[ ]$_3$ having transport provided by Pika Wiya
[ ]$_4$ having no charge for treatment
[ ]$_5$ having the Aboriginal Dental Scheme at a private practice
[ ]$_6$ none of these
[ ]$_7$ not applicable
[ ]$_8$ other - please identify it _____

B20. Are there other things that you believe would help you visit the dentist?

[ ]$_1$ yes → please identify them _____
[ ]$_2$ no

B21. How much difficulty would you have paying a $100 dental bill?

[ ]$_1$ none
[ ]$_2$ hardly any
[ ]$_3$ a little
[ ]$_4$ a lot of difficulty
[ ]$_5$ I couldn't pay the bill on my own

C. This section asks you about what you do at home for your mouth and teeth.

C1. Do you own a toothbrush? [ ]$_1$ yes
[ ]$_2$ no *(go to the next section D)*

C2. Did you brush your teeth or clean your false teeth yesterday?

[ ]$_1$ yes
[ ]$_2$ no

C3. Do you use toothpaste when you brush your teeth?

[ ]$_1$ yes
[ ]$_2$ no

D. This section asks you what you think about your general and dental health.

D1. How would you rate your general health?

[ ]$_1$ excellent
[ ]$_2$ very good
[ ]$_3$ good
[ ]$_4$ fair
[ ]$_5$ poor

D2. How would you rate your dental (or oral) health?

[ ]$_1$ excellent
[ ]$_2$ very good
[ ]$_3$ good
[ ]$_4$ fair
[ ]$_5$ poor

For people with teeth some or all of their own teeth:

D3. Do you think you have holes in your teeth?
[ ]$_1$ yes
[ ]$_2$ no
[ ]$_3$ don't know

D4. Do you think you have gum disease?
[ ]$_1$ yes
[ ]$_2$ no
[ ]$_3$ don't know

D5. Do you think you need to have any teeth filled?
[ ]$_1$ yes
[ ]$_2$ no
[ ]$_3$ don't know

D6. Do you think you need to have any teeth pulled out?
[ ]$_1$ yes
[ ]$_2$ no
[ ]$_3$ don't know

D7. Do you think you need to have your teeth cleaned (by a dentist)?
[ ]$_1$ yes
[ ]$_2$ no
[ ]$_3$ don't know

D8. Do you think you need to have a dental check-up?
[ ]$_1$ yes
[ ]$_2$ no
[ ]$_3$ don't know

E. The next section asks you how often in the last year problems with your teeth, mouth or false teeth have affected you.

E1. How often in the last year have you had trouble **pronouncing (or saying)** any words because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E2. How often in the last year have you felt that your **sense of taste** has worsened because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E3. How often in the last year have you had **painful aching** in your mouth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E4. How often in the last year have you found it **uncomfortable** to eat any foods because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E5. How often in the last year have you been **self-conscious** because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E6. How often in the last year have you **felt tense** because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E7. How often in the last year has your **diet been unsatisfactory** because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E8. How often in the last year have you had to **interrupt meals** because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E9. How often in the last year have you found it **difficult to relax** because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E10. How often in the last year have you been a bit **embarrassed** because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E11. How often in the last year have you been **irritable** with other people because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E12. How often in the last year have you had **difficulty doing your usual jobs** because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E13. How often in the last year have you felt that **life in general was less satisfying** because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

E14. How often in the last year have you been totally **unable to function** because of problems with your teeth, mouth or false teeth?

[ ]$_1$ very often
[ ]$_2$ fairly often
[ ]$_3$ occasionally
[ ]$_4$ hardly ever
[ ]$_5$ never

F. This section asks you what you think about looking after your teeth.

F1. How many times do you think teeth should be brushed each day?

[ ]$_1$ none
[ ]$_2$ once
[ ]$_3$ twice
[ ]$_4$ more than twice
[ ]$_5$ not sure or don't know

Are the following things good or bad for teeth?

F2. Cordial	[ ]$_1$ good	[ ]$_2$ bad	[ ]$_3$ don't know
F3. Soft-drink	[ ]$_1$ good	[ ]$_2$ bad	[ ]$_3$ don't know
F4. Toothpaste	[ ]$_1$ good	[ ]$_2$ bad	[ ]$_3$ don't know
F5. Water with fluoride	[ ]$_1$ good	[ ]$_2$ bad	[ ]$_3$ don't know

G. This section asks about how confident you are that you would brush your teeth or false teeth at night when you are feeling different ways.

G1. How confident do you feel about your ability to brush your teeth or clean your false teeth at night when you are under a lot **of stress?**

[ ]$_1$ very confident
[ ]$_2$ fairly confident
[ ]$_3$ occasionally confident
[ ]$_4$ hardly ever confident
[ ]$_5$ not at all confident
[ ]$_6$ I never feel like this

G2. How confident do you feel about your ability to brush your teeth or clean your false teeth at night when you are **depressed?**

[ ]$_1$ very confident
[ ]$_2$ fairly confident
[ ]$_3$ occasionally confident
[ ]$_4$ hardly ever confident
[ ]$_5$ not at all confident
[ ]$_6$ I never feel like this

G3. How confident do you feel about your ability to brush your teeth or clean your false teeth at night when you are **anxious?**

[ ]$_1$ very confident
[ ]$_2$ fairly confident
[ ]$_3$ occasionally confident
[ ]$_4$ hardly ever confident
[ ]$_5$ not at all confident
[ ]$_6$ I never feel like this

G4. How confident do you feel about your ability to brush your teeth or clean your false teeth at night when you are feeling like you do not have the time **(too busy)?**

[ ]$_1$ very confident
[ ]$_2$ fairly confident
[ ]$_3$ occasionally confident
[ ]$_4$ hardly ever confident
[ ]$_5$ not at all confident
[ ]$_6$ I never feel like this

G5. How confident do you feel about your ability to brush your teeth or clean your false teeth at night when you are **tired**?

[ ]$_1$ very confident
[ ]$_2$ fairly confident
[ ]$_3$ occasionally confident
[ ]$_4$ hardly ever confident
[ ]$_5$ not at all confident
[ ]$_6$ I never feel like this

G6. How confident do you feel about your ability to brush your teeth or clean your false teeth at night when you are **worried** about other things in your life?

[ ]$_1$ very confident
[ ]$_2$ fairly confident
[ ]$_3$ occasionally confident
[ ]$_4$ hardly ever confident
[ ]$_5$ not at all confident
[ ]$_6$ I never feel like this

H. This section asks if you agree with things other people say about teeth.

How much do you agree with the following statements?

H1. Most people will develop **problems** with their teeth…

[ ]$_1$ strongly agree
[ ]$_2$ moderately agree
[ ]$_3$ neither agree or disagree
[ ]$_4$ moderately disagree
[ ]$_5$ strongly disagree
[ ]$_6$ don't know

H2. Most people will need to have their **teeth pulled out**…

[ ]$_1$ strongly agree
[ ]$_2$ moderately agree
[ ]$_3$ neither agree or disagree
[ ]$_4$ moderately disagree
[ ]$_5$ strongly disagree
[ ]$_6$ don't know

H3. Most people will eventually get a **tooth ache** ...

[ ]$_1$ strongly agree
[ ]$_2$ moderately agree
[ ]$_3$ neither agree or disagree
[ ]$_4$ moderately disagree
[ ]$_5$ strongly disagree
[ ]$_6$ don't know

H4. Most people will have **bleeding gums** ...

[ ]$_1$ strongly agree
[ ]$_2$ moderately agree
[ ]$_3$ neither agree or disagree
[ ]$_4$ moderately disagree
[ ]$_5$ strongly disagree
[ ]$_6$ don't know

H5. Most adults will eventually get **wobbly teeth** ...

[ ]$_1$ strongly agree
[ ]$_2$ moderately agree
[ ]$_3$ neither agree or disagree
[ ]$_4$ moderately disagree
[ ]$_5$ strongly disagree
[ ]$_6$ don't know

I. This section asks you about dental care and dental information.

I1. Are you able to find the energy to manage your dental or oral health?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I2. Are you able to pay attention to your dental or oral health needs?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I3. Are you able to make time for things that are good for your dental or oral health?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I4. Are you able to change your lifestyle to improve your dental or oral health?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I5. Are you able to find dental health information in a language you understand?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I6. Are you able to fill in dental forms eg enrolment forms?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I7. Are you able to read written information eg leaflets given to you by your dentist?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I8. Are you able to read dental or oral health information brochures left in dental clinics and waiting rooms?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I9. Are you able to discuss your dental or oral health with people other than a dentist?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I10. Are you able to take family or a friend with you to a dental appointment?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I11. Are you able to ask someone to go with you to a dental appointment?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I12. Are you able to ask family or friends for help to understand dental or oral health information?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I13. Are you able to pay to see a dentist?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I14. Are you able to afford transport to dental clinics?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I15. Are you able to pay for medication to manage your dental or oral health?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I16. Do you know where a dentist can be contacted?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I17. Do you know how to get a dentist's appointment?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I18. Do you know what to do to get a dentist's appointment?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I19. Do you know where you can see a dentist?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do

I20. Are you able to ask a dentist questions to help you understand dental information?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I21. Are you able to get the information you need when seeing a dentist?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I22. Are you able to follow up with a dentist to understand information about your dental health?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I23. Are you able to change to a different dentist to get better dental care?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I24. Are you able to get a second opinion about your dental health from a dental health professional?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I25. Are you able to look for a second opinion about your dental health from a dental health professional?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I26. Are you able to use information from a dentist to make decisions about your dental health?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don't go to the dentist

I27. Are you able to follow instructions that a dentist gives you?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don’t go to the dentist

I28. Are you able to carry out instructions that a dentist gives you?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don’t go to the dentist

I29. Are you able to use advice from a dentist to make decisions about your dental health?

[ ]$_1$ without any difficulty
[ ]$_2$ little difficulty
[ ]$_3$ with some difficulty
[ ]$_4$ very difficult
[ ]$_5$ unable to do
[ ]$_6$ I don’t go to the dentist

There are some questions that might feel very personal. We are asking these questions because we think it is important to look at how problems with people's mouths affect the way that they feel. If people are feeling a bit stressed, it can be pretty hard to look after their teeth. We want to understand this better so we can help people with their dental health.

J. This section asks about demands that have been placed on you in the past year.

J1. How often in the last year have you felt upset because of something that happened unexpectedly?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J2. How often in the last year have you felt unable to control the important things in your life?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J3. How often in the last year have you felt either nervous or stressed?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J4. How often in the last year have you dealt successfully with irritating life hassles?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J5. How often in the last year have you effectively coped with important changes in your life?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J6. How often in the last year have you felt confident about your ability to handle your personal problems?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J7. How often in the last year have you felt things were going your way?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J8. How often in the last year have you felt unable to cope with all the things that you had to do?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J9. How often in the last year have you felt able to control irritations in your life?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J10. How often in the last year have you felt you were on top of things?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J11. How often in the last year have you felt angered because of things that happened outside of your control?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J12. How often in the last year have you found yourself thinking about all the things that you have to accomplish?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J13. How often in the last year have you felt able to control the way you spend your time?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

J14. How often in the last year have you felt difficulties were piling up so high that you could not overcome them?

[ ]$_1$ not at all
[ ]$_2$ rarely
[ ]$_3$ sometimes
[ ]$_4$ fairly often
[ ]$_5$ very often

K. This section asks you about how well you feel in control of day- to-day things.

K1. I can do just about anything I really set my mind to.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K2. Other people determine most of what I can and cannot do.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K3. When I really want to do something I usually find a way to succeed at it.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K4. Whether or not I am able to get what I want is in my own hands.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K5. There is little I can do to change many of the important things in my life.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K6. I often feel helpless in dealing with the problems of life.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K7. There are many things that interfere with what I want to do.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K8. I have little control over the things that happen to me.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K9. There is really no way I can solve all the problems I have.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K10. I sometimes feel I am being pushed around in my life.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K11. What happens to me in the future mostly depends on me.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

K12. What happens in my life is often beyond my control.

[ ]$_1$ strongly agree
[ ]$_2$ agree
[ ]$_3$ neither agree nor disagree
[ ]$_4$ disagree
[ ]$_5$ strongly disagree

L. This section asks key information about yourself and your living situation.

L1. Date of Birth ____/_____/_____

L2. Sex [ ]$_1$ male [ ]$_2$ female

L3. Aboriginal
[ ]$_1$ Aboriginal
[ ]$_2$ Torres Strait Islander
[ ]$_3$ both

L4. Residential Location
[ ]$_1$ Port Augusta
[ ]$_2$ Davenport
[ ]$_3$ Stirling North
[ ]$_4$ other _____

L5. Level of education

[ ]$_1$ no schooling
[ ]$_2$ primary school
[ ]$_3$ high school
[ ]$_4$ trade or TAFE
[ ]$_5$ university

L6. Are you currently studying?

[ ]$_1$ yes → where? _____
[ ]$_2$ no

L7. Income

[ ]$_1$ job → what type of work? _____

[ ]$_2$ Centrelink payment
[ ]$_3$ other

L8. Benefits Card

[ ]$_1$ health care card
[ ]$_2$ pension card
[ ]$_3$ none
[ ]$_5$ other

L9. How many people stayed in your house last night? _____

L10. Do you have or look after children under 18?

[ ]$_1$ yes → how many? _____
[ ]$_2$ no

L11. If you have children or look after children, do they attend school in Port Augusta?

[ ]$_1$ yes → which one(s)? _____
[ ]$_2$ no

L12. Do you own a car? [ ]$_1$ yes [ ]$_2$ no

These next questions ask about your involvement in clubs and community centres.

L13. Where do you normally go for your medical appointments?

[ ]$_1$ Pika Wiya Town Clinic
[ ]$_2$ Pika Wiya Davenport Clinic
[ ]$_3$ a different doctor in Pt Augusta
[ ]$_4$ I go to any doctor who is available

L14. Are you involved in any sporting clubs?

[ ]$_1$ yes ⟶ What club(s)? _____
[ ]$_2$ no

L15. Do you regularly attend any community groups or centres in Pt Augusta? For example, a Church group, Arts and Craft group, Males in Black .

[ ]$_1$ yes ⟶ Which ones? _____
[ ]$_2$ no

Other comments

Are there any other things you would like to tell us?

Thank you for taking the time to complete this questionnaire.

ARCPOH
Australian Research Centre for POPULATION ORAL HEALTH

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Appendix 8: co-authored publication completed during my PhD candidature evaluating the IOHLP

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ORIGINAL ARTICLE

WILEY Community Dentistry and Oral Epidemiology

Efficacy of an oral health literacy intervention among Indigenous Australian adults

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Abstract

Objective: To determine the effect of an oral health literacy intervention on oral health literacy-related outcomes among rural-dwelling Indigenous Australian adults.

Methods: A total of 400 Indigenous adults (203 intervention and 197 control participants) were recruited into a randomized controlled trial; a functional, context-specific oral health literacy interventions were developed and implemented by Indigenous staff. The intervention comprised five sessions, each lasting 1.5 hours, across a 1-year period. The primary outcome was oral health literacy as assessed by the HeLD-14 instrument, with secondary outcomes including the social impact of oral disease, and psychosocial and knowledge-related factors. Three scenarios were used in data analysis: (I) intention to treat; (II) as treated and; (III) adherence only. Multiple imputation (MI) was used to replace missing data.

Results: The proportion reporting that "water with fluoride" was good increased in the intervention group within both crude and MI data analyses under the three scenarios. Other crude data analysis yielded no significant differences for either primary or secondary outcomes between intervention and control groups under the three scenarios. After MI, oral health literacy improved when assessed under scenario II (mean change=1.3, 95% CI: 1.1, 1.6). Improvements under three scenarios were also observed for the Oral Health Impact Profile (OHIP-14; mean change ranged from −0.7 to −3.8), sense of control (mean change ranged from 0.4 to 1.1), oral health-related fatalism (mean change ranged from −0.7 to −0.4) and perceived stress (mean change ranged from −2.1 to −1.1). The proportion reporting that "cordial was good" decreased in the intervention group from MI analysis under scenarios II and III.

Conclusions: A context-specific oral health literacy intervention was partially successful in improving oral health literacy and oral health literacy-related outcomes in this vulnerable population, but only after MI.

KEYWORDS
dental knowledge, intervention, oral health literacy, psychosocial outcomes

1 | INTRODUCTION

Oral health literacy has gained prominence in the dental literature in the last decade. The theoretical paradigm that underpins oral health literacy and its role in oral health outcomes is that without functional, applied and contextual understanding of both oral health behaviours and oral health services, optimal oral health cannot be reached.[1] This is based on the conceptual model developed by Paasche-Orlow and Wolf,[2] which indicates the pathway by which social determinants of oral health and oral health literacy are linked to oral health outcomes (Figure 1). Oral health literacy has at its heart the social determinants of health, being directly linked with upstream factors including social inequalities and inequities in access to dental services.[3] Although there has been a plethora of instruments developed to assess oral health literacy[4-13] and many reports of associations of oral health literacy with dental disease experience,[14] self-rated oral health,[15] oral hygiene behaviours,[16] dental attendance[17] and oral health-related quality of life,[18] to the best of our knowledge, there are no reports on the efficacy of oral health literacy interventions in improving oral health-related outcomes. Health literacy interventions typically include attempts to make health information more accessible to those with limited literacy; examples include materials written in simpler, easier-to-read prose or the use of pictographs or electronic media.[19]

Indigenous Australians, despite residing in one of the world's most prosperous nations, experience poorer general and oral health than their non-Indigenous counterparts.[20,21] Regrettably, such inequities in oral health appear to be widening.[22] This study focuses on an oral health literacy intervention that was developed specifically in relation to requests from a group of Indigenous Australians who recognized the deteriorating oral health in their community, understood the importance of communicating fundamental oral health principles and had worked in close partnership with the study authors for a decade. The study aims were to: (i) determine whether a functional, context-specific oral health literacy intervention improves oral health; and (ii) determine whether a functional, context-specific oral health literacy intervention improves related outcomes, including social impact of oral conditions, sense of personal control, oral health-related self-efficacy, oral health-related fatalism, perceived stress and dental knowledge. "Functional" means addressing basic health literacy skills that are sufficient for individuals to obtain relevant health information and to apply that knowledge to a

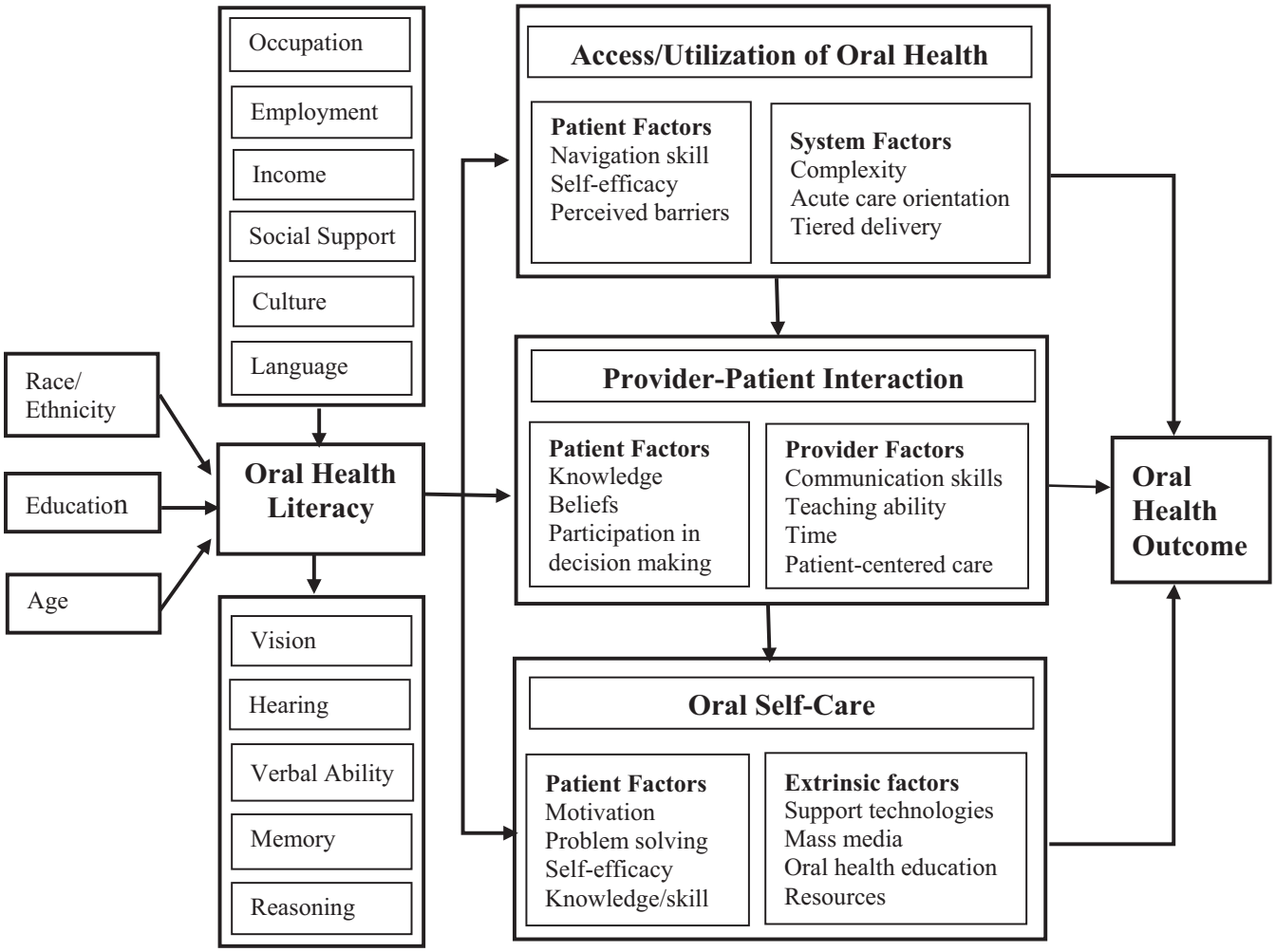

FIGURE 1 Causal pathway between oral health literacy and oral health outcomes (modified from Paasche-Orlow and Wolf)[2]

limited range of prescribed activities,[23] while, "context-specific" means an intervention that is suitable for the population group in terms of its culture, socio-demographic characteristics and geographic setting. We hypothesized that a context-specific oral health literacy intervention would improve both oral health literacy and related outcomes among this vulnerable population.

2 | METHODS

Participants were 400 Indigenous Australian adults residing in a regional location in South Australia who agreed to take part in a randomized controlled trial that involved an oral health literacy intervention to improve oral health.[24] Participants were recruited using a range of strategies, including word-of-mouth, presentations to key stakeholder groups, home visits, visits to community centres, posters in community centres, advertisements on the local radio station and self-nomination. Ethical approval was granted by the Aboriginal Health Council of South Australia and the Human Research Ethics Committee of the University of Adelaide. The Board of Management of the local Aboriginal Community Controlled Health Organisation, Pika Wiya Health Service, also gave approval for the study. Each individual provided signed, informed consent.

2.1 | Oral health literacy intervention

The oral health literacy intervention was underpinned by Bandura's Social Cognitive Theory (SCT),[25] which posits that individuals will not change behaviours unless they have appropriate levels of knowledge, self-efficacy and a sense of control over such behaviours and their health consequences. The intervention was developed with two Indigenous research officers and pilot tested in an Indigenous population located geographically close to the site of the actual intervention. The final intervention comprised five interactive, contextually relevant oral health-tailored workshops over a 1-year period; these were conducted by Indigenous staff. The themes of each of the sessions included as follows: (i) information about dental disease processes (dental caries, periodontal disease, dental erosion); (ii) accessing dental services; and (iii) becoming familiar with the dental clinic, instruments, X-rays (including time spent in the dental clinic of the Pika Wiya Health Service, where the oral health literacy intervention was conducted). Each workshop lasted approximately one and a half hours. Children were welcome to attend and were cared for by an additional Indigenous research officer. The workshops comprised presentations, hands-on activities, interactive displays (use of microscope, for example), group discussions and role plays. A key focus of the workshops was to breakdown communication barriers and to improve participants' confidence in asking questions and accessing care. There were several themes consistent across all workshops: (i) oral health-related self-efficacy; (ii) oral health-related fatalism; (iii) oral health knowledge; (iv) access to dental care; and (v) rights and entitlements as a patient.

2.2 | Sample size

The original power calculation was based on Indigenous Australian estimates that utilized REALD-30.[15] Using these prior findings, it was estimated that a sample size of 310 would be necessary to detect a 7.5 per cent difference in the proportion of problem-based dental attenders (pre-intervention vs postintervention), a 25 per cent difference in the proportion of those who believe teeth should be brushed none or once daily (pre-intervention vs postintervention) and a 30 per cent difference in the proportion of those who believe cordial is good for teeth, do not own a toothbrush or own a toothbrush but did not brush the previous day (pre-intervention vs postintervention) at the significance criterion of 0.05 and power of 0.80. Allowing for an attrition rate of 25 per cent after 12 months, 388 participants would be necessary at base-line, rounded to 400 for convenience; this would include 200 in the intervention group and 200 in the control group. Although the community no longer wanted to use the REALD-30 instrument, we had no other estimates upon which to base sample size. Hence, the original calculation was retained as the best indicator of sample size.

2.3 | Data collection

Data were collected through self-report questionnaires at baseline and 12-months follow-up. The questionnaires were administered by the Indigenous project officers, who were provided with a scripted method of introducing and administering them. When required, the Indigenous project staff would read out and/or elaborate on specific items in the questionnaires to study participants, for example by using additional simple and easily understood words and/or sentence structures.

2.4 | Primary outcome

The primary outcome was oral health literacy. Because the Indigenous Australian community with whom we collaborated did not feel comfortable with other oral health literacy instruments, we developed, in consultation with this group, an instrument that was deemed culturally sensitive and safe. This instrument is called the Health Literacy in Dentistry scale (HeLD); it has both long (29 items) and short (14 items) forms validated for use in this population.[11,26] The HeLD is based on constructs originally defined in the Health Literacy in Medicine (HeLM) scale. The HeLM designers developed a conceptual framework of health literacy skills, which focussed on the key individual abilities of "seeking," "understanding" and "utilizing."[27] The HeLD-14 was used in this study as the primary outcome. It comprised 14 items from the seven conceptual domains of communication, access, receptivity, understanding, utilization, support and economic barriers (Table A1). Each item is ranked on 5-point Likert scale ranging from 1 (without any difficulty) to 5 (unable to do). After recoding of 5-0, 4-1, 3-2, 2-3 and 1-4, summary scores ranged from 0 to 56. High scores indicate high oral health literacy. The Cronbach alpha for HeLD-14 in this group was 0.87.[26]

2.5 | Secondary outcomes

Secondary outcomes included the following: (i) the social impact of oral health; (ii) sense of personal control; (iii) oral health-related self-efficacy; (iv) oral health-related fatalism; (v) perceived stress; and (vi) dental knowledge.

The assessment of social, functional and psychological impacts on oral health was measured using the short-form of the Oral Health Impact Profile (OHIP-14; Table A2).[28] Scores were summed and ranged from 0 to 56, with higher scores reflecting greater social impact. Cronbach's alpha for the OHIP-14 in this group was 0.95.

Sense of personal control was assessed with the Lachman and Weaver scale,[29] which comprised 12 items with two subscales of "personal mastery" and "perceived constraint." Mastery refers to an individual's beliefs concerning the extent to which he or she is able to influence outcomes and achieve goals, while constraint refers to the extent to which external factors or fate determine outcome. Each item is ranked on a 5-point scale (Table A3). The eight negatively worded items were reverse scored. Summary scores ranged from 0 to 48, with higher scores indicating higher personal control. The Cronbach alpha for sense of personal control in this group was 0.83.

Oral health-related self-efficacy was measured with the instrument developed by Finlayson and colleagues.[30] It comprised six items ranked on a 5-point Likert scale ranging from 1 through to 5 (Table A4). Summary scores ranged from 0 to 24 after recoding, with higher scores indicating higher oral health-related self-efficacy. The Cronbach alpha for oral health-related self-efficacy in this group was 0.91.

Oral health-related fatalism was also measured with the instrument developed by Finlayson and colleagues[30] and comprised five items. Each item is ranked on a 5-point scale ranging from 1 through to 5 (Table A5). Scores were summed after recoding, ranging from 0 to 20. High scores indicated greater oral health-related fatalism. The Cronbach alpha for oral health-related fatalism in this group was 0.83.

Perceived stress evaluates the frequency with which people appraise situations as threatening, along with their appraised capacity to cope with threatening situations. It was evaluated using the instrument developed by Cohen and colleagues.[31] There were 14 items, with each item ranked on a 5-point Likert scale ranging from 1 through to 5 (Table A6). After recoding, and reverse scoring the negatively worded items, summary scores ranged from 0 to 56. Higher scores indicated greater perceived stress. The Cronbach alpha for perceived stress in this group was 0.86.

Oral health knowledge was assessed by asking: "Are the following things good or bad for teeth?" (i) Cordial, (ii) Soft-drink, (iii) Toothpaste and (iv) Water with fluoride? Response options for each of these were as follows: "Yes," "No," or "Don't know."

2.6 | Reimbursement for time

Participants received a $20 supermarket gift voucher upon completion of each questionnaire, and a $10 gift voucher for each intervention session attended. At each intervention session, refreshments were offered, and participants were provided with a variety of products to reinforce the key messages (for example, water bottles, tooth brush and tooth paste and disposable dental mirrors).

2.7 | Randomization

Participants were randomized on a 1:1 basis to either the intervention or control group. A computer-generated permuted block randomization sequence was used.

2.8 | Data analysis

Data analyses were conducted under three different scenarios.

- Scenario I (intention to treat): Intervention and control group data analysis based on the principle of "intention to treat"; that is, all randomized samples are analysed according to the original intervention.[32]
- Scenario II (as treated): Intervention and control group data analysis based on real (true) conditions, meaning that participants randomized to the intervention group but not attending any workshops were moved to the "control" group for data analysis.
- Scenario III (adherence only): analysis excluded those belonging to intervention group who did not attend any intervention sessions.

Baseline and 12-months data (including lost to and follow-up, and number of interventions attended) were used to provide a comparison between the intervention and control groups.

Also, a series of sensitivity analyses were conducted to compare those attending a range of intervention sessions. ANCOVA was used to assess between-group changes in mean scores for primary and secondary outcomes. The effect of the oral health literacy intervention on oral health knowledge was estimated (between-group prevalence difference) using generalized estimating equations (GEE). Risk ratios and 95% confidence intervals were produced in all analyses.

Oral health literacy information for those lost to follow-up (see Figure 1) was imputed with sample characteristics, such as sex, education level, income status, tobacco smoking, alcohol consumption, number of intervention sessions attended, as well as all primary and secondary outcome items based on the three scenarios. The related outcome items were included as covariates in the imputation model, as it is recommended that the inclusion of the dependent variable of the risk prediction model in the imputation model enables unbiased estimates of model coefficients.[33,34] The fully conditional method with a logistic model was used to generate 50 multiple imputation (MI) data for each scenario. Scores for each oral health-related outcome variable were then summed for data analysis. Both crude and imputed results are presented. SAS statistical software (SAS 9.4, SAS Institute Inc., Cary, NC, USA) was used to impute and analyse data.

3 | RESULTS

Four hundred Indigenous Australian adults who completed an oral health literacy questionnaire at baseline were randomly allocated to

either the oral health literacy intervention (Group A: n=203) or control group (Group B: n=197). As permuted block randomization was utilized, the numbers in the intervention and control group were not precisely equal. In the intervention group, 95 Indigenous adults (46.8%) attended at least one oral health literacy-tailored workshop during the 12-months intervention period. There were 293 (73.3%) Indigenous adults who completed the 12-months follow-up oral health literacy-related questionnaire; 151 (74.4%) from Group A and 142 (72.1%) from Group B (Figure 2).

Socio-demographic characteristics of the sample are presented in Table 1. Overall, there was a higher proportion of participants who were female, had lower levels of education, sourced their income from welfare, or were current tobacco smokers or current consumers of alcohol. Importantly, there were no notable differences in characteristics between the intervention and control groups at baseline, over those retained and lost to follow-up at 2 years. However, there was a higher proportion of participants who were male, current tobacco smokers and current consumers of alcohol in the intervention group who did not attend an intervention. The distribution of participants by different scenarios is also presented in Table 1. In scenario I (intention to treat), 294 participants completed a follow-up questionnaire at 1 year; with a relatively similar distribution between intervention and control groups (152 vs 142). In scenario II (as treated), the same number of participants completed a follow-up questionnaire at 12 months as in scenario I (294), but the distribution in intervention and control differed (95 vs 199). In scenario III (adherence only), 237 participants completed a follow-up questionnaire at 12 months; 95 from the intervention group and 142 from the control group.

The association between the number of interventions attended and oral health literacy is shown in Table 2. Within the intervention group, the mean HeLD-14 score was lower among participants who did not attend an intervention than those attending one or more intervention sessions. However, there were no significantly different HeLD-14 scores with greater numbers of intervention sessions attended.

Data on changes in oral health literacy and related outcomes based on the three scenarios are presented in Table 3. There were no significant mean score difference for either the primary outcome (oral health literacy; HeLD-14) or secondary outcome measures between intervention and control groups under the three scenarios from crude data analyses. However, after MI, oral health literacy was shown to have improved when assessed under scenario II (as treated). Improvements were also observed for the social impact of oral health (OHIP-14; scenarios I, II and III), oral health-related sense of personal control, fatalism and stress (scenarios I, II and III).

The proportion of participants with dental knowledge before and after the oral health literacy-related intervention under the three scenarios is presented in Table 4. The proportion reporting

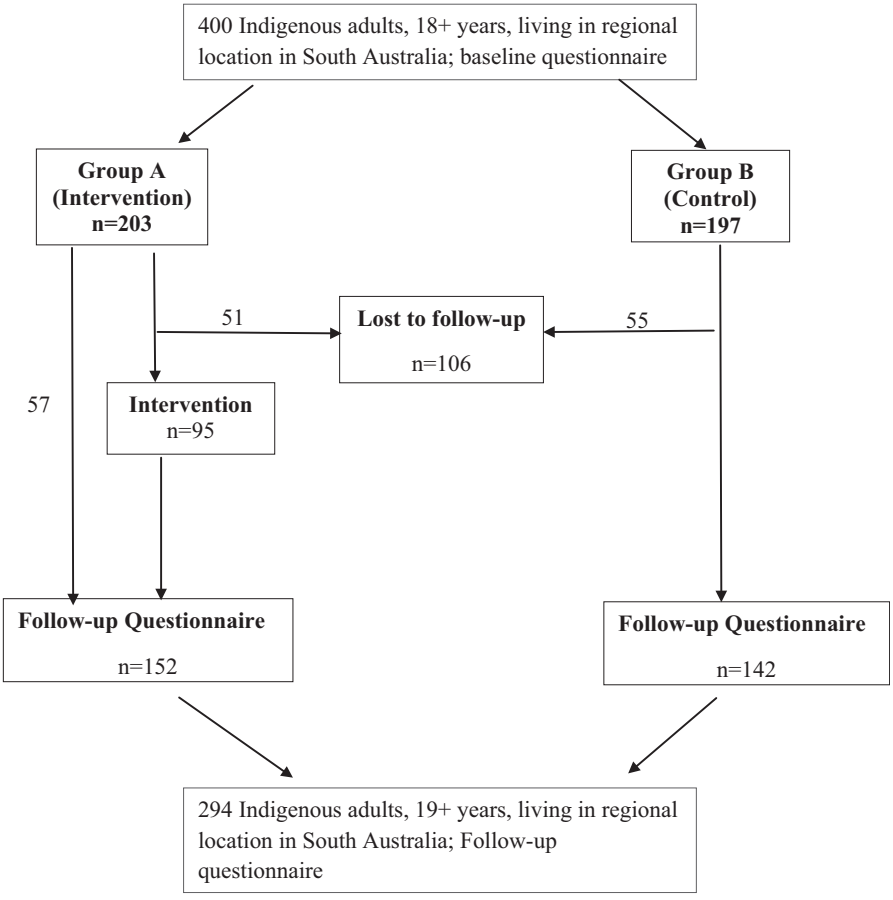

FIGURE 2 Flow chart of data collection

TABLE 1 Sample characteristics and inclusion in different scenarios by groups between baseline and 2-y follow-up

	Baseline			2 y					Lost to follow-up at 2 y		
	Total (n=400)	Intervention (n=203)	Control (n=197)	Total (n=294)	Intervention (n=152)			Control (n=142)	Total (n=106)	Intervention (n=51)	Control (n=55)
Baseline characteristics	Number (%)			Number (%)					Number (%)		
						Intervention attending					
						0 (n=57)	1+ (n=95)				
Sex											
Male	131 (32.8)	66 (32.5)	65 (33.0)	89 (30.3)	49 (32.2)	**26 (45.6)**	**23 (24.2)***	40 (28.2)	42 (39.6)	17 (33.3)	25 (45.5)
Female	269 (67.3)	137 (67.5)	132 (67.0)	205 (69.7)	103 (67.8)	**31 (54.4)**	**72 (75.8)**	102 (71.8)	64 (60.4)	34 (66.7)	30 (54.6)
Education level											
Lower	301 (76.0)	156 (77.6)	145 (74.4)	222 (75.5)	117 (77.5)	46 (80.7)	71 (75.5)	105 (75.0)	79 (74.5)	39 (78.0)	40 (72.7)
Higher	95 (24.0)	45 (22.4)	50 (25.6)	69 (23.5)	34 (22.5)	11 (19.3)	23 (24.5)	35 (25.0)	26 (24.5)	11 (22.0)	15 (27.3)
Missing	4 (1.0)			3 (1.0)					1 (1.0)		
Income											
Job	85 (21.9)	**51 (26.0)**	**34 (17.7)***	70 (23.8)	42 (28.6)	13 (23.2)	29 (31.9)	28 (20.14)	15 (14.2)	9 (18.4)	6 (11.3)
Welfare	303 (78.1)	**145 (74.0)**	**158 (82.3)**	216 (73.5)	105 (71.4)	43 (76.8)	62 (68.1)	111 (79.9)	87 (82.1)	40 (81.6)	47 (88.7)
Missing	12 (3.0)			8 (2.7)					4 (3.7)		
Tobacco smoking status											
Currently smoke	247 (61.9)	120 (59.1)	127 (64.8)	173 (58.8)	85 (55.9)	**43 (75.4)**	**42 (44.2)***	88 (62.4)	74 (69.8)	35 (68.6)	39 (70.9)
Ever/Never smoker	152 (38.1)	83 (40.9)	69 (35.2)	120 (40.8)	67 (44.1)	**14 (24.6)**	**53 (55.8)**	53 (37.6)	32 (30.2)	16 (31.4)	16 (29.1)
Missing	1 (0.3)			1 (3.4)							
Alcohol consumption											
Currently drink alcohol	227 (58.5)	115 (58.7)	112 (58.3)	158 (53.7)	80 (54.4)	**39 (72.2)**	**41 (44.1)***	78 (56.5)	69 (65.1)	35 (71.4)	34 (63.0)
Ever/Never drink alcohol	161 (41.5)	81 (41.3)	80 (41.7)	127 (43.2)	67 (45.6)	**15 (27.8)**	**52 (55.9)**	60 (43.5)	34 (32.1)	14 (28.6)	20 (37.0)
Missing	12 (3.0)			9 (3.1)					3 (2.8)		
Scenarios											
Scenario I (intention to treat)	400	203 (50.8)	197 (49.3)	294 (73.3)	152 (74.4)			142 (72.1)	106 (26.8)	51 (25.6)	55 (27.9)
Scenario II (as treated)	400	147 (36.8)	253 (63.3)	294 (73.3)	95 (64.6)			198 (78.3)	106 (26.8)	51 (35.4)	55 (21.7)
Scenario III (adherence only)	343	146 (42.6)	197 (57.4)	237 (68.9)	95 (64.6)			142 (72.1)	106 (31.1)	51 (35.4)	55 (27.9)

Bold values denote statistically significant differences.

*Chi-square test: $P<.05$.

TABLE 2 Mean HeLD-14 scores (95% CI) under different scenarios among the intervention group

Models	No. of Intervention -attending	0 (n=57)	1 (n=18)	1-2 (n=36)	3-5 (n=48)	1+ (n=84)
		42.1 (38.9-45.3)	47.8 (45.7-51.9)	46.3 (43.24-49.3)	46.1 (44.1-48.2)	46.2 (44.5-47.9)
P-value vs the '0' sessions category[a]			**.03**	**.06**	**.04**	**.02**
Model[b]	Estimate (β)	−14.0	-	0.2	Ref.	
	(SE)	(1.9)	-	(2.2)		
	P-values	**.04**	-	.92		

Bold values denote statistically significant differences.
[a]*t* test.
[b]Unadjusted GLM models.

TABLE 3 Changes in oral health literacy and related outcomes under different scenarios

	Intervention		Control		Crude		Multiple imputation	
	Baseline Mean (SD)	Follow-up Mean (SD)	Baseline Mean (SD)	Follow-up Mean (SD)	ANCOVA least squares Mean (Δ; 95% CI)	*P*-value	ANCOVA least squares Mean (Δ; 95% CI)	*P*-value
Scenario I (intention to treat)								
	(n=203)	(n=152)	(n=197)	(n=142)				
HeLD_14	44.8 (7.9)	44.5 (9.9)	45.3 (8.0)	46.0 (8.2)	−1.3 (−3.3, 0.7)	.19	−1.4 (−3.3, 0.6)	.17
OHIP_14	18.9 (14.3)	19.0 (14.1)	19.9 (14.1)	20.4 (13.7)	−1.0 (−3.9, 1.9)	.50	−0.7 (−1.1, −0.4)	<.01
Sense of control	28.0 (7.2)	29.1 (8.0)	27.3 (6.4)	28.3 (7.5)	0.6 (−1.1, 2.3)	.49	0.4 (0.3, 0.7)	<.01
Self-efficacy	16.3 (6.3)	15.7 (6.2)	15.6 (7.0)	14.9 (6.5)	0.7 (−0.7, 2.1)	.32	0.7 (−1.1, 1.3)	.91
Fatalism	15.7 (4.6)	14.7 (4.7)	15.4 (4.7)	15.5 (4.4)	−0.6 (−1.7, 0.4)	.24	−0.7 (−0.9, −0.6)	<.01
Stress	28.5 (6.3)	25.7 (6.1)	28.3 (5.4)	26.7 (5.0)	−1.1 (−2.4, 0.2)	.09	−1.1 (−1.3, −1.0)	.01
Scenario II (as treated)								
	(n=147)	(n=95)	(n=253)	(n=198)				
HeLD_14	45.6 (6.7)	46.2 (7.8)	44.8 (8.3)	44.9 (9.6)	1.1 (−1.1, 3.3)	.33	1.3 (1.1-1.6)	<.01
OHIP_14	20.0 (14.4)	17.9 (13.3)	19.2 (14.2)	20.5 (14.0)	−2.8 (−5.9, 0.4)	.08	−3.8 (−4.2, −3.5)	<.01
Sense of control	28.2 (7.2)	29.6 (7.9)	27.5 (6.7)	28.3 (7.7)	1.1 (−0.7, 2.9)	.24	0.8 (0.5, 0.9)	<.01
Self-efficacy	16.7 (6.2)	15.4 (6.1)	15.8 (6.8)	15.2 (6.4)	0.0 (−1.5, 1.5)	1.00	−0.1 (−0.2, 0.1)	.36
Fatalism	16.3 (4.6)	14.6 (5.0)	15.3 (4.7)	15.3 (4.4)	−0.6 (−1.8, 0.6)	.35	−0.4 (−0.5, −0.3)	<.01
Stress	27.8 (5.9)	25.5 (6.2)	28.6 (5.8)	26.5 (5.3)	−0.9 (−2.3, 0.4)	.18	−2.1 (−3.2, −0.9)	<.01
Scenario III (adherence only)								
	(n=146)	(n=95)	(n=197)	(n=142)				
HeLD_14	45.6 (6.7)	46.2 (7.8)	45.3 (8.0)	46.0 (8.2)	0.1 (−2.0, 2.2)	.92	0.1 (−0.2, 0.2)	.07
OHIP_14	20.0 (14.4)	18.0 (13.3)	19.9 (14.1)	20.4 (13.7)	−2.4 (−5.7, 0.8)	.13	−3.5 (−3.7, −2.9)	<.01
Sense of control	28.2 (7.2)	29.6 (7.9)	27.3 (6.4)	28.3 (7.5)	1.0 (−0.8, 2.9)	.28	1.1 (0.9, 1.3)	<.01
Self-efficacy	16.7 (6.2)	15.4 (6.1)	15.6 (7.0)	14.9 (6.5)	0.3 (−1.2, 1.8)	.70	0.2 (−0.1, 0.4)	.34
Fatalism	16.3 (4.6)	14.6 (5.0)	15.4 (4.7)	15.5 (4.4)	−0.8 (−2.1, 0.5)	.21	−0.4 (−0.5, −0.3)	<.01
Stress	27.8 (5.9)	25.5 (6.2)	28.3 (5.4)	26.7 (5.0)	−1.2 (−2.6, 0.2)	.10	−1.8 (−1.9, −1.6)	<.01

that "cordial was good" decreased (ranging from 40% to 50%) in the intervention group than in the control group from MI analysis under scenarios II and III. The proportion reporting that "water with fluoride" was good increased (ranging from 10% to 20%) in the intervention group within both crude and MI data analyses under the three scenarios.

4 | DISCUSSION

Our hypotheses that a context-specific oral health literacy intervention would improve both oral health literacy and related outcomes among Aboriginal Australians proved only partially true. HeLD-14 scores did improve in the intervention vs control group, but not

TABLE 4 Changes in oral health knowledge under the different scenarios

	Crude					Multiple imputation				
	Intervention		Control			Intervention		Control		
	Baseline % (SE)	Follow-up % (SE)	Baseline % (SE)	Follow-up % (SE)	RR (95% CI)	Baseline % (SE)	Follow-up % (SE)	Baseline % (SE)	Follow-up % (SE)	RR (95% CI)
Scenario I (intention to treat)										
Dental knowledge										
Cordial										
Good	8.9 (2.0)	5.1 (1.9)	4.6 (1.5)	4.2 (1.7)	0.9 (0.3-2.5)	8.9 (0.3)	5.1 (0.2)	4.6 (0.2)	4.4 (0.2)	1.3 (0.9-1.5)
Soft-drink										
Good	3.9 (1.4)	2.9 (1.4)	2.5 (1.1)	2.8 (1.4)	0.9 (0.3-3.1)	3.9 (0.2)	3.6 (0.2)	2.5 (0.2)	2.4 (0.1)	1.2 (0.9-1.4)
Toothpaste										
Good	95.1 (1.5)	98.6 (1.0)	93.9 (1.7)	97.2 (1.4)	1.0 (0.9-1.0)	95.1 (0.2)	98.2 (0.1)	93.9 (0.2)	97.0 (0.2)	1.0 (1.0-1.0)
Water with fluoride										
Good	73.9 (3.1)	91.4 (2.4)	73.6 (3.1)	76.8 (3.6)	**1.2 (1.0-1.3)**	73.9 (0.4)	89.8 (0.3)	73.6 (0.4)	77.3 (0.4)	**1.1 (1.1-1.2)**
Scenario II (as treated)										
Dental knowledge										
Cordial										
Good	7.5 (2.1)	2.5 (1.7)	5.9 (1.4)	5.5 (1.6)	0.4 (0.1-1.6)	7.5 (0.3)	2.5 (0.2)	6.3 (0.2)	5.5 (0.2)	**0.4 (0.3-0.5)**
Soft-drink										
Good	2.7 (1.4)	2.5 (1.7)	3.5 (1.2)	3.0 (1.2)	1.2 (0.3-4.6)	2.7 (0.2)	2.5 (0.2)	3.5 (0.2)	3.0 (0.2)	1.1 (0.9-1.4)
Toothpaste										
Good	93.8 (2.0)	97.6 (1.7)	94.7 (1.4)	98.0 (1.0)	1.0 (1.0-1.0)	93.8 (0.3)	97.9 (0.3)	94.9 (0.4)	97.6 (0.1)	1.0 (1.0-1.0)
Water with fluoride										
Good	68.5 (3.9)	94.0 (2.6)	76.8 (2.7)	79.9 (2.8)	**1.2 (1.1-1.2)**	68.5 (0.5)	90.1 (0.3)	76.8 (0.4)	80.2 (0.4)	**1.1 (1.1-1.2)**
Scenario III (adherence only)										
Dental knowledge										
Cordial										
Good	7.5 (2.1)	2.5 (1.7)	4.6 (1.5)	4.2 (1.7)	0.5 (0.1-2.2)	7.5 (0.3)	2.5 (0.2)	4.6 (0.2)	4.2 (0.2)	**0.5 (0.4-0.6)**
Soft-drink										
Good	2.7 (1.4)	2.5 (1.7)	2.5 (1.1)	2.8 (1.4)	1.1 (0.3-4.5)	2.7 (0.2)	2.5 (0.2)	2.5 (0.2)	2.8 (0.2)	1.1 (0.9-1.3)
Toothpaste										
Good	93.8 (2.0)	97.6 (1.7)	93.9 (1.7)	97.2 (1.4)	1.0 (1.0-1.0)	93.8 (0.3)	97.1 (0.3)	93.9 (0.2)	97.0 (0.3)	1.0 (0.9-1.0)
Water with fluoride										
Good	68.5 (3.9)	94.0 (2.6)	73.6 (3.1)	76.8 (3.6)	**1.2 (1.1-1.3)**	68.5 (0.5)	91.4 (0.3)	73.6 (0.4)	77.7 (0.4)	**1.1 (1.0-1.2)**

Bold values denote statistically significant differences.

under all scenarios and only with MI. There were many improvements in the oral health literacy-related outcomes (most notably improved knowledge of water with fluoride), but not all, and not under all scenarios.

The study has three main strengths. The first is the use of a randomized controlled trial to determine the efficacy of an oral health literacy intervention. The second strength is the deep and sustained involvement of the Indigenous community with whom the intervention was conducted, from oral health literacy instrument development to development, pilot testing and ultimate delivery of the oral health literacy intervention. The third strength is the use of MI to give additional power to the findings when missing data were common, with appropriate techniques utilized so that bias was minimized. It is important to report the study limitations, which include the high loss to follow-up, the lack of clinical oral health data, the possibility of contamination (intervention and control group participants residing in the same location, with some intervention participants possibly sharing information regarding sessions they had attended), inaccurate intervention effect estimation with more than 30% not having attended an intervention session, and a lack of long-term observation. The high loss to follow-up is particularly problematic (although mitigated by the use of MI) and is certainly corroborated by others conducting trials with Indigenous populations. For example, Sibthorpe and colleagues disbanded their randomized controlled trial involving an Aboriginal Medical Service due to recruitment and retention difficulties.[35] For the current study, a considerable investment was made

in employing Indigenous staff specifically to maintain contact with (and retain) study participants. Transport was provided, as were babysitting services. However, the Aboriginal population in Australia can be very transient, with community responsibilities usually taking precedence over any commitments to completing a study.[36] Although it is encouraging that the oral health literacy intervention was shown to be efficacious after MI, we cannot ignore the fact that any translation to policy/uptake in government clinics, who would likely expend less effort and resources than we did, may face similar challenges in programme participation and completion.

There may be concerns that MI to replace missing data is a study limitation. However, MI techniques are increasingly considered de rigueur in both clinical and pragmatic community trials, given the difficulties in avoiding loss to follow-up, and the time and resources invested. Indeed, there are some who argue that, instead of disregarding randomized controlled trials with high levels of missing data, MI serves to consolidate such findings and adds extra value to the conclusions able to be derived.[37,38]

Given that this was a health literacy study, where a contextually relevant instrument was designed specifically for the community group of interest, it is important to consider that other outcome measures had, in their wording, sometimes complex sentence structures (for example, the OHIP-14) and large words (for example, in the psychosocial instruments), which may have been problematic if participants did have poor literacy. In future, it will be important to ensure that the reading level of other instruments is similar to that of HeLD.

Inclusion of the "cordial" item in relation to oral health knowledge was considered after consulting with the study's Aboriginal Reference Group. Its inclusion was based on many Indigenous families in the study area providing cordial in baby bottles or cups (instead of formula, milk or water) because they did not want to be seen as giving their children "povo drinks" (drinks that people in poverty have). Inclusion of other outcomes relevant to oral health, for example, tobacco smoking would have likely yielded additional valuable information. However, we believe that the inclusion of cordial and the other knowledge items was relevant for the context of this study.

The poor attendance at our intervention sessions is an obvious weakness, and suggests that the overall feasibility of the study design and likelihood of the findings to be translated into policy is poor. We invested substantially in Aboriginal staff employment solely for the retention/follow-up of study participants with respect to participation in the intervention sessions, far more than would a government agency or any other group hoping to roll-out a literacy-based intervention to improve health outcomes among this group. That we achieved such a poor outcome after investing such a huge amount of resources is an indication of how such an approach is unlikely to be successful in the real-world setting, where resources are fewer, and programme staff are perhaps less motivated to maximize participation rates.

Given that the emphasis of the oral health literacy intervention was underpinned by Bandura's model of SCT,[39] reporting changes in psychosocial outcomes were considered to be as important as reporting changes more directly related to oral health such as social impact of oral disease and dental knowledge. Improvements in perceived stress and fatalism validated this approach, although there were no reported differences in self-efficacy.

The intervention was successful in improving dental-related knowledge, specifically in regard to sugar-sweetened beverages (cordial) and the importance of fluoride in drinking water. Oral health-related knowledge is widely acknowledged as being associated with both adult and child oral health behaviours and outcomes,[40,41] with the assumption being that, as knowledge accumulates, attitudes change, and that these changes in attitude in turn promote behaviour change. A hidden assumption is that improved knowledge also gives a person the skills to change behaviour; that is, there is inherently something self-empowering about knowledge that provides the skills or self-efficacy to change behaviour. However, much of the psychology literature suggests that the knowledge, attitudes and behaviour paradigms are essentially ineffective with respect to long-term behaviour change.[42] Additionally, Kay and Locker questioned the sustained benefit of one-off oral health education sessions,[43] so the true benefit of the intervention may only be realised if longer-term "refreshers" for study participants are undertaken and maintained. In their review of health literacy interventions and outcomes, Berkman and colleagues reported that components of effective interventions appeared to be their high intensity, theoretical underpinnings, pilot testing, emphasis on skill building and delivery of the intervention by appropriate staff.[19] Successful interventions appeared to affect intermediate factors, such as increasing knowledge or self-efficacy or by changing behaviour. Although not successful in all outcomes, our findings, on the whole, reflect these strengths.

The use of the term "as treated" does not reflect that the intervention was education-based, as opposed to more traditional clinical trials involving drugs. We elected to use this term as our study was a RCT, and we wished to reflect the normal wording used when reporting outcomes for such trials.

In conclusion, a context-specific oral health literacy intervention was partially successful in improving oral health literacy and oral health literacy-related outcomes in a group of regional-dwelling Indigenous Australians, but only after MI for the missing data.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

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APPENDIX

TABLE A1 HeLD_14

Communication
1. Are you able to look for a second opinion about your dental health from a dental health professional?
2. Are you able to use information from a dentists to make decisions about your dental health?
Access
1. Do you know how to get a dentist's appointment?
2. Do you know what to do to get a dentist's appointment?
Receptivity
1. Are you able to pay attention to your dental or oral health?
2. Are you able to make time for things that are good for your dental or oral health?
Understanding
1. Are you able to read written information eg, leaflets given to you by your dentist?
2. Are you able to read dental or oral health information brochures left in dental clinics and waiting rooms?
Utilisation
1. Are you able to carry out instructions that a dentist gives you?
2. Are you able to use advice from a dentist to make decisions about your dental health?
Support
1. Are you able to take family or a friend with you to a dental appointment?
2. Are you able to ask someone to go with you to a dental appointment?
Economic barriers
1. Are you able to pay to see a dentist?
2. Are you able to pay for medication to manage your dental or oral health?
Answer
[1] Without any difficulty
[2] Little difficulty
[3] With some difficulty
[4] Very difficult
[5] Unable to do

TABLE A2 Oral health impact profile (OHIP-14)

1. How often in the last year have you had trouble pronouncing (or saying) any words because of problems with your teeth, mouth or false teeth?
2. How often in the last year have you felt that your sense of taste has worsened because of problems with your teeth, month or false teeth?
3. How often in the last year have you had painful aching in your mouth?
4. How often in the last year have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or false teeth?
5. How often in the last year have you been self-conscious because of problems with your teeth, mouth or false teeth?
6. How often in the last year have you felt tense because of problems with your teeth, mouth or false teeth?
7. How often in the last year has your diet been unsatisfactory because of problems with your teeth, mouth or false teeth?
8. How often in the last year have you had to interrupt meals because of problems with your teeth, mouth or false teeth?
9. How often in the last year have you found it difficult to relax because of problems with your teeth, mouth or false teeth?
10. How often in the last year have you been a bit embarrassed because of problems with your teeth, mouth or false teeth?
11. How often in the last year have you been irritable with other people because of problems with your teeth, mouth or false teeth?
12. How often in the last year have you had difficulty doing your usual jobs because of problems with your teeth, mouth or false teeth?
13. How often in the last year have you felt that life in general was less satisfying because of problems with your teeth, mouth or false teeth?
14. How often in the last year have you been totally unable for function because of problems with your teeth, mouth or false teeth?
Answer
[1] Very often
[2] Fairly often
[3] Occasionally
[4] Hardly ever
[5] Never

TABLE A3 Sense of personal control

1. I can do just about anything I really set my mind to
2. Other people determine most of what I can and cannot do
3. When I really want to do something I usually find a way to succeed at it
4. Whether or not I am able to get what I want is in my own hands
5. There is little I can do to change many of the important things in my life
6. I often feel helpless in dealing with the problems of life
7. There are many things that interfere with what I want to do
8. I have little control over the things that happen to me
9. There is really no way I can solve all the problems I have
10. I sometimes feel I am being pushed around in my life
11. What happens to me in the future mostly depends on me
12. What happens in my life is often beyond my control
Answer
[1] Strongly agree
[2] Agree
[3] Neither agree nor disagree
[4] Disagree
[5] Strongly disagree

TABLE A4 Oral health-related self-efficacy

How confident do you feel about your ability to brush your teeth or clean your false teeth at night when you are
1. Under a lot of stress
2. Depressed
3. Anxious
4. Too busy
5. Tired
6. Worried about other things in your life
Answer
[1] Very confident/I never feel like this
[2] Fairly confident
[3] Occasionally confident
[4] Hardly ever confident
[5] Not at all confident

TABLE A5 Fatalism

How do you agree with
1. Most people will develop problems with their teeth
2. Most people will need to have their teeth pulled out
3. Most people will eventually get a tooth ache
4. Most people will have bleeding gums
5. Most adults will eventually get wobbly teeth
Answer
[1] Strongly agree
[2] Moderately agree
[3] Neither agree nor disagree
[4] Moderately disagree
[5] Strongly disagree

TABLE A6 Perceived stress

How often during the past year have you felt
1. Upset because of something that happened unexpectedly?
2. Unable to control the important things in your life?
3. Either nervous or stressed?
4. That you dealt successfully with irritating life hassles?
5. That you effectively coped with important changes in your life?
6. Confident about your ability to handle your personal problems?
7. Things were going your way?
8. Unable to cope with all the things that you had to do?
9. Able to control irritations in your life?
10. You were on top of things?
11. Angered because of things that happened outside of your control?
12. Yourself thinking about things that you have to accomplish?
13. Able to control the way you spend your time?
14. Difficulties were piling up so high that you could not overcome them?
Answer
[1] Not at all
[2] Rarely
[3] Sometimes
[4] Fairly often
[5] Very often

TABLE A7 Mapping of social cognitive theory (SCT)[a] on to target intervention sessions (all intervention components delivered by Indigenous staff)[b]

SCT constructs	Information sharing	Hands-on activities
Intervention session 1		
Self-efficacy; mastery experience[c]	Introduction and group discussion; "... if people believe they have no power to produce results, they will not attempt to make things happen" (Bandura)	
Knowledge; social modelling	Parts of tooth, bacteria, plaque, fluoride Gum problems - gingivitis, periodontal disease, calculus, sensitive teeth Relationship of oral health and diabetes, pregnancy Care of dentures	Prevention - how to brush, when, type of toothbrush and paste, disclosing solution See bacteria in microscope Difference healthy/unhealthy gums, checking this out with mirrors Items to take home - toothbrushes for family, toothpaste, disclosing tablets, toothbrush holders, dental mirror
Fatalism; moving beyond	Dental schemes and practices available in community	Roleplay about being in control at dentist - asking to be sat up to talk to dentist, showing it is OK to ask questions
Intervention session 2		
Self-efficacy; mastery experience	Introduction and group discussion; "... if people believe they have no power to produce results, they will not attempt to make things happen" (Bandura)	
Knowledge; social modelling	Defining dental decay Describing the role of sugars, bacteria and acids in the decay process Fluoride in tap water and toothpaste - spit not rinse Importance of water for whole body Sugars in foods and beverages Caring for children's teeth	Chalk dipped in dye Sorting bottles of drink into how much sugar Reading and interpreting nutrition labels on foods Watch DVD - caring for baby teeth Items to take home; water bottle, toothpaste, brushes etc.
Fatalism; moving beyond	How to make dental appointments	Roleplay making dental appointments; telephone conversation, conversation with mock receptionist
Intervention session 3		
Self-efficacy; mastery experience	Introduction and group discussion; "... if people believe they have no power to produce results, they will not attempt to make things happen" (Bandura)	
Knowledge; social modelling	Erosion, importance of saliva Cause - acids in diet, intrinsic eg, reflux, vomiting during pregnancy Prevention - water drinking, fluoride, timing acid intake	Problem solving different scenarios regarding erosion/dry mouth Items to take home; brushes, paste, chewing gums
Fatalism; moving beyond	Understanding rights of dental patients and what to do if want to make complaint	Roleplaying conversations regarding rights as a dental patient
Intervention session 4		
Self-efficacy; mastery experience	Introduction and group discussion; "... if people believe they have no power to produce results, they will not attempt to make things happen" (Bandura)	
Knowledge; social modelling	Why flossing is important Discussing different scenarios regarding oral health presentations described in previous sessions (caries, gum disease, erosion) and problem solving what to do in each case	Flossing techniques
Fatalism; moving beyond	How to have conversations with family members re: dental hygiene and attending dental services	Roleplaying conversations with family members re: dental hygiene and attending dental services

(Continues)

TABLE A7 (Continued)

SCT constructs	Information sharing	Hands-on activities
Intervention session 5		
Self-efficacy; mastery experience	Introduction and group discussion; "... if people believe they have no power to produce results, they will not attempt to make things happen" (Bandura)	
Knowledge; social modelling	Revisiting topics raised in previous sessions, answering any queries/concerns participants have, overview of previous slides	Visiting dental clinic - allowing participants to lead discussion regarding treatment options, x-rays, materials, instruments etc.
Fatalism; moving beyond		

[a]Social cognitive theory is a learning theory based on the premise that people learn by observing others. Bandura posits that behaviour is influenced by the interaction of three determinants:

1. Personal: Whether an individual has high or low self-efficacy towards the behaviour.
2. Behavioural: The response an individual receives after they perform a behaviour.
3. Environmental: Aspects of the environment influence an individual's ability to successfully perform a behaviour.[44]

[b]People are more likely to follow behaviours modelled by someone with whom they can identify with. The more commonalities or emotional attachments perceived between the observer and the model, the more likely the observer learns to re-enact the modelled behaviour.[42]

[c]Self-efficacy can be developed or increased by:

1. Mastery experience: a process that helps an individual achieve simple tasks that lead to more complex objectives.
2. Social modelling: provides an identifiable model that shows the processes that accomplish a behaviour.
3. Improving physical and emotional states: ensuring a person is rested and relaxed prior to attempting a new behaviour; the less relaxed and the less patient, the more likely a client won't attain the goal behaviour.
4. Verbal persuasion: providing encouragement for a person to complete a task or achieve a certain behaviour.[43]