

Second Edition

Oral Healthcare and the Frail Elder



Editors

**Michael I. MacEntee • Frauke Müller
C. Peter Owen • W. Murray Thomson**

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Contents

Foreword xv

Preface xvi

List of Contributors xix

1 Demography of Aging and Frailty, and the Epidemiology of Oral Conditions 1

W. Murray Thomson, Moira B. Smith, Fernando Neves Hugo, and Philippe Mojon

Demography of Aging and Frailty 1

The Aging Population 1

Conceptualizing Aging 1

Multimorbidity 2

Frailty 3

Oral Frailty 4

Importance of the Life-Course 4

Epidemiology of Oral Conditions in Older People 5

Edentulism and Incremental Tooth Loss 5

Dental Caries 7

Periodontitis 7

Oral Mucosal Lesions 7

Dry Mouth 9

Muscular and Joint Disorders 9

Conclusion 10

References 10

2 Challenges with Noncommunicable Diseases and Frailty 16

Michael I. MacEntee, Paul Allison, Denise Laronde, and Bruce Wallace

Noncommunicable Disease 16

Frailty 18

Noncommunicable Diseases of the Mouth 19

Dental Caries 19

Periodontal Disease 21

Tooth Loss 23

Oral Cancers 24

Risks for Noncommunicable Diseases of the Mouth 25

Sugar 25

Tobacco 25

Alcohol	26
Aging	26
Immune System and Oxidative Stress	26
Other Risks	27
Social Determinants	27
Conclusion	28
References	28
3 Theoretical Perspectives on Frailty, Oral Health-Related Quality of Life, and Well-Being in Old Age	37
<i>Michael I. MacEntee, Dominique Niesten, Mario A. Brondani, and Maha M. Al-Sahan</i>	
Health	38
International Classification of Functioning	39
Oral Health	40
Comfort, Well-Being, and Quality of Life	42
The Myth of Measurement	42
Frailty	43
Oral Frailty	44
Managing Ill-Health and Frailty	45
A Metatheory	45
A Clinical Scenario	46
Conclusion	47
References	47
4 Communities and Frail Elders	54
<i>C. Peter Owen, Michael I. MacEntee, Rodrigo Marino, Victor Minichiello, and Gladys Meriting Thokoane</i>	
What Is a Community?	54
Culture and Ethnicity	55
Culture and Acculturation	55
Ethnicity	56
Communities of Elders	56
Barriers to Equitable Healthcare	57
Agism	57
Racism	58
Migration	59
Equitable Healthcare and Cultural Competence	60
Health Advocacy	61
Conclusion	63
References	63
5 Oral Healthcare Policy, Equity, Economics, and Political Action for Aging Populations	68
<i>F.A. Clive Wright, Michael I. MacEntee, Joke Duyck, Moira B. Smith, Bruce Wallace, and C. Peter Owen</i>	
Purpose of Policy	68
Categories of Public Health Policy	69
Uniqueness of Health Policy	70

Forming Health Policy	70
Equality and Equity	71
Agism	71
Adopting Health Policy	72
Financial Policies	73
Analyzing and Assessing Health Policy	73
Global Strategy on Oral Health	76
The Challenge	76
Promoting Oral Healthcare Policies	76
Oral Healthcare Workforce	78
Pyramid of Primary Oral Healthcare	78
Conclusion	79
References	80

6 The Influence of the Mouth and Mouthcare on the Body-Image and Social Interactions of Frail Elders 87

Leeann Donnelly, Laura Hurd, Alison Phinney, and Michael I. MacEntee

Body-Image and Oral Health	87
Social Isolation, Loneliness, and Depression	88
Clinical Implications	89
Oral Health and Social Interactions	90
Clinical Script	90
Conclusion	92
References	92

7 Ethical and Moral Considerations for Oral Healthcare of Frail Elders 96

Michael I. MacEntee, Mario A. Brondani, Nico Creugers, Shafik Dharamsi, and Mary E. McNally

Healthcare Ethics	96
Frailty	97
Ethical Theory and Principles in Healthcare	97
Patient-Centered Care, Care Ethics, Narrative Ethics, and Feminism	98
Moral Distress	99
Moral Injury	100
Surrogate Decision-Makers	100
Ethical Dilemmas	101
Socially Responsible Care	101
Universal Health Coverage	101
Professional Responsibilities	102
Elder Abuse	102
Reporting Abuse	103
Identifying and Managing Elder Abuse	103
An Ethical Framework	104
Clinical Context	105
Clinical Scripts	106
Complexities	106
References	109

- 8 Educating a Workforce for Dental Geriatrics 115**
Matana Kettratad-Pruksapong, Shiva Khatami, Linda Slack-Smith, Jirakate Madiloggovit-Lower, Leonardo Marchini, C. Peter Owen, and Michael I. MacEntee
 Teaching and Learning Dental Geriatrics 115
 Exposure to Frailty 116
 Postgraduate Education 116
 Cultivating Clinical Reasoning 116
 Promoting Compassion 118
 Healthcare-Teams 119
 Conclusion 120
 References 120
- 9 Chronic Orofacial Pain and Movement Disorders in Old Age and Frailty 125**
Pierre J. Blanchet, Limor Avivi-Arber, Barry J. Sessle, and Gilles J. Lavigne
 Assessing Pain 125
 Age-Related Changes in Processing Pain 126
 Mechanisms of Processing and Modulating Pain 126
 Afferent Nerve Fibers 127
 Pain Processing and Modulation 127
 Pain-Related Sensorimotor and Other Functions of the CNS 127
 Orofacial Pain 128
 Temporomandibular Disorder (TMD) Pain 128
 Management of TMD Pain 128
 Lesion or Disease of the Cranial Nerves 128
 Trigeminal Neuralgia 128
 Other Trigeminal Neuropathic Pain 129
 Postherpetic Neuralgia 129
 Idiopathic Orofacial Pain Conditions 130
 Burning Mouth Syndrome 130
 Persistent Idiopathic (Atypical) Facial Pain 131
 Persistent Idiopathic Dentoalveolar Pain (Atypical Odontalgia) 131
 Movement Disorders and Orofacial Pain 132
 Oromandibular Dystonia 132
 Management of Oromandibular Dystonia 132
 Oral Dyskinesia 132
 Management of Oral Dyskinesia 133
 Stereotypies 133
 Management of Stereotypies 133
 Bruxism 133
 Management of Bruxism 134
 Parkinson Disease 134
 Management of Parkinson Disease 134
 Conclusion 135
 References 138

- 10 Nutritional Consequences of Oral Health in Frail Elders 143**
Paula Moynihan, Kazunori Ikebe, and Rena Zelig
Changing Nutritional Needs of Frail Elders 143
 Energy Requirements 143
 Protein 144
 Micronutrients 144
 Vitamins 144
 Minerals 145
 Hydration 145
Malnutrition/Undernutrition in Elders 145
 Malnutrition/Undernutrition Prevalence in Facility and Community Settings 146
 Reasons for Malnutrition 146
 Consequences of Malnutrition 148
 Assessing Malnutrition in Older People 148
 Interventions for Patients with, or at Risk of, Malnutrition/Undernutrition 150
Diet and Oral Health in Frail Elders 151
 Diet and Dental Caries in Frail Elders 151
 Oral Function and Nutrition 152
 Importance of Oral Health in Preventing Frailty 153
 Impact of Prosthodontics on Diet 153
 Wearing Dentures 153
 Dentures and Eating-Related Quality of Life 154
 Dietary Advice with Tooth Loss 154
References 154
- 11 Dry Mouth and Medications 160**
W. Murray Thomson and Chao Shu Yao
The Salivary System 160
 Nerve Supply 161
The Role of Saliva 163
What Is Dry Mouth? 165
How Do We Measure Dry Mouth? 165
Prevalence and Impact of Dry Mouth 167
Medications and Dry Mouth 168
Managing and Preventing Dry Mouth 173
Conclusion 175
References 175
- 12 Dementia, Sleep Apnea, and Dysphagia 180**
Michael I. MacEntee, Fernanda Almeida, B. Lynn Beattie, Najla Chebib, and Frauke Müller
Dementia 180
 Diagnostic Challenges 183
 Care-Resistant Behavior 183
 Preparing for the Worst 185
 Home Care and Prophylaxis 185

	Sleep and Aging	187
	Common Sleep Disorders in Old Age	187
	Insomnia	187
	Restless Legs Syndrome (RLS) and Periodic Limb Movements in Sleep	187
	REM Sleep Behavior Disorder	187
	Sleep-Disordered Breathing	188
	OSA and Complete Dentures	189
	Swallowing, Dysphagia, and Pneumonia	189
	Swallowing	189
	Oral Phases	190
	Pharyngeal and Esophageal Phases	190
	Dysphagia	191
	Aspiration	192
	Pneumonia	193
	Controversy	194
	References	195
13	A Framework for Assessing Oral Healthcare Programs in Residential Care Facilities	200
	<i>Matana Kettratad-Pruksapong, Joke Duyck, Michael I. MacEntee, Arminee Kazanjian, and B. Lynn Beattie</i>	
	Challenges	200
	Healthcare Accountability	200
	Quality of Care-Assessment	200
	Program Evaluation	201
	Meaningful Outcomes in Residential Care	202
	Residential Facilities	203
	Conclusion	205
	References	205
14.1	Mitigating the Effects of Harmful Commodities on Dental Caries and Periodontal Diseases: Section 1: Dental Caries	208
	<i>Alan A. Deutsch, W. Murray Thomson, and Michael I. MacEntee</i>	
	Caries Through the Life-Course	208
	Caries Risk	209
	Risk Assessment	209
	Prevention and Management	210
	Dietary Sugars	210
	Saliva	211
	Fluorides	211
	Oral Hygiene	213
	Conclusion	214
	References	214
14.2	Mitigating the Effects of Harmful Commodities on Dental Caries and Periodontal Diseases: Section 2: Periodontitis and Gingivitis	217
	<i>Jim Yuan Lai, Howard C. Tenenbaum, Michael B. Goldberg, and Elaine Cardoso</i>	
	Periodontitis as a Noncommunicable Disease	217

Pathogenesis	217
Mitigation and Management	218
Periodontitis and Other Noncommunicable Diseases	218
Diabetes	219
Managing Periodontal Conditions for Frail Elders with Diabetes	219
Hypoglycemic Emergency	220
Cardiovascular Diseases	220
Epinephrine and Cardiovascular Disease	221
Treatment Sessions	221
Anticoagulants and Postsurgical Bleeding	221
Conclusion	222
References	223

15 Treatment Planning, and Integrating Oral and General Healthcare 226

C. Peter Owen, Joke Duyck, Barbara Janssens, David MacDonald, Chao Shu Yao, Alan A. Deutsch, and Michael I. MacEntee

Integrating Oral and General Health	226
Integrated Care	227
Assessing the Need for Care	228
Age	228
General Health	229
Communications	229
Social and Financial Status	229
Environment	230
Mobility	230
Cooperation	232
Clinical Assessment—Screens	232
Screening by Dental Personnel	232
Screening by Nondental Personnel	232
Radiography	233
Planning Protocols	235
Infections	236
Contamination	236
Control	237
Waste Management	237
Disinfecting Environmental Surfaces and Fomites	237
Conclusion	238
References	239

16 Care and Management of Frail and Osteoporotic Elders with Special Emphasis on Minor Oral Surgery 245

Michael M. Bornstein and Pedro Molinero-Mourelle

Minor Oral Surgery for Elders—General Considerations	246
Local Anesthesia	246
Sedation and General Anesthesia	247
Presurgical Considerations	247
The Osteoporotic Patient	247

- Antiresorptive Therapy 249
- Respiratory Conditions 249
- Cardiovascular Diseases 251
 - Antibiotic Prophylaxis 251
- Antiplatelet and Anticoagulant Drugs 252
- Diabetes Mellitus 254
- Psychological Disorders 255
- Cancer 255
- Recommendations and Conclusion 255
- References 256

17 Oral Rehabilitation of the Frail Elder 260

C. Peter Owen, Shane White, Gerald McKenna, Sabrina Maniewicz, Nico Creugers, Michael I. MacEntee, and Frauke Müller

- Endodontic Rehabilitation 261
 - Epidemiology and Diagnosis 261
 - Endodontic Outcomes 261
 - Patient Considerations 262
 - Technical Challenges 262
- Restoring Endodontically Treated Teeth 263
 - Structurally Weak Teeth 263
- Partial Tooth-Loss 265
 - Shortened Dental Arch 265
 - Resin-Bonded Fixed Dental Prostheses 265
 - Metal-Ceramic Prostheses 265
 - Fiber-Reinforced Composite 266
- Removable Dental Prostheses 267
- Tooth-Supported Overdentures 268
- Complete Tooth-Loss 269
 - Mucosa-Borne Complete Dentures 269
 - Relining Removable Dentures 270
 - Duplicating Dentures 271
 - Labeling Removable Dentures 272
- Implant-Supported Prostheses 272
- Dental Restorations and Prostheses 275
- Digitally Constructed Prostheses 275
- Cross-Infection During Dental Treatment 275
- Denture Hygiene 276
- Sleep Apnea and Denture Use 276
- Conclusion 276
- References 277

18 Integrating Oral Health in Palliative Medicine 286

Martin Schimmel, Frauke Müller, Chao Shu Yao, Stephen Sonis, and Michael Wiseman

- Dentistry in Palliative Care 286
- Oral Health in Palliative Care 288
- Therapies 289

Radiation Therapy	289
Chemotherapy	289
Immunotherapy and Targeted Therapy	289
Oral Health and Terminal Illness	290
Oral Mucositis	290
Treating Oral Mucositis	291
Scoring Mucositis	291
Preventing and Treating Mucositis	292
Oral Hygiene and Dental Caries	292
Dry Mouth	293
Fungal Infections	293
Taste Disorders and Dysphagia	295
Nausea and Vomiting	295
Dentistry	296
Conclusion	296
References	297

19 Mobile Dental Services 303

Murali Srinivasan, Barbara Janssens, David MacDonald, and Frauke Müller

Preferences of Frail Elders	304
Service Models	304
Fixed Dental Clinics	304
Mobile Dental Clinics	305
Mobile Equipment	305
Portable Domiciliary Care	306
Mobile Clinic in a Vehicle	307
Lighting Mobile Clinics	307
Setting-up Mobile Dental Services	308
A Mobile Clinic	309
Equipment and Instruments	309
Organization	309
Costs	310
Scope of Mobile Services	310
Cost-Effectiveness	311
Challenges	311
Mitigating Challenges	312
Setting-up Mobile Equipment	312
Conclusion	313
References	313

20 Communications and Teledentistry 316

Chris Wyatt, Mario A. Brondani, Leeann Donnelly, Nicholas Tong, and Shunhau To

Introduction	316
Principles of Communication	316
Person-Centered Communication	317
Communication Strategies	318
Institutional Communication	318

Community Dental Clinic Communication	319
Interprofessional Communication	319
Medical and Dental Records	321
Teledentistry	322
Teledentistry Referrals	322
Conclusion	325
References	325
21 Oral Healthcare for Frail Elders in Low-Income Communities	329
<i>C. Peter Owen, Matana Kettratad-Pruksapong, Matshediso Mothopi-Peri, Frankie Hon Ching So, F.A. Clive Wright, and Michael I. MacEntee</i>	
Global Expenditures on Health	329
Appropriatech	330
Responses to Constrained Resources	332
Australia and New Zealand	332
Canadian Indigenous Communities	333
Hong Kong	335
South Africa	335
Thailand	336
Conclusion	336
References	336
22 Summary	340
<i>Michael I. MacEntee</i>	
Index	341

Foreword

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It is now over 10 years since the first edition of *Oral Healthcare and the Frail Elder* was published. This edition is a significant expansion from the previous one. Interesting new chapters have been added and the emphasis has shifted from the clinical to a more philosophical and global approach.

The population of the US and Canada is aging. However, as people age, they are influenced by a variety of behaviors, such as poor diets, high sugar intakes, sedentary lifestyles which result in suboptimal exercise, and misuse of tobacco, alcohol, and drugs which lead to many chronic non-communicable diseases (NCD). With age, the culmination of these diseases is frailty both systemic and oral. Another complicating factor, according to the WHO, which can lead to frailty is the persistent and pervasive advertising and influence of the sugar, alcohol, and tobacco industries as increased consumption of these products can cause a variety of NCDs. These systemic and oral diseases have long latency periods before the development of acute exacerbations, for which there is no cure.

Oral healthcare is unfortunately not uniformly accessible in most countries. The fact is that the most vulnerable members of our society are the most likely to face the greatest barriers for receiving inadequate oral healthcare. The impact of not caring for these oral noncommunicable diseases (dental caries, periodontitis, mucositis, tooth loss, and some cancers) in frail older adults is magnified and has an impact on the quality of their life, general health, and morbidity and mortality. Caries is the most prevalent of these diseases and in general, preventive programs in the frail population have been a failure. The relationship between periodontal disease and other NCDs such as diabetes, cardiovascular disease, dementia, and mortality has been intensely studied. This relationship may be that periodontal disease and these other diseases share age-related inflammatory responses.

Unfortunately, total loss of teeth has been accepted in many cultures as the normal price of aging. In many frail older adults, the entry into long-term care has been associated with a breakdown in the dentition. The incidence of oral precancers and cancers is significant in frail populations. The social, emotional, and biological consequences of oral NCDs in frail older adults are discussed in detail in this book.

The purpose of the book is to provide the reader with the functional knowledge needed to understand the frail older population and to help clinicians develop and provide evidence-based care.

Preface: The Challenge of Aging and Frailty and Why a Second Edition?

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I will apply the regimens of treatment according to my ability and judgment for the benefit of my patients and protect them from harm and injustice... [and] Into whatever house I enter; I will do so for the benefit of the sick...

Source: Adapted from the Hippocratic Oath,
translation by Nicholas Dunkas, MD
(Retsas, 2019)



Why a Second Edition?

It is 10 years since the first edition of this book appeared and much has happened. Above all, there is mounting evidence that the dental and other healthcare professions are beginning to approach the challenges of oral health and related care in old age differently and more constructively than we did a decade ago. This change is occurring slowly but progressively, and it has prompted an

extensive reconsideration of the information in the first edition. Consequently, in constructing this new edition, we are responding to the following.

- There has been a substantial increase over the last decade in the population of frail and disabled elders who need continuous, safe, effective transdisciplinary care at home for as long as possible, and in residential facilities where available as their frailty and dependency on others increase (Table 1).
- Healthcare professions are now more aware than ever of these demographic and healthcare challenges as they search for their appropriate roles within the complicated environment of transdisciplinary care.
- It is clear that mouthcare is integral to general health in all age groups and possibly even more with increasing frailty.
- Knowledge of disease and disability has increased over the last decade, and many of the beliefs and recommendations in the original edition warrant revision to explain current challenges and barriers to oral health, and to better prepare dental and other professions for the needs and demands of frail elders.
- Oral diseases sit prominently within the context of noncommunicable disease that the World Health Organization (2020) identifies as a major global challenge for human development, a leading cause of morbidity, and disproportionately burdensome within low-income communities. Yet the curative interventions favored by the dental professions tend mainly to the biomedical demands of affluent communities (Watt et al., 2019).
- There is a need in dental geriatrics for a global focus on the principles of population and public health and of equity in healthcare by acknowledging that oral healthcare succeeds only by recognizing that oral disease and disability are, like cardiovascular disease, diabetes, cancer, obesity, and other noncommunicable diseases, influenced strongly by the pervasive social and commercial determinants of health and unrelenting social inequalities (Benzian et al., 2021).

This new edition attends closely to these upstream determinants of health as the foundation underlying a broad range of strategies for effectively managing the oral healthcare of frail elders. We focus particularly on people who are frail and unable to access the usual dental services accessible to older people. This acknowledges the broad challenges of oral healthcare in the context of noncommunicable disease, and health equity as a compounding challenge to frailty. Our evidence is drawn from, and relevant to, the international community of clinicians, public health providers, educators, and researchers in the dental and other health professions. We provide information that is highly relevant to public health and residential care administrators, policy makers, nurses, nutritionists, speech therapists, and physicians attending elders who are home-bound or in residential care.

Table 1 Five-year probability of survival with low or high frailty and co-morbidity.

Condition		Low frailty, no co-morbidity			High frailty, high co-morbidity		
Age in years		75	80	85	75	80	85
Survival %	Women	93	88	78	65	58	44
	Men	89	82	70	55	49	38

Source: Adapted from Schoenborn et al. (2022).

Overall, this book provides an evidence-based foundation of clinical knowledge from a global perspective for managing the oral health of frail elders.

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1

Demography of Aging and Frailty, and the Epidemiology of Oral Conditions

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This chapter covers the population aspects of aging and oral health. First, we consider the demography of aging and frailty, followed by a look at the aging process itself. Multimorbidity and frailty, including the notion of oral frailty, are described. We also provide an epidemiological overview of the common oral conditions, including tooth loss, dental caries, periodontitis, dry mouth, oral mucosal lesions, and temporomandibular disorders.

Demography of Aging and Frailty

The Aging Population

Worldwide, increased life expectancy and falling birth rates, which are largely a consequence of improved public health actions, have meant that the number and proportion of older people in many countries have increased. This rise has been rapid and is expected to continue. By 2050, 2.1 billion people, or 1 in 6, will be aged over 60 years, which is double the current older population. Within that group, the oldest-old (≥ 85 years) will increase the most, tripling current levels by 2050. While the age-related demographic changes up to now have predominantly occurred in high-income countries, it is the low- and middle-income countries where growth is expected in the future; by 2050, two-thirds of the global older population will reside in low- and middle-income countries.

Conceptualizing Aging

Aging is an inevitable feature of the human experience. Efforts to understand it have resulted in a plethora of explanatory biological and social theories (Table 1.1). No single theory fully explains aging, which underlines its complex and multifactorial nature. Moreover, the biological events involved in aging take place within social norms and societal contexts, which themselves show considerable variation.

Table 1.1 Theories of aging.

Theory	Brief description
<i>Biological theories^a</i>	
Replicative senescence	Somatic cells are capable of a finite number of divisions.
Accumulated mutation	Accumulation of somatic damage from “wear and tear” and compromised repair of DNA.
Antagonistic pleiotropy	Genes favoring survival in youth at the cost of harm in old age.
Disposable soma	Biological priority to perpetuate the species is followed by ineffective repair and maintenance of somatic cells when reproduction is complete.
<i>Social theories^b</i>	
Activity theory	Participation in enjoyable social activities promotes health and satisfaction in old age.
Disengagement theory	Gradual withdrawal from previously held roles benefits both the individual and society.
Continuity theory	Substitution of new roles for past activities and responsibilities as adaptation to age-associated changes occur. This challenges both activity theory and disengagement theory.

^a Adapted from Lipsky and King (2015).

^b Adapted from Hasworth and Cannon (2015).

While we all age at the same rate chronologically, there is considerable variation in rates of biological aging. Elliott et al. (2021) recently characterized and described differences in the pace of aging among participants followed to age 45 years in the Dunedin Multidisciplinary Health and Development Study, a prospective study which (to date) has followed a complete birth cohort to midlife. Using a composite measure assembled from 19 different biomarkers representing the cardiovascular, metabolic, renal, immune function, oral, and pulmonary domains, the pace of aging in the cohort was found to range from 0.4 to 2.4 biological years per chronological year. Participants who were aging faster already had poorer cognitive and sensorimotor function, along with anatomical evidence of higher brain age and central nervous system degeneration assessed using magnetic resonance scans. That these differences were already apparent by age 45 means that noncommunicable disease (NCD) trajectories are already well-established by midlife. They arise from individual differences in genetic endowment, cellular biology, life-experiences and exposures. Such aging has usually involved decades of subclinical decline—in, variously, the cardiovascular, metabolic, renal, immunological, neurological, and pulmonary organ systems—prior to clinical manifestation, diagnosis, and management later in life. Thus, as people pass through late middle age and into old age, their ongoing decline manifests as a steadily accumulating number of chronic conditions requiring medical or surgical intervention (Thomson, 2023).

Multimorbidity

Multimorbidity is defined as the co-existence of two or more conditions in the same individual (Jose et al., 2009). Conditions that commonly cluster include diabetes, hypertension, osteoarthritis, dementia, dyslipidaemia, depression, heart failure, and cancer (Ofori-Asenso et al., 2018; Skou et al., 2022). Estimates of multimorbidity vary according to the data source and how it is defined (Gontijo Guerra et al., 2019; Johnston et al., 2019). Recent metaanalyses provide a global prevalence

ranging from 37.2% in the community (Chowdhury et al., 2023) to 42.4% in a combination of community and healthcare settings (Ho et al., 2022). Disparities in the prevalence of multimorbidity by gender, socioeconomic status, and ethnicity are evident, with higher prevalence among women, those living in deprivation, and in indigenous and ethnic minority groups (Stanley et al., 2018; Quiñones et al., 2021; Alshakhs et al., 2022; Ho et al., 2022; Chowdhury et al., 2023).

The prevalence of multimorbidity also increases with age, a consequence of the slow progression of chronic conditions and longer life-expectancy, and (in turn) the high prevalence of chronic conditions among older people. Most people aged over 60—and virtually all of the oldest old—live with two or more chronic conditions (Ofori-Asenso et al., 2018; Ho et al., 2022; Chowdhury et al., 2023). The number of conditions also rises with age (Chowdhury et al., 2023). The combination of population aging and the rising prevalence of chronic conditions means that multimorbidity is a substantial global public health concern (Pearson-Stuttard, et al., 2019).

Multimorbidity has considerable consequences for older people, including functional decline and greater disability, poor quality of life, a higher risk of hospitalization and longer hospital stays, polypharmacy, and premature death (Skou et al., 2022). There are also implications for their families, communities, health systems, and society. Individuals with multimorbidity rely on family members and others to support the usual activities of daily living (ADL), which can range from shopping and housework to full personal care. For the health system, the substantial expenditure associated with high health service-use, including health and social care, is a considerable burden (Skou et al., 2022; Tran et al., 2022). Managing the care of someone with multimorbidity is complex, requiring a well-coordinated, comprehensive, and person-centered approach (Whitty et al., 2020; Skou et al., 2022). Treating each condition singly typically results in inadequate and inefficient care, and a high probability of iatrogenic damage through polypharmacy. Apparently, the cost of caring for someone with multimorbidity is greater than that for each single condition combined (Tran et al., 2022).

As the proportion of older people in the population continues to rise, so too will the demand on health and social services, along with associated financial costs (Prince et al., 2015). Given that most health and social services are underresourced, especially in low- and middle-income countries, and inadequately prepared, it is challenging to appropriately addressing the future needs of people with multimorbidity.

Chronic conditions are patterned by exposure over time to a range of risks, such as environmental, social, and workplace influences, and the individual behaviors resulting from those exposures, including diet, physical activity, use of tobacco and alcohol, and poor access to health services (Marmot, 2005; Peters et al., 2019).

Frailty

Frailty is closely related to aging. It arises from a decline in functioning in multiple physiological systems, with a resultant higher vulnerability to stressors. Frailty is characterized by a loss of biological reserves, a failure of physiological mechanisms, and vulnerability to a range of adversities, including multimorbidity, cognitive decline, late-life dependency, and premature death. Conceptually and physically, it overlaps with disability and the accumulated burden of NCDs. There are two widely cited conceptual approaches to measuring frailty (Walston, 2021): the model of *physical frailty*, characterized as a phenotype arising from the loss of biological reserve with subsequent weakness, fatigue, weight loss, and slowing down; and the model of *deficit accumulation*, understood as the accumulation of deficits from illnesses and disability, along with cognitive and functional decline, that drives frailty.

The global prevalence of frailty remains unclear, owing to such classification differences and a lack of nationally representative data. A recent systematic review of available population-level studies from 62 countries indicated a prevalence for frailty of between 1 in 8 and 1 in 4 older adults, with little change in prevalence since 2012 (O’Caoimh et al., 2021). It also highlighted *pre-frailty* as a recognized prodromal state before the onset of clinically identifiable frailty, with sarcopenia in old age as a key precursor. There was an overall estimate of 12% for physical frailty and 24% for the deficit accumulation model. For pre-frailty, the respective estimates were 46% and 49%. These estimates underline the importance of frailty as a gerontological state.

Oral Frailty

The concept of “oral frailty” has emerged in recent years with the term “oral hypofunction” applied to the oral manifestations of aging-associated sarcopenia and dry mouth (Minakuchi et al., 2018). Oral hypofunction is determined by identifying seven clinical signs; five represent functional aspects of oral musculature and two represent bacterial counts and moisture on the dorsum of the tongue. While it remains unclear whether the concept implies a syndrome, there is the possibility that treating oral hypofunction could help slow the rate of onset of general frailty. It is noteworthy that, in the absence of convincing evidence of its efficacy from interventional studies, the treatment of oral hypofunction has already been included in the Japanese dental payment schedule. At this early stage, questions remain about the validity of this approach, and whether its philosophical basis fits with contemporary biopsychosocial concepts of positive aging.

Importance of the Life-Course

Appreciating the life-course journey is crucial to understanding aging and oral health. The dental literature on older people has almost exclusively focused on the personal behaviors and exposures leading to the burden of chronic oral conditions, without considering the course of life leading to a particular point in time. Such a narrow focus has not been helpful, enabling misinterpretation of much of the available evidence. A wider perspective is needed and, when considered, has revealed that the circumstances and consequences of the past typically have a lasting effect on developments throughout life (Gilleard and Higgs, 2016; Heckhausen and Wrosch, 2016; MacEntee et al., 2019; Thomson, 2023).

People with what we would consider to be “good oral health” in old age are those who have adapted successfully to the burden of their oral disease, accumulated over the years. They are able to chew, taste, and enjoy their food, and to smile and speak comfortably and without social embarrassment (MacEntee et al., 1997; Locker, 1988). They may have retained most of their natural teeth, maybe they are complete denture-wearers, or they may have a combination of these. Successful oral aging cannot be defined solely by the outdated concept of a complete dentition, that is, whether someone is with or without teeth or their replacements.

Thus, the concept of adequate oral functioning is considerably broader than the biomedical notions which have largely predominated to date (McGrath et al., 2022). Given the value placed by older people on social engagement, independence, physical health, and positive attitudes (Reich et al., 2020), having a mouth and dentition that enables those is important. Accordingly, a biopsychosocial and functional concept is more appropriate, given the wide variation in biological status observed in older populations. The biopsychosocial model emphasizes the interconnections among biological, psychological and socioenvironmental factors in determining health states, and it is consistent with the definition of healthy aging as “developing and maintaining the functional ability that enables well-being in older age” (World Health Organization, 2015).

Understanding how people's health develops is critical to understanding and accepting the biopsychosocial model of oral health in old age.

It can be helpful to consider the three types of capital pertaining to the resources used to achieve and maintain health (Frytak et al., 2002). *Financial* capital is someone's income and wealth, upon which consumption of health-promoting goods is highly dependent. *Human* capital is the investments in education and training that enable people to avoid risky exposures or behaviors. *Social* capital comprises their personal relationships and interactions. Using experiences with dental caries as a simple example, financial capital enables the purchase of fluoridated toothpaste and a healthier diet, together with being able to afford ongoing maintenance of the dentition; human capital enables the long-term practice of a health-promoting behavior, such as twice-daily toothbrushing; and social capital would be apparent through the social norm of having clean white teeth, and a full complement of anterior teeth (Thomson, 2023).

Being operative day after day over many decades of life, the three forms of capital favor less dental caries and more tooth retention. Comparing people with more capital against those with less capital at any age during the life-course will show marked differences in rates of oral disease and in numbers of missing teeth. Comparisons at older ages will show greater differences, consistent with the cumulative nature of both exposure and outcome. An appreciation of such processes is crucial for understanding and interpreting epidemiological data on the oral status of older people.

Epidemiology of Oral Conditions in Older People

Tooth loss, dental caries, periodontitis, dry mouth, oral mucosal lesions, and musculoskeletal disorders are the most impactful oral conditions observed in older populations (Kassebaum et al., 2017). They are all chronic and noncommunicable. The more common chronic oral conditions, such as dental caries and periodontitis, are cumulative in nature, which means that their extent and severity generally increase with age. Tooth loss can be a consequence of either condition, which makes the interpretation of dental epidemiological information on dental caries and periodontitis challenging. The complication arises from the fact that, as teeth are gradually lost over time because of either of those conditions, the remaining teeth are essentially the healthy survivors. The same issue arises at the personal level, whereby people living into their seventh decade and beyond are relatively healthy survivors, and differ in important and meaningful ways from those who did not survive. Consider also the cumulative nature of dental caries, periodontitis and consequent tooth loss, where the earliest exposures to the various causes will have commenced very distally indeed and then accrued day by day, week by week, month by month as the life-course unfolded.

All these considerations make the interpretation of oral epidemiological data on older people a complicated exercise, fraught with difficulties. In the sections which follow, we summarize what is currently known about the occurrence of tooth loss, dental caries, periodontitis, dry mouth, oral mucosal lesions, and musculoskeletal disorders in older populations.

Edentulism and Incremental Tooth Loss

Edentulism is the state of having had all natural teeth removed. By contrast, incremental tooth loss is the gradual loss of teeth, whether due to dental caries, severe periodontitis, orofacial trauma or other reasons, as people move through life. People who are edentate have had all their remaining natural teeth removed, usually after many years of incremental tooth loss, which is as much a

social as a clinical decision (Sanders et al., 2004; Sussex et al., 2010; Gibson et al., 2017; Goulart et al., 2019). It requires the patient and dentist to have colluded in the decision to remove the remaining teeth. Edentulism is usually considered by dentists to be an undesirable, “biographically disruptive” endpoint representing the failure of both self-care and the dental care system (Rousseau et al., 2014), but the transition to edentulism can also mark the end of decades of misery and eating problems with impaired natural teeth (Thomson, 2014).

The combination of disease-related and sociocultural influences makes complete tooth loss a complex phenomenon. It is relatively easy to measure, usually by self-reports, which obviates the need for the systematic and detailed clinical examination (Gilbert et al., 1999; Høvik et al., 2022). Accordingly, edentulism has been the focus of much investigation, with a search on PubMed revealing almost 2000 articles published between 1983 and 2023, with two peaks in published reports in 2015–2018 and 2021–2022.

Edentulism is strongly and positively associated with age (Slade et al., 2014; Ren et al., 2017). For example, in Switzerland in 2012, fewer than 1 in 100 of those younger than 45 years were edentate, in contrast to about 1 in 10 of 75–84 year olds (Schneider et al., 2017). In China at that time, fewer than 1 in 50 aged 45–54 years and about one-third of those aged 75 or more were edentate (Ren et al., 2017). In Brazil, while 6% of the overall adult population were edentate in 2010, it was 77% among older people (Cardoso et al., 2016).

There are also marked socioeconomic and education-level differences in complete tooth loss, observable in both cross-national comparisons (Tyrovolas et al., 2016; Borg-Bartolo et al., 2022) and within-country investigations (Suominen-Taipale et al., 1999; Olofsson et al., 2018). There are also large differences in tooth loss by income among countries (Tyrovolas et al., 2016), whereby the prevalence of edentulism in countries with Gross National Income <\$15,000 is about one-third higher than in countries where the Gross National Income is >\$45,000. Moreover, tooth loss is increasing in low- and middle-income countries while continuing to decrease in high-income countries. It is also more prevalent in rural than urban populations (Sussex, 2008), and where dental services are readily accessible (Mojon, 2003; Winkelmann et al., 2022).

The prevalence of complete tooth loss has decreased in recent decades by about 1% every year in high-income countries for various reasons, but that decline has leveled off recently, contrary to earlier predictions (Suominen-Taipale et al., 1999; Mojon et al., 2004; Thomson, 2012; Slade et al., 2014; Cardoso et al., 2016). For example, among Swiss 65–74 year olds, the annual decline in edentulism between 1992 and 2002 was around 1.1%, but it was only 0.8% for the following decade (Schneider et al., 2017). Without much doubt, very few young adults in wealthy countries today lose all their natural teeth; however, complete tooth loss from the maxilla is likely to remain highly prevalent for the foreseeable future, and especially in older populations (Cardoso et al., 2016).

There are notable social influences on the occurrence of incremental tooth loss, defined as the unplanned, episodic loss of some but not all natural teeth. Very few people reach old age without losing one or more teeth. For example, there is a wide diversity of residual dentitions and associated use of dentures among older New Zealanders, but rarely are there completely intact dentitions in this age group (Hyland et al., 2019, 2022). A number of cohort studies of older adults demonstrated that incremental tooth loss continues in people aged 65 or older (Drake et al., 1995; Locker et al., 1996; Slade et al., 1997; Gilbert et al., 1999; Warren et al., 2002; De Marchi et al., 2012).

In high-income European countries, there has been a decline in the proportion of adults with 1–5 teeth missing (Suominen-Taipale et al., 1999; Unell et al., 2015; Schneider et al., 2017). While diseases play an important role in the incremental loss of teeth, on many occasions is to prevent future pain, to lower the cost associated with dental treatment, or to minimize the anxiety caused by dental treatment (Bouma et al., 1987). Cultural factors, including societal norms and beliefs