

Article

Prevalence of Medical Conditions and Medication Usage: Implications for Oral Health among Older Adults in Rural Victoria

Rodrigo Mariño ^{1,2,*} , Kristen Glenister ³ , Lisa Bourke ³ and David Simmons ^{3,4} ¹ Melbourne Dental School, The University of Melbourne, Parkville, VIC 3010, Australia² Center for Research in Epidemiology, Economics and Oral Public Health (CIEESPO), Faculty of Dentistry, Universidad de La Frontera, Temuco 4811230, Chile³ Department of Rural Health, Department of Rural Health, The University of Melbourne, Shepparton, VIC 3630, Australia; kristen.glenister@unimelb.edu.au (K.G.); bourke@unimelb.edu.au (L.B.); da.simmons@westernsydney.edu.au (D.S.)⁴ Macarthur Clinical School, Western Sydney University, Sydney, NSW 2060, Australia

* Correspondence: r.marino@unimelb.edu.au

Featured Application: Oral health-related general health diseases and conditions refers to medical conditions or diseases that have a connection or impact on both oral health and overall health.

Abstract: (1) Background: A study was undertaken to provide a comprehensive profile of the prevalence and distribution, by selected socio-demographic characteristics, of chronic diseases and health conditions including those that impact the oral health and oral health self-care of independently living older adults in rural areas of the state of Victoria; (2) Methods: The study analyzed data from the Crossroads-II project, with a total of 1407 participants aged 55 years and older. Participants responded to questionnaires about their medical health history, health service use, and socio-demographics. In total, 572 attended a 2-h health screening that included an assessment of prescribed medications; (3) Results: Most participants were female (55.3%), with a mean age of 69.1 (SD = 9.2) years. Participants had a high prevalence of medical conditions; the most common were high blood pressure, arthritis, high lipids, hearing loss, and chronic pain. Almost all participants reported taking medications, with an average of 4.3 medications per person. Among those who attended the health screening, 78.1% were taking medications that could cause xerostomia (dry mouth); (4) Conclusions: This study provides initial information on the prevalence of medical conditions, medication usage, and the potential impact on the oral health of older adults living in rural Victoria. This information would be valuable for healthcare and dental workforce planning, policy development, and improving the overall well-being of this population.

Keywords: oral health; xerostomia; Australia; non-communicable diseases

Citation: Mariño, R.; Glenister, K.; Bourke, L.; Simmons, D. Prevalence of Medical Conditions and Medication Usage: Implications for Oral Health among Older Adults in Rural Victoria. *Appl. Sci.* **2024**, *14*, 7270. <https://doi.org/10.3390/app14167270>

Academic Editor: Bruno Chrcanovic

Received: 13 July 2024

Revised: 15 August 2024

Accepted: 17 August 2024

Published: 19 August 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Australian rural and remote encompasses all areas outside Australia's Major cities [1,2]. Populations living in those areas are characterized by their varied locations, compositions, and sizes. However, one common trend across these populations is accelerated aging when compared to their urban counterparts. This demographic transition brings forth considerable challenges for healthcare professionals, as it not only necessitates adapting to changing disease patterns but also requires specialized care tailored to the unique needs of rural and remote communities [1,2].

Furthermore, as countries undergo this demographic transition, they also experience an epidemiological transition. This shift necessitates an enhanced emphasis on the prevention and management of non-communicable diseases, including oral health conditions like dental caries and periodontal diseases. These conditions pose a significant global health

burden and require a robust public health response to mitigate their impact [3]. Addressing these oral health issues is crucial in improving overall health outcomes and quality of life, particularly as populations age and chronic conditions become more prevalent. More specifically, they have a vital role in promoting the understanding of the bidirectional relationship between oral health and systemic health. They are well-positioned to convey the message that oral health and general health are interconnected. Their awareness, communication, and education efforts can contribute to improved health outcomes for patients, particularly among older populations.

Recently, the International Dental Federation (FDI) approved a new definition of oral health: “Oral health is multifaceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow, and convey a range of emotions through facial expressions with confidence and without pain, discomfort, and disease of the craniofacial complex” [4]. Furthermore, within this new definition, the FDI highlighted that oral health is “a fundamental component of health and physical and mental well-being”. The FDI’s new definition of oral health encompasses physiological, social, and psychological aspects that contribute to the person’s quality of life. Oral health is dynamic and can be by individual experiences, perceptions, expectations, and adaptive abilities in different circumstances [4].

The recognition of oral health as an integral part of overall health has gained attention from organizations such as the World Health Organization [5,6], the World Dental Federation [4,7], and national health strategies [8,9]. The global oral health status report indicates that oral diseases pose a serious burden to health, affecting 3.5 billion people around the world, making them the most prevalent non-communicable diseases (NCD) [3]. Additionally, oral health professionals should have a comprehensive understanding and familiarity with their patients’ general health conditions. This knowledge is essential because issues in the mouth have an impact on the health of the entire body and systemic conditions can manifest in oral health problems. Conditions like diabetes, heart disease, and immune disorders have reciprocal links and, as such, can influence oral health and vice versa.

The emerging and growing evidence of the associations between oral health and other non-communicable diseases (NCDs) has gained substantial support, confirming the existence of strong interconnections between these conditions [10–16]. While the evidence of influence varies in strength across different diseases, there is now a heightened awareness that neglecting oral hygiene can have consequences that extend beyond oral health. Numerous biological mechanisms have been proposed, such as the entry of mediators of oral inflammation into the bloodstream, contributing to systemic inflammation [17–19], as well as the potential development of aspiration pneumonia [20]. Notably, improving oral hygiene in nursing homes could potentially prevent 1 in 10 cases of pneumonia-related deaths [20].

This also underscores the importance of considering the unique oral health challenges faced by older populations. As people age, they may be more susceptible to oral health issues and other systemic health conditions and medications may have a more pronounced impact on oral health, such as causing xerostomia (i.e., dry mouth). The risk of xerostomia is a particular concern. Insufficient saliva production can contribute to dental problems such as cavities, gum disease, and oral infections. The severity of xerostomia can vary, ranging from mild discomfort to more severe complications affecting oral health. However, it should be noted that not everyone taking these medications will experience dry mouth. This is also important because it is possible for dryness to occur in other mucous membranes throughout the body, although it might not be directly correlated with dry mouth [21]. Thus, being aware of the medications that their patients are taking is crucial. Some medications can have side effects that affect oral health.

To reinforce awareness among clinicians, researchers, and administrators regarding systemic conditions’ impact on oral health, this paper, as part of a larger effort organized in the Australian state of Victoria (The Crossroads-II project), aims to provide a comprehensive profile of the prevalence and distribution, by selected socio-demographic characteristics, of

chronic diseases and health conditions including those that impact on the oral health and oral health self-care of independent living older adults in rural areas of the state of Victoria. The Crossroads-II (XRoadsII) study is one of the largest and most comprehensive studies of rural health in Australia, providing valuable data for service planning and delivery to ensure equitable access to healthcare across the Goulburn Valley (GV) region of Victoria, Australia [22].

By understanding this prevalence and highlighting this relationship, among both healthcare providers and the public, it is hoped that oral health can be better acknowledged as an integral part of overall health and personal well-being, with a focus on preserving and maintaining oral health-related quality of life of older adults. This information is valuable for health and welfare providers and caregivers to better understand the oral health implications of common systemic diseases and their treatment, improving health outcomes and social well-being within the communities they serve. Additionally, it aids in identifying and prioritizing oral health diseases and conditions.

2. Materials and Methods

2.1. Study Design and Participants

The study is a secondary analysis of the (XRoadsII) study. The (XRoadsII) study was designed as a cross-sectional survey of randomly selected households in the Goulburn Valley (GV) of regional Victoria, Australia, to assess the prevalence of chronic health conditions, self-reported health, health behavior, access to care, and use of health services. Additionally, the study involved comparing participant-reported health and healthcare utilization information with corresponding data from specified primary health services and hospitals. This process enabled the validation of self-reported information [22].

With the approval granted by the Goulburn Valley Health Ethics Committee (GVH 20/16), informed consent to participate in the study was obtained from each participant. Separate individual written consent was obtained for a more detailed clinical assessment including dental examination [22]. Half of the adult household survey participants were invited to attend the health screening clinic. Data were collected between October 2016 and October 2018.

A total of 1407 people aged 55 years and older, who were residents of rural areas of Victoria, took part in the survey and were included in the present analysis. Participants self-completed a series of questionnaires asking 25 health conditions, health services use, concerns about healthcare, and demographic queries. Of this group, a total of 572 attended a 2-h health screening that included prescribed medications, where self-reported health and health information was verified and supplemented [22].

2.2. Data Collection

The data collection instrument included a series of questionnaires examining a variety of topics, including participants' socio-demographic characteristics, diet, exercise, social connectedness, smoking, alcohol intake, chest pain, health knowledge and attitudes, oral health, caffeine intake, marijuana use, pesticide exposure, and women's health (as applicable). For the present analysis, the following variables were included:

- (a) Socio-demographic: sex; age measured at the time of the examination and regrouped into three groups: '55 to 64'; '65 to 74'; and '75 and older'; and marital status, coded as 'Single/Separated/divorced'; 'Widow/widower'; and 'Married/de facto'. Participants' level of formal education was classified into the following categories: 'Some secondary', 'Secondary complete', 'Trades', 'Tertiary education', and 'Other'.

Additionally, data on the locality of residence were collected. The study is set in the Goulburn Valley region of Victoria, Australia, which is situated 200 km away from Melbourne. The research includes three "Shire capitals" (Benalla, Cobram, and Seymour) and the "Regional centre" (Shepparton/Mooroopna). These towns were chosen based on their geographic proximity to the regional center and their accessibility to other health

services. Furthermore, participants were questioned about their health insurance coverage, including eligibility for a healthcare/pensioner card.

- (b) Oral health questions included the self-assessed number of natural teeth recoded into two groups: 'No teeth' and 'Partial/None missing';
- (c) Medical history was assessed by asking participants' medical history based on the presence or absence of 25 medical conditions, including but not limited to arthritis, heart conditions, high blood pressure, respiratory problems, allergies, hearing loss, kidney problems, liver diseases, diabetes, and depression. A health conditions score was computed by summing the number of positive responses to these conditions.

The assessment also included conditions that may affect, or make it difficult, to maintain self-care, including oral hygiene; blindness and visual difficulties; audition impairments; and disability affecting arms and fingers. It was considered that this disability would affect manual dexterity.

Self-reported disabilities affecting the feet and legs were also included. It was considered that this would be indicative of difficulties accessing healthcare services.

- (d) As part of the medical history, participants were questioned about their current medication regimen, including the number of medications they were taking. Additionally, they were prompted to list up to seven medications they were currently using. Subsequently, these medications were categorized according to their potential to induce xerostomia. These included medication for six conditions: heart conditions; high blood pressure; arthritis; anxiety; allergies; and sleeping medications [23];
- (e) Participants were also asked about various risk behaviors, including their alcohol and tobacco consumption habits. They were inquired about the frequency and quantity of alcohol they typically consume, as well as whether they are current or past smokers, and how many cigarettes they smoke per day [24,25];
- (f) To better understand the broader context of participants' health and well-being, participants were queried about their involvement in social activities, such as participating in clubs, organizations, or community events, to gauge their level of community engagement and social support networks.

2.3. Data Analysis

The analysis provides descriptive information on the crude prevalence of General Health Diseases and Conditions in the population is described in terms of frequency distribution and by selected socio-demographic characteristics. To determine differences between groups on health and medical conditions, ANOVAs and Chi-square tests were employed. A significant ANOVA was followed by post-hoc comparisons using Tukey's Honestly Significant Differences tests. Data manipulation and analyses were conducted using IBM-SPSS Statistics (Version 29.0).

3. Results

A total of 1407 aged 55 years and older were included in the present analysis. Of them, the majority (55.3%) were female. The participants' mean age was 69.1 (SD = 9.2; range: 55–97) years. Almost half (49.6%) had primary education only or incomplete secondary education; 21.5% had secondary completion or trades certification; and 18.2% had at least some tertiary education. Another 10.7% did not have well-defined levels of education. More than half of the participants (53.9%) were from the shire capitals of Benalla, Cobram, and Seymour, while 46.1% were from the regional center of Shepparton/Mooroopna. Details of the sample's sociodemographic characteristics are provided in Table 1.

Table 1. Socio-demographic characteristics of older adults living in rural Victoria, Australia.

Variables		
Mean age (years)		69.1 (SD = 9.2)
Sex	categories	% ¹
	Male	44.7
	Female	55.3
Education	Some secondary	49.6
	Secondary complete	8.2
	Trades	13.3
	Tertiary	18.2
	Other	10.7
Location	Benalla/Cobram/Seymour	53.9
	Shepparton/Mooroopna	46.1

¹ n = 1407.

Regarding self-reported medical conditions, three participants reported no medical conditions and another 164 participants (11.6%) reported 1 or 2 medical conditions; 30.7% reported 3–5 conditions; 6–10 conditions were reported by 41.6% of participants; and 16.1% reported between 11 and 19 conditions. The average number of self-reported medical conditions was 6.7 conditions per person (SD = 3.7). The medical conditions most reported were high blood pressure (54.4%); arthritis (49.2%); high lipids (40.5%); hearing loss (35.2%); and chronic pain (28.3%). Additionally, about one-quarter (23.0%) reported depression or cancers (23.2%). Concerning disabilities, 15.4% reported disability of feet and legs and another 8.1% had a disability of the arms and hands. Overall, 20.9% reported having no natural dentition.

Almost all participants (99.4%) self-reported taking medications, with an average of 4.3 medications per person (SD = 3.2; range 1–29). No significant differences were present by health conditions or number of medications by sex. However, differences in health conditions and the number of medications were significant by age. As age increased, there were more health conditions and more medications were taken. By level of education, those with tertiary education had fewer health conditions than any other education level and consequently took fewer medications. Those with no natural dentition (20.9%) reported an average of 7.6 (SD = 3.7) conditions compared to 6.3 (SD = 3.6) of those who reported having some natural teeth ($p < 0.001$). Consequently, they also self-reported taking more medications (4.8 (SD = 3.5) vs. 4.0 (SD = 3.1); $p < 0.001$). The distribution of health conditions among older adults is presented in Table 2.

Of particular significance, among the participants who underwent the 2-h health screening (n = 572), a substantial proportion (79.9%) reported taking at least one medication that had the potential to induce xerostomia (such as antidepressants, antihypertensives, etc.) (See Table 3).

Moreover, in relation to dry mouth, as age increases, there is a significantly higher intake of medications that could lead to xerostomia. In addition, by absence or presence of natural dentition, those with no natural dentition had a higher intake of medications (1.46 (SD = 1.0) vs. 1.20 (SD = 0.9); $p = 0.015$). However, there were no differences in the number of medications that may cause dry mouth by sex, place of residence, or level of education.

Almost two-thirds (65.2%) of participants reported consuming alcohol, with an average intake of 8.1 drinks per week among those who self-reported alcohol consumption. About 1 in 4 (24.9%) of them reported consuming more than 10 standard drinks per week.

Table 2. Distribution of health conditions among older adults living in rural Victoria, Australia.

Variables	Categories	% ¹
Medical conditions	High blood pressure	54.4
	Arthritis	49.2
	Allergies	32.1
	Chronic pain	28.2
	Depression	23.0
	Diabetes	14.9
	Cardiovascular disease	12.9
	Respiratory disease	21.2
	Cancer	23.2
	Hearing loss	35.2
	Eye problems	93.5
	Disability feet and legs	15.4
	Disability arms and fingers	8.1
Number of medical conditions	None	0.2
	One	5.3
	Two	6.6
	Three	9.4
	Four	10.9
	Five	10.4
	Six	11.6
	Seven or more	46.9

¹ n = 1407.**Table 3.** Distribution of medication consumption among older adults living in rural Victoria, Australia.

Variables	Categories	% ¹
Number of medications	None	0.9
	One	24.2
	Two	19.5
	Three	16.1
	Four	10.9
	Five	10.2
	Six or more	19.2
Number of medications that may affect xerostomia	None	20.1
	One	44.6
	Two	25.0
	Three or more	10.3

¹ n = 572.

Additionally, 9.5% of participants identified as current smokers, with an average of 13.4 cigarettes smoked per day. Among those who reported smoking, the proportion of light smokers (fewer than 10 cigarettes per day) was 25.8%, moderate smokers (10 to 19 cigarettes per day) accounted for 53.1%, and another 21.1% was accounted for by heavy smokers (20 or more cigarettes per day). Furthermore, 38.1% of participants reported being

past smokers. As expected, significant differences by sex were found in both the number of drinks per week ($p < 0.01$) and the number of cigarettes per day ($p < 0.05$), with men drinking and smoking larger amounts than women. By location, those living in Shire capitals tended to smoke more compared to those living in Shepparton ($p < 0.02$). No differences were found by location in the level of alcohol consumption.

Beyond these lifestyles, the study also found that the majority of participants (60.2%), were involved in clubs and other social organizations. No differences were observed in community participation by sex or place of living. By level of education, those with tertiary education tended to have a higher participation than other education groups ($p < 0.01$). It was also found that the average age of participants in community groups was higher compared to those who did not participate (70.3 (SD = 9.1) years vs. 67.1 (SD = 8.7) years; $p < 0.001$).

4. Discussion

This study examined the demographic characteristics and distribution of common systemic health conditions of a group of adults aged 55 years and older living in rural areas of the Australian state of Victoria. The findings of this study are consistent with previous research on oral health conditions in rural areas of Victoria [26]. Furthermore, the study aligns with existing evidence that non-communicable diseases are the primary contributors to morbidity and mortality rates in Australia [27]. The study reveals that a majority reported having multiple medical conditions that may affect their oral health. Heart-related diseases, high blood pressure, arthritis, high lipids, visual impairments, hearing loss, chronic pain, diabetes, and depression were found to be highly prevalent in this sample of older adults.

The assessment also included conditions that may impact oral healthcare and oral hygiene, including visual impairments (even with the use of corrective eyewear), hearing impairments, and manual dexterity challenges as measured by arm and hand disabilities. Furthermore, the findings also report the presence of other disabilities among the participants, as these may affect access to healthcare services. For example, some reported having a disability in their feet and legs. Also, a significant proportion of the participants reported not having all of their natural teeth. Although the absence of natural teeth, or edentulism, is not universally classified as a disability in all contexts [27], it can significantly impact an individual's quality of life, leading to functional impairments that may be recognized as disabling in certain circumstances [28]. For example, functional or psychological impairments [29]. Additionally, the role of certain foods in promoting health, enhancing well-being, and reducing the risk of diseases has led to the use of terms such as functional or therapeutic foods [30]. Tooth loss can alter dietary intake and therefore contribute to an increased risk of chronic disease development and decreased well-being [30].

The majority of participants were taking medications, with an average of 4.3 medications per person. Among them, a large proportion reported taking medications that could cause xerostomia (i.e., dry mouth). For example, 54.4% of the participants reported a positive history of high blood pressure and another 49.3% reported arthritis, which raises concerns for oral healthcare as high blood pressure and arthritis (e.g., Nonsteroidal Anti-Inflammatory Drugs) medication is associated with salivary hypofunction and can contribute to dry mouth [23,31,32]. Depression was another health condition observed: the use of antidepressants can reduce salivary flow and cause dry mouth. Depressed individuals also tend to have lower rates of salivary flow even without medication and untreated depression can lead to neglected oral hygiene and gum disease. Additionally, several over-the-counter medications, such as expectorants and decongestants, can also reduce saliva flow [23]. Interestingly, in the present study, those with no natural teeth (i.e., edentulous) reported more health conditions and higher medication consumption than those who kept some natural teeth.

The prevalence and amount of alcohol consumption and smoking and average number of drinks per week and cigarettes smoked per day were relatively high among (XRoadsII)

participants, although not different from the national averages for these age groups [24,25]. Still, the present results reinforce the need for targeted interventions to address these risk factors and promote healthier behaviors. Additionally, there is a need for comprehensive oral cancer-related education and screening training for oral health professionals to enhance the prevention and early detection of oral cancer [33]. It is also essential to increase the level of confidence among oral health professionals in discussing behavioral issues that may impact oral health, such as smoking and alcohol consumption, with their patients. By addressing these areas, a significant impact can be made on improving oral health outcomes in older adults [33].

The involvement in social activities suggests an acceptable, although lower than the national average (77%) [26], level of community engagement and could indicate strong social support networks and integration into communal life, which are important for health promotion [34,35]. Older adult communities often engage in club activities. Utilizing this 'settings approach' for promoting oral health among older adults aligns well with the WHO Primary Health Care Model and the principles outlined in the Ottawa Charter on Health Promotion [34].

In spite of numerous studies demonstrating the interrelationship between systemic conditions and oral health, there is a notable deficit of knowledge and understanding among healthcare professionals about this connection [36], highlighting a gap between scientific evidence and actual practices. Furthermore, the availability of preventive measures for oral diseases is often underestimated and considered to be inevitable, resulting in increased national and household healthcare expenditures [8]. Individuals with chronic diseases tend to experience a considerably higher burden of oral disease compared to their healthy peers [37]. The integration of oral health into general health programs, particularly targeting older adults, is being advocated [8,38,39].

This study highlights the importance of knowledge and understanding among healthcare professionals about the connection between oral health and systemic conditions. This leads to underestimation and neglect of oral diseases, resulting in increased healthcare expenditures. Healthcare professionals often do not inquire about patients' oral health [40]. Bridging the gap between oral and general health can lead to comprehensive care and improved health outcomes for older adults. The challenges in maintaining good oral health include low awareness, a lack of motivation, and discomfort [36]. Educating healthcare professionals about the relationship between oral and systemic health is crucial for informed treatment decisions.

Although the results of this study should be interpreted in light of its cross-sectional design, given the self-reported nature of the data and the specific focus on rural areas of the state of Victoria, we believe that the large sample size, use of validated assessment instruments, comprehensive data collection, and the substantial population base provide a significant contribution to the understanding of older Victorians' health. With the aging population in Australia and other developing nations, particularly in rural areas [41] coupled with robust evidence on the reciprocal links between oral diseases and chronic conditions, it is imperative to implement policies and innovative initiatives to make oral healthcare services and preventive programs affordable and accessible for this growing demographic.

The FDI's statement on oral health emphasizes the need to articulate a clear understanding of oral health to improve and facilitate effective communication and collaboration among healthcare professionals [4]. This improves communication and collaboration within the dental field and with other healthcare professionals and policymakers.

Education programs are crucial in raising awareness about the impact of systemic oral health by helping healthcare practitioners make informed clinical decisions. Pharmacists should also be aware of the association between over-the-counter medications and dry mouth. Many countries face similar challenges, making current research results relevant for further investigation and planning.

5. Conclusions

In Australia and around the world, older populations have grown consistently in recent decades, with this trend projected to continue. As such, it is crucial to actively anticipate and meet the needs of this aging population. This study provides insights into the demographics, medical conditions, medication use of the older adult population, and lifestyle factors and social engagement of older adults living in rural areas of Victoria with a specific focus on addressing the importance of oral health. The findings suggest that age, education level, and natural dentition may be associated with different health conditions and medication consumption patterns. More importantly, the study supports the notion that disparities in health begin early in life and persist throughout the lifespan [42]. Individuals with chronic diseases tend to experience a significantly higher burden of oral disease compared to their healthy counterparts [41].

This study emphasizes the need for enhanced education and training for oral health professionals regarding the interplay between oral health and systemic health in order to promote better interdisciplinary collaboration and comprehensive patient care. These findings highlight the fundamental role of oral health professionals, such as dentists, dental hygienists, and oral health therapists, in recognizing and communicating the significant connection between oral health and systemic health to their patients. The findings also offer initial insights into the prevalence of medical conditions and medication usage among older adults in rural Victoria, which may have implications for their oral health. Information from this study can be invaluable for healthcare and dental workforce planning, policy development, and the enhancement of overall well-being in this population.

Author Contributions: Conceptualization and methodology K.G., L.B. and D.S.; formal analysis, R.M.; writing—original draft preparation, R.M.; writing—review and editing, R.M., K.G., L.B. and D.S. All authors have read and agreed to the published version of the manuscript.

Funding: The Crossroads-II was supported by the National Health and Medical Research Council (NHMRC), partnership grant (APP 1113850) and associated partners, including Goulburn Valley Health, Primary Care Connect, Benalla Health, Cobram District Health, Seymour Health, Moira Shire, Goulburn Valley Primary Care Partnerships, Shepparton Access, City of Greater Shepparton, Alfred Health, and the Department of Rural Health, The University of Melbourne.

Institutional Review Board Statement: The primary study, Crossroad II, was conducted in accordance with the Declaration of Helsinki and the ethics approval was granted by the Goulburn Valley Health Ethics Committee (GVH 20/16).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data will be available on reasonable request using an application form from the Crossroads Chief Investigator (D.S.).

Acknowledgments: The researchers thank all participants who volunteered their time to the Crossroads II study. We are also grateful for all the Research Assistants who collected data for the Crossroads II, namely Sian Wright, Veronica Coady, Fulya Torun, Zahra Ali, Delia Allen, Jayden Andrew, Shane Barbary, Lauren Barker, Felicity Booth, Lou Bush, Amanda Clarkson, Nicole Dalle-Nogare, Madhulika Golhar, Priscilla Howden, Terry James, Viv Jeffries, James Kolacz, Lisa McCoy, Jill McFarlane, Angela Magoga, Zubaidah Mohamed Shaburidin, Bruce Naylor, Patricia Patt, Lyn Pierce, Karen Quinlan, Catherine Sambell, and Peter Wnukowski-Mtonga. We acknowledge the National Health and Medical Research Council and our local partners for funding. Furthermore, research within the Department of Rural Health, University of Melbourne is supported by the Australian Government Department of Health through the Rural Health Multidisciplinary Training Program.

Conflicts of Interest: The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of the data; in the writing of the manuscript; or in the decision to publish the results.

References

1. Australian Institute of Health and Welfare. *Rural & Remote Health Australians*; AIHW: Canberra, Australia, 2024. Available online: <https://www.aihw.gov.au/reports/rural-remote-australians/rural-and-remote-health> (accessed on 7 June 2024).
2. Skinner, M.W.; Winterton, R. Interrogating the Contested Spaces of Rural Aging: Implications for Research, Policy, and Practice. *Gerontologist* **2017**, *5*, 15–25. [CrossRef]
3. World Health Organization. *Global Oral Health Status*; Department of Noncommunicable Diseases, Universal Health Coverage/Communicable and Noncommunicable Diseases (UCN) World Health Organization (WHO): Geneva, Switzerland, 2022.
4. Glick, M.; Williams, D.M.; Kleinman, D.V.; Vujicic, M.; Watt, R.G.; Weyant, R.J. A new definition for oral health developed by the FDI World Dental Federation opens the door to a universal definition of oral health. *J. Am. Dent. Assoc.* **2016**, *147*, 915–917. [CrossRef]
5. World Dental Federation. FDI Policy Statement. Noncommunicable Diseases. 2012. Available online: <https://fdiworlddental.org/noncommunicable-diseases> (accessed on 7 June 2024).
6. World Health Organization. *Oral Health in Ageing Societies: Integration of Oral Health and General Health*; WHO: Geneva, Switzerland, 2008.
7. U.S. Department of Health and Human Services. *Oral Health in America: A Report of the Surgeon General*; U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health: Rockville, MD, USA, 2000. Available online: <https://www.nidcr.nih.gov/sites/default/files/2017-10/hck1ocv.www.surgeon.fullrpt.pdf> (accessed on 13 April 2013).
8. Australian Institute of Health and Welfare. Oral Health and Dental Care in Australia. 2023. Available online: <https://www.aihw.gov.au/getmedia/54eca525-8a32-4ec4-96cb-f3c8aa551f8c/oral-health-and-dental-care-in-australia.pdf?inline=true> (accessed on 7 June 2024).
9. Ministerio de Salud. Estrategia Nacional de Salud para los Objetivos Sanitarios al 2030. 2022. Available online: <https://www.minsal.cl/wp-content/uploads/2022/03/Estrategia-Nacional-de-Salud-2022-MINSAL-V8.pdf> (accessed on 3 March 2024).
10. Loesche, W.J.; Schork, A.; Terpenning, M.S.; Chen, Y.M.; Dominguez, B.L.; Grossman, N. Assessing the relationship between dental disease and coronary heart disease in elderly U.S. veterans. *J. Am. Dent. Assoc.* **1998**, *129*, 301–311. [CrossRef] [PubMed]
11. Cohen, M. Major long-term factors influencing dental education in the twenty-first century. *J. Dent. Educ.* **2002**, *66*, 360–373. [CrossRef]
12. Kandelman, D.; Petersen, P.E.; Ueda, H. Oral health, general health, and quality of life in older people. *Spec. Care Dentist.* **2008**, *28*, 224–236. [CrossRef]
13. Genco, R.; Williams, R. (Eds.) Overview. In *Periodontal Disease and Overall Health: A Clinicians' Guide*; Professional Audience Communications, Inc.: Yardley, PA, USA, 2010; pp. 1–4.
14. Hein, C. The role of the professional in education the public about the importance of oral health. In *Periodontal Disease and Overall Health: A Clinicians' Guide*; Genco, R., Williams, R., Eds.; Professional Audience Communications, Inc.: Yardley, PA, USA, 2010; pp. 288–304.
15. Al-Maweri, S.A.; Ibraheem, W.I.; Al-Ak'hali, M.S.; Shamala, A.; Hal-boub, E.; Alhajj, M.N. Association of periodontitis and tooth loss with liver cancer: A systematic review. *Crit. Rev. Oncol. Hematol.* **2021**, *159*, 103221. [CrossRef] [PubMed]
16. Seitz, M.W.; Listl, S.; Bartols, A.; Schubert, I.; Blaschke, K.; Haux, C.; Van Der Zande, M.M. Current Knowledge on Correlations Between Highly Prevalent Dental Conditions and Chronic Diseases: An Umbrella Review. *Prev. Chronic Dis.* **2019**, *16*, E132. [CrossRef]
17. Ioannidou, E.; Swede, H.; Dongari-Bagtzoglou, A. Periodontitis predicts elevated C-reactive protein levels in chronic kidney disease. *J. Dent. Res.* **2011**, *90*, 1411–1415. [CrossRef] [PubMed]
18. Thomopoulos, C.; Tsioufis, C.; Soldatos, N.; Kasiakogias, A.; Stefanadis, C. Periodontitis and coronary artery disease: A questioned association between periodontal and vascular plaques. *Am. J. Cardiovasc. Dis.* **2011**, *1*, 76–83. [PubMed]
19. Willershausen, B.; Kasaj, A.; Willershausen, I.; Zahorka, D.; Briseño, B.; Blettner, M.; Genth-Zotz, S.; Münzel, T. Association between chronic dental infection and acute myocardial infarction. *J. Endod.* **2009**, *35*, 626–630. [CrossRef]
20. Sjögren, P.; Nilsson, E.; Forsell, M.; Johansson, O.; Hoogstraate, J. A Systematic Review of the Preventive Effect of Oral Hygiene on Pneumonia and Respiratory Tract Infection in Elderly People in Hospitals and Nursing Homes: Effect Estimates and Methodological Quality of Randomized Controlled Trials. *JAGS* **2008**, *56*, 2124–2130. [CrossRef] [PubMed]
21. Ito, K.; Takamatsu, K.; Nohno, K.; Sugano, A.; Funayama, S.; Katsura, K.; Kaneko, N.; Ogawa, M.; Meurman, J.H.; Inoue, M. Factors associated with mucosal dryness in multiple regions and skin: A web-based study in women. *J. Obstet. Gynaecol. Res.* **2017**, *43*, 880–886. [CrossRef] [PubMed]
22. Glenister, K.M.; Bourke, L.; Bolitho, L.; Wright, S.; Roberts, S.; Kemp, W.; Rhode, L.; Bhat, R.; Tremper, S.; Magliano, D.J.; et al. Longitudinal study of health, disease and access to care in rural Victoria: The Crossroads-II study: Methods. *BMC Public Health* **2018**, *18*, 670. [CrossRef] [PubMed]
23. Plemons, J.M.; Al-Hashimi, I.; Marek, C.L. Managing xerostomia and salivary gland hypofunction Executive summary of a report from the American Dental Association Council on Scientific Affairs. *JADA* **2014**, *145*, 867–873. [CrossRef] [PubMed]
24. Australian Institute of Health and Welfare. Older People's Use of Alcohol, Tobacco, e-Cigarettes and Other Drugs. 2024. Available online: <https://www.aihw.gov.au/reports/older-people/older-people-alcohol-drugs> (accessed on 7 June 2024).

25. Greenhalgh, E.M.; Scollo, M.M.; Bayly, M. 2.3 Self-reported measures of tobacco consumption. In *Tobacco in Australia: Facts and Issues*; Greenhalgh, E.M., Scollo, M.M., Winstanley, M.H., Eds.; Cancer Council Victoria: Melbourne, Australian, 2024. Available online: <http://www.tobaccoinaustralia.org.au/chapter-2-consumption/2-3-self-reported-measures-of-tobacco-consumption> (accessed on 7 June 2024).
26. Simmons, D.; Culliney, K.; Joshy, G.; McKenzie, A.; Morgan, M. Dental health in rural Victoria: The Crossroads Household Survey. *Aust. Dent. J.* **2006**, *51*, 140–145. [[CrossRef](#)] [[PubMed](#)]
27. Australian Institute of Health and Welfare. Older Australians. Available online: <https://www.aihw.gov.au/reports/older-people/older-australians/contents/demographic-profile#Australia%E2%80%99s%20older%20population> (accessed on 7 June 2024).
28. Emami, E.; de Souza, R.F.; Kabawat, M.; Feine, J.S. The impact of edentulism on oral and general health. *Int. J. Dent.* **2013**, *2013*, 498305. [[CrossRef](#)] [[PubMed](#)]
29. Locker, D. Measuring oral health: A conceptual framework. *Community Dent. Health* **1988**, *5*, 3–18. [[PubMed](#)]
30. Maćkowiak, K.; Torlińska-Walkowiak, N.; Torlińska, B. Dietary fibre as an important constituent of the diet. *Postepy Hig. Med. Dosw.* **2016**, *70*, 104–109. [[CrossRef](#)] [[PubMed](#)]
31. Gheezi, E.; Ship, J. Systematic disease and their treatment in the Elderly: Impact on oral health. *J. Public Health Dent.* **2000**, *60*, 289–296. [[CrossRef](#)]
32. Queremel-Milani, D.A.; Davis, D.D. Pain Management Medications. In *StatPearls [Internet]*; StatPearls Publishing: Treasure Island, FL, USA, 2024. Available online: <https://www.ncbi.nlm.nih.gov/books/NBK560692/> (accessed on 7 June 2024).
33. Mariño, R.; Haresaku, S.; McGrath, R.; Bailey, D.; McCullough, M.; Musolino, R.; Kim, B.; Chinnasamy, A.; Morgan, M.V. Oral Cancer Screening Practices of Australian Oral Health Professionals. *BMC Oral. Health* **2017**, *17*, 151. [[CrossRef](#)]
34. World Health Organization: Ottawa Charter for Health Promotion 1986. Charter Adopted at an International Conference on Health Promotions. Available online: <https://www.who.int/teams/health-promotion/enhanced-wellbeing/first-global-conference/emblem> (accessed on 12 February 2024).
35. Mariño, R.; Calache, H.; Wright, C.; Schofield, M.; Minichiello, V. Oral health promotion programme for older migrant adults. *Gerodontology* **2004**, *21*, 216–225. [[CrossRef](#)] [[PubMed](#)]
36. Parveen, S.; Qahtani, A.S.A.; Halboub, E.; Hazzazi, R.A.A.; Madkhali, I.A.H.; Mughals, A.I.H.; Baeshen, S.A.A.; Moaidi, A.M.; Al-Ak'hali, M.S. Periodontal-Systemic Disease: A Study on Medical Practitioners' Knowledge and Practice. *Int. Dent. J.* **2023**, *73*, 854–861. [[CrossRef](#)] [[PubMed](#)]
37. Oral Health in America: Advances and Challenges. Section 1, *Effect of Oral Health on the Community, Overall Well-Being, and the Economy*; National Institute of Dental and Craniofacial Research: Bethesda, MD, USA, 2021. Available online: <https://www.ncbi.nlm.nih.gov/books/NBK578297> (accessed on 17 May 2024).
38. Chan, A.K.Y.; Tsang, Y.C.; Jiang, C.M.; Leung, K.C.M.; Lo, E.C.M.; Chu, C.H. Integration of Oral Health into General Health Services for Older Adults. *Geriatrics* **2023**, *8*, 20. [[CrossRef](#)] [[PubMed](#)]
39. Institute of Medicine and National Research Council. *Improving Access to Oral Health Care for Vulnerable and Underserved Populations*; The National Academies Press: Washington, DC, USA, 2011. Available online: <https://nap.nationalacademies.org/read/13116/chapter/1#ii> (accessed on 17 May 2024).
40. Dubar, M.; Delatre, V.; Moutier, C.; Sy, K.; Agossa, K. Awareness and practices of general practitioners towards the oral-systemic disease relationship: A regionwide survey in France. *J. Eval. Clin. Pract.* **2020**, *26*, 1722–1730. [[CrossRef](#)]
41. Australian Institute of Health and Welfare. Older Australians. Older Australians Living in Rural and Remote Communities. Cat. no: AGE 87. 2024. Available online: <https://www.aihw.gov.au/getmedia/73a6a317-b508-4ecc-834a-cb0a54378b9d/older-australians.pdf?v=20240410145557&inline=true> (accessed on 7 June 2024).
42. Acheson, D. *Independent Inquiry into Inequalities in Health*; Stationery Office: London, UK, 1998. Available online: <https://assets.publishing.service.gov.uk/media/5a759e7c40f0b67b3d5c7e6f/ih.pdf> (accessed on 7 June 2024).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.