

Age-friendly oral health care: A scoping review and conceptual framework for integrating dentistry into healthy ageing

Soyeon Kim¹, Young-Seok Park^{1,*}, Kung-Rock Kwon²¹Department of Oral Anatomy and Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Korea²Department of Prosthodontics, School of Dentistry, Kyung Hee University, Seoul, Korea

ABSTRACT

Purpose: Oral health is increasingly recognized as a key component of healthy ageing, yet it remains insufficiently integrated into age-friendly health systems. To map existing evidence on oral health in older adults and propose a conceptual framework for age-friendly oral health care.

Methods: A scoping review was conducted following Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines. A PubMed search identified 708 records (April 18, 2026). After applying filters (last 10 years, ≥ 65 years, human studies), 247 records remained. Following thorough screening, 52 studies were included and thematically analyzed.

Results: The included studies showed consistent associations between oral health and functional outcomes, frailty, and quality of life. Functional oral health, particularly mastication and dentition, emerged as a key determinant of healthy ageing. However, the evidence was fragmented, and no study proposed an integrated framework linking oral health to age-friendly health systems.

Conclusion: The concept of age-friendly oral health care is proposed to bridge this gap and align dentistry with broader ageing frameworks. Establishing this concept may support more coherent policy development and integrated care for older adults. (*J Korean Dent Assoc* 2026; 64(7): 235-244)

Key words : Healthy Ageing; Oral Health; Frailty; Geriatric Dentistry

Introduction

Population aging is a defining demographic transformation of the twenty-first century, placing unprecedented demands on healthcare systems to evolve beyond clinical efficacy toward coordinated, person-centered care¹⁾. The World Health Organization (WHO) has redefined healthy aging as the preservation of functional ability

and well-being rather than the mere absence of disease²⁾. This paradigm shift has been operationalized through the Age-Friendly Health Systems (AFHS) initiative and its 4Ms framework (What Matters, Medication, Mentation, and Mobility), which provides a structured approach to aligning care with the needs of older adults^{1,3,4)}.

Despite the rapid adoption of age-friendly principles in general medicine, dentistry remains largely procedure-oriented and fragmented, often isolated from broader geriatric care models⁵⁾. Clinical oral care for older adults, particularly those in long-term care or with functional dependency, is frequently compromised by a lack of integrated routines, time constraints, and insufficient provider confidence⁶⁾. This gap is particularly critical because

Received Apr 21, 2026; Revised Jul 6, 2026; Accepted Jul 8, 2026

This study was supported by the fund supported by the Health Policy Institute of the Korean Dental Association (KDA-HPI).

*Corresponding author: Prof. Young-Seok Park
Department of Oral Anatomy, School of Dentistry, Seoul National University,
101 Daehak-ro, Jongno-gu, Seoul 03080, Korea
Tel: +82-2-740-8627, E-mail: ayoyo7@snu.ac.kr

ISSN: 0376-4672
eISSN: 2713-7961

Copyright© 2026 by Korean Dental Association
This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY-NC-ND) license
(<https://creativecommons.org/licenses/by-nc-nd/4.0/>).

oral health is closely associated with systemic health, nutrition, and psychological well-being⁷). Furthermore, older adults tend to perceive oral care not merely as a technical service, but in relation to autonomy, trust, and life-course experiences^{8,9}).

Addressing these challenges requires moving beyond chairside-centered interventions toward a comprehensive system of assessment and support. Persistent barriers—such as mobility limitations, reduced oral health literacy, and cognitive decline—highlight the necessity of multidisciplinary approaches involving caregivers and non-dental professionals^{10–12}). In practice, oral care for dependent older adults is often delegated to nursing or caregiving staff; however, such integration remains inconsistent and insufficiently structured¹³). In addition, social and environmental factors, including community structure and access to care, may further influence oral health outcomes in older populations¹⁴). Nevertheless, many clinicians report uncertainty and insufficient training when managing patients with advanced frailty or cognitive impairment, particularly in relation to the Mentation domain.

In response, the concept of Age-Friendly Oral Health Care (AFOHC) is emerging as a framework to align dental practice with AFHS principles. Rather than defining a new subspecialty, AFOHC emphasizes system-level adaptation, including environmental modification, caregiver engagement, and clinical protocols tailored to varying levels of functional and cognitive capacity. This perspective is consistent with earlier calls for a broader, system-oriented approach to oral health promotion in older adults^{15,16}).

Accordingly, the aim of this study is to conceptualize an AFOHC framework by adapting AFHS principles to dental settings, with particular consideration of the Korean context. As a society undergoing rapid demographic transition to a super-aged structure, Korea faces a “time-compressed” challenge in which advanced clinical dental capabilities coexist with insufficient system-level readi-

ness for managing frail and cognitively impaired older adults. By proposing a model tailored to such conditions, this study seeks to contribute to a more coherent, equitable, and sustainable oral health care system that recognizes oral health as an essential component of healthy aging.

Materials and Methods

This scoping review was conducted in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines. The study aims to map the evidence on AFOHC and establish its conceptual framework within the broader health system¹⁷).

A systematic literature search was conducted in PubMed on April 18, 2026. The search strategy combined terms related to ageing, oral health, and age-friendly care concepts. The full search string was as follows: (“older adults” OR elderly OR ageing OR aging OR geriatric*) AND (“oral health” OR “oral care” OR dentistry OR “dental care” OR “geriatric dentistry”) AND (“healthy ageing” OR “healthy aging” OR “age-friendly” OR frailty OR “intrinsic capacity” OR “Age-Friendly Health Systems”). Filters were applied for human studies, adults aged ≥ 65 years, English language, and publication years 2016–2026. The search initially yielded 708 records. After applying automated filters for human subjects, age ≥ 65, and a 10-year publication window (2016–2026), 247 records remained. Following a title and abstract screening for conceptual relevance to AFOHC, a final total of 52 studies were included for analysis.

Title and abstract screening were independently conducted by two reviewers to evaluate conceptual relevance to AFOHC. Studies with uncertain eligibility underwent full-text assessment. Disagreements regarding study selection were resolved through discussion and consensus among the authors.

Data were extracted using a structured charting framework. The variables captured included: 1) study characteristics: author, year, country, and study design, 2) context: population and setting, 3) clinical and systemic domains: oral health domains (e.g., oral frailty, mastication), aging-related constructs (e.g., intrinsic capacity), care delivery models, and alignment with age-friendly health frameworks.

A thematic synthesis approach was employed to categorize the findings into five core domains: 1) conceptual frameworks and healthy aging, 2) functional oral health, 3) oral frailty and intrinsic capacity, 4) care delivery and system integration, 5) education and workforce development.

In this framework, “functional oral health” refers primarily to the performance-related aspects of oral function, including mastication, dentition status, and chewing ability, whereas “oral frailty and intrinsic capacity” addresses the broader relationship between oral conditions and systemic ageing processes, including physical frailty, cognitive decline, and reductions in intrinsic capacity. These synthesized findings were ultimately integrated to develop a conceptual model that links oral health to the overarching principles of AFHS.

Results

The initial systematic search of PubMed retrieved 708 records. After applying automated eligibility filters for publication date (2016–2026) and population age (≥ 65 years), 247 records were retained for screening. Following title and abstract screening for conceptual relevance to AFOHC, a final total of 52 studies were included in the review. For studies with uncertain or ambiguous relevance, full-text evaluation was conducted by the authors to ensure appropriate inclusion. Among the 52 included studies, 28 were identified as core studies for the thematic synthesis^{18–45}, while the remaining studies were clas-

sified as supportive studies^{46–69}. The detailed selection process is illustrated in the PRISMA flow diagram (Fig. 1).

The included studies ($n = 52$) exhibited significant methodological heterogeneity, comprising cross-sectional studies, longitudinal cohorts, qualitative research, systematic reviews, and conceptual policy papers. Geographically, the evidence base spanned Europe, North America, and Asia, reflecting a burgeoning global interest in the intersection of aging and dentistry.

From a methodological standpoint, the majority of the literature was observational. A notable paucity of research was observed regarding structured, system-level interventions or the implementation of integrated care models within dental settings.

The thematic analysis identified five dominant domains that characterize the current landscape of AFOHC (Fig. 2). A subset of the literature positioned oral health within the broader paradigm of healthy aging. These studies framed oral health not as an isolated clinical outcome but as a determinant of functional ability and quality of life (QoL)^{18,27,42}. However, a significant conceptual gap was identified, as no studies proposed a comprehensive framework integrating oral health into AFHS^{23,38,39}.

A subset of the literature positioned oral health within the broader paradigm of healthy aging. These studies framed oral health not as an isolated clinical outcome but as a determinant of functional ability and quality of life (QoL)^{18,27,42}. However, a significant conceptual gap was identified, as no studies proposed a comprehensive framework integrating oral health into AFHS^{23,38,39}.

A substantial body of evidence focused on clinical-functional correlates such as masticatory efficiency, dentition status, and chewing ability. Masticatory dysfunction was associated with decreased psychological and social well-being^{33,44}, while tooth loss was identified as a significant risk factor for frailty, disability, and mortality^{30,35,45}. In addition, oral function was found to play a critical role in maintaining nutritional homeostasis and overall health status^{27,33}.

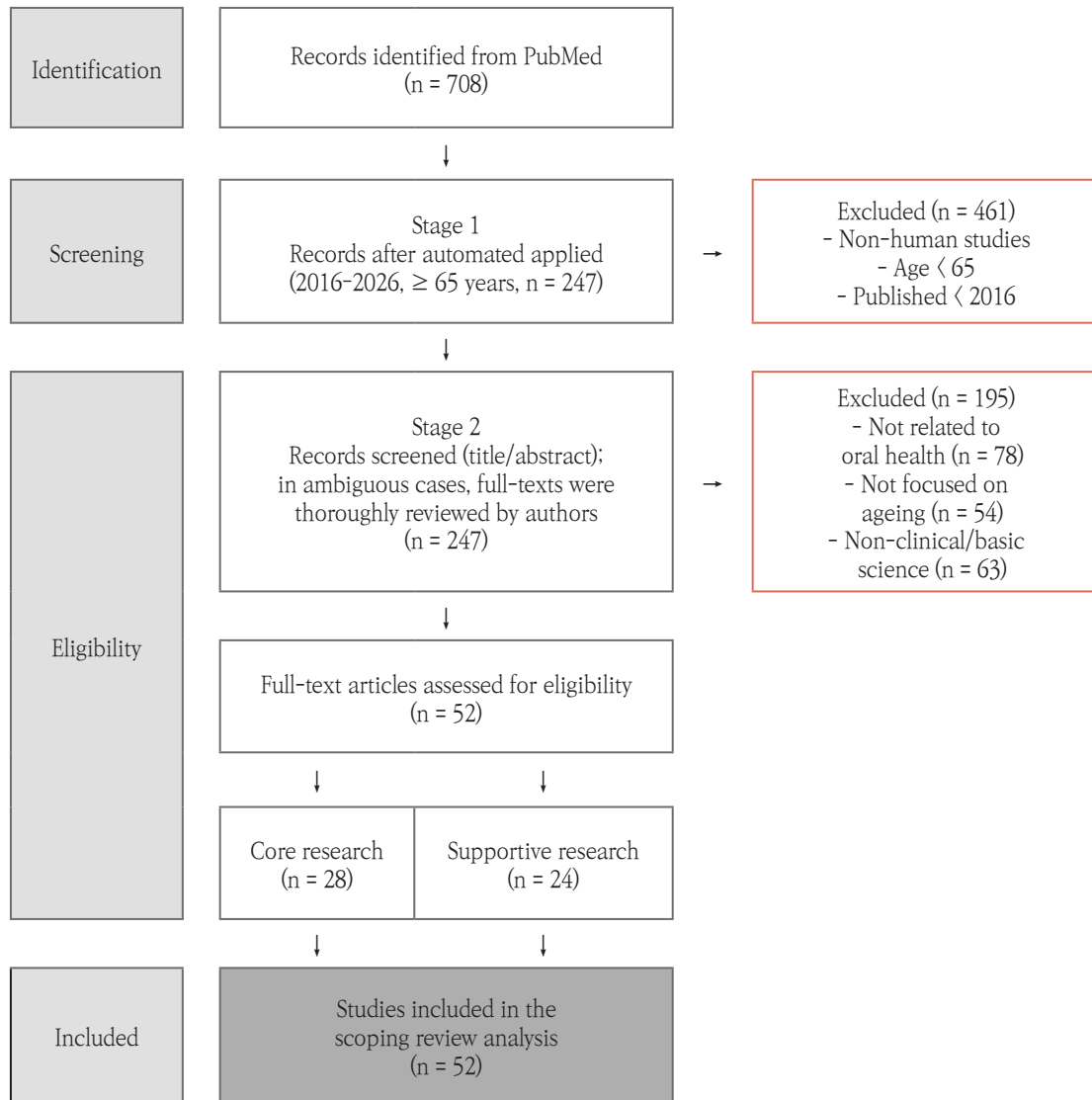


Fig. 1. Selection process of articles by PRISMA guidelines.



Fig. 2. Thematic Synthesis based on the selection of articles. Five thematic domains identified in the literature highlight both the strength and fragmentation of current evidence. AFOHC is proposed as a unified framework that integrates oral health into the AFHS 4Ms—What Matters, Medication, Mentation, and Mobility—to achieve healthy ageing outcomes.

The literature increasingly links oral health to the constructs of intrinsic capacity and frailty. Poor oral status, often conceptualized as oral frailty, was associated with declines in physical function and increased vulnerability^{30,31,35}. Furthermore, studies suggested a bidirectional relationship between masticatory function and cognitive decline^{25,27}. Oral health was also identified as a modifiable factor influencing transitions from pre-frailty to frailty^{30,35}.

The analysis revealed persistent systemic barriers in current dental delivery models. Care fragmentation between dental and general healthcare systems remains a major issue^{20,36}, while access barriers related to mobility, cognitive impairment, and socioeconomic dependency were consistently reported^{41,57}. Oral care is frequently underprioritized in long-term care and community settings^{24,31}. Although interprofessional and alternative delivery models such as teledentistry have been proposed, their implementation remains inconsistent^{40,41}.

The need for an age-friendly dental workforce emerged as a recurring theme. Studies emphasized the importance of integrating age-friendly principles into dental education^{21,22}, improving communication competencies for cognitively impaired patients²¹, and strengthening interprofessional education models to support oral health in aging populations⁴⁰.

The synthesis of these domains highlights a critical disconnect. While substantial evidence links oral health to functional aging and frailty, this knowledge remains fragmented across disciplines^{18,27,30,35}. Importantly, no study has established a unified framework integrating oral health into AFHS^{23,38,39}. This gap suggests that dentistry has yet to fully align with the broader transformation toward age-friendly care, underscoring the need for a system-level conceptual model aligned with the 4Ms framework.

Discussion

This scoping review reveals a paradoxical landscape in geriatric oral health: while the evidence linking oral health to functional aging, frailty, and QoL is robust, its application remains fragmented and isolated. Current research continues to operate within disciplinary silos—geriatric dentistry, epidemiology, and health services—failing to translate clinical findings into a unified, system-level framework. Historically, dentistry has maintained a "procedure-oriented" specialty status, largely disconnected from the broader AFHS movement. This disconnect or evidence system gap suggests that the primary challenge in aging societies is not a lack of clinical evidence, but a lack of systemic integration that aligns oral care with the 4Ms of geriatric care.

The necessity for an AFOHC framework is particularly acute in South Korea, a nation navigating a "time-compressed" transition to a super-aged society. Our analysis highlights three critical structural barriers that characterize the "Korean Paradox". One major challenge is the persistent fragmentation between dental care and the broader systems supporting healthy ageing, including medicine, long-term care, community welfare, nutrition, and functional support services. As a result, oral health is often insufficiently incorporated into multidisciplinary care and public ageing policies, despite its close relationship with frailty, cognition, nutrition, and QoL in older adults⁷⁰. This disconnect may leave frail older adults in a "dental vacuum," where oral health needs are overlooked within comprehensive ageing support systems. The national health insurance structure is heavily weighted toward discrete restorative or surgical interventions. This model provides limited support for the preventive and functional components of AFOHC, such as functional maintenance, caregiver education, and interdisciplinary care coordination, making the adoption of age-friendly models economically unsustainable for practitioners. While clinical expertise is world-class, the dental cur-

riculum has yet to fully embed age-friendly principles. In particular, education related to frailty assessment, communication with cognitively impaired patients, and interdisciplinary geriatric care remains limited, leaving the workforce ill-equipped to lead the shifting demographic reality. In this sense, the Korean paradox reflects not only demographic pressure, but also a structural mismatch between a rapidly ageing society and an oral health delivery system that has yet to be fully integrated into comprehensive healthy ageing and welfare strategies⁷¹⁾.

Given these barriers, the explicit adoption and pre-emption of the term "Age-Friendly Oral Health Care" is a strategic necessity rather than a mere semantic exercise. In Korea, health policies are often driven by administrative or financial agendas rather than clinical philosophy. By preemptively defining AFOHC through a rigorous academic framework, the dental community can establish a "gold standard," preventing the concept from being diluted into a superficial administrative label or a mere cost-cutting tool. A clearly defined concept serves as a conceptual anchor for aligning research, education, and policy. It provides the dental profession with the intellectual leadership required to ensure that future systemic reforms remain grounded in functional outcomes and patient-centered goals rather than sector-specific interests⁷²⁾.

While this study provides a comprehensive conceptual framework for AFOHC, the findings should be interpreted within the context of the study design. The literature search was conducted exclusively in PubMed, which may have limited the comprehensiveness of the evidence base by excluding relevant studies indexed in other databases. In addition, the review emphasized conceptual and thematic synthesis rather than quantitative meta-analysis, thereby focusing on framework development rather than statistical evaluation of pooled outcomes. Future research should involve multi-database validation and empirical testing of the proposed AFOHC model in diverse clinical settings.

This scoping review identified five major thematic domains linking oral health and healthy ageing: 1) conceptual frameworks and healthy ageing, 2) functional oral health, 3) oral frailty and intrinsic capacity, 4) care delivery and system integration, and 5) education and workforce development. The findings demonstrate that while substantial evidence supports the association between oral health and ageing-related outcomes, the current evidence remains fragmented and lacks an integrated system-level framework. Based on this synthesis, this study proposes the concept of AFOHC as a person-centered and system-oriented framework that integrates oral health into the broader principles of AFHS. In particular, this study contributes to the field by conceptually distinguishing functional oral health from oral frailty and intrinsic capacity, and by mapping oral health domains onto the 4Ms framework of age-friendly care. Through this approach, AFOHC is positioned not simply as a clinical dental model, but as an essential component of comprehensive healthy ageing and welfare systems for older adults.

Conflicts of Interest: None

Acknowledgement

The authors acknowledge the use of Generative AI for linguistic refinements and grammatical improvements. All generated suggestions and conclusions were critically reviewed and verified by the authors, who remain responsible for the integrity of the work

References

1. Dolansky MA, Pohnert A, Ball S, McCormack M, Hughes R, Pino L. Pre-implementation of the age-friendly health systems evidence-based 4Ms framework in a multi-state convenient care practice. *Worldviews Evid Based Nurs* 2021; 18: 118-128.

2. Xu D, Xu S, Zheng K, Zhang M. Barriers and facilitators to age-friendly health care: a scoping review. *J Adv Nurs* 2025; 81: 3564-3582.
3. Tzeng HM, Franks HE, Passy E. Facilitators and barriers to implementing the 4Ms framework of age-friendly health systems: a scoping review. *Nurs Rep* 2024; 14: 913-930.
4. Beck MS, Murdock CC, Woolverton CB, Kwak MJ, Onyema EC, Atai FD, et al. Leveraging teams to implement age-friendly health systems across settings in a major academic medical center. *J Gerontol Nurs* 2026; 52: 37-43.
5. Ek K, Browall M, Eriksson M, Eriksson I. Healthcare providers' experiences of assessing and performing oral care in older adults. *Int J Older People Nurs* 2018; 13: e12189.
6. Koistinen S, Olai L, Ståhlacke K, Fält A, Ehrenberg A. Oral health and oral care in short-term care: prevalence, related factors and coherence between older peoples' and professionals' assessments. *Scand J Caring Sci* 2019; 33: 712-722.
7. Slade GD, Sanders AE. The paradox of better subjective oral health in older age. *J Dent Res* 2011; 90: 1279-1285.
8. Khabra KK, Compton SM, Keenan LP. Independent older adults perspectives on oral health. *Int J Dent Hyg* 2017; 15: 295-305.
9. McKenzie-Green B, Giddings LS, Buttle L, Tahana K. Older peoples' perceptions of oral health: 'it's just not that simple'. *Int J Dent Hyg* 2009; 7: 31-38.
10. Jablonski RA, Swecker T, Munro C, Grap MJ, Ligon M. Measuring the oral health of nursing home elders. *Clin Nurs Res* 2009; 18: 200-217.
11. Aagaard K, Meléndez-Torres GJ, Overgaard C. Improving oral health in nursing home residents: a process evaluation of a shared oral care intervention. *J Clin Nurs* 2020; 29: 3392-3402.
12. De Vleeschauwer A, Poppe L, Colman R, Janssens B. Can a low-threshold check-up motivate older adults to schedule a dental visit? study protocol for a randomized controlled trial. *Trials* 2025; 26: 23.
13. Fitzpatrick J. Oral health care needs of dependent older people: responsibilities of nurses and care staff. *J Adv Nurs* 2000; 32: 1325-1332.
14. Chakraborty B, Widener MJ, Mirzaei Salehabadi S, Northridge ME, Kum SS, Jin Z, et al. Estimating peer density effects on oral health for community-based older adults. *BMC Oral Health* 2017; 17: 166.
15. Gift HC. Research directions in oral health promotion for older adults. *J Dent Educ* 1992; 56: 626-631.
16. Entwistle BA. Oral health promotion for the older adult: implications for dental and dental hygiene practitioners. *J Dent Educ* 1992; 56: 636-639.
17. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med* 2018; 169: 467-473.
18. Colombo AP, Wu B. Aging and oral health: biological and sociobehavioral perspectives. *J Dent Res* 2023; 102: 841-843.
19. Sáenz-Ravello G, Contreras J, Baeza M, Silva AB, Danke K, Gonzalez S, et al. Functional dentition and well-being among Chilean 80-year-olds. *Gerodontology* 2024; 41: 251-262.
20. Czwikla J, Rothgang H, Schwendicke F, Hoffmann F. Dental care utilization among home care recipients, nursing home residents, and older adults not in need of long-term care: an observational study based on German insurance claims data. *J Dent* 2023; 136: 104627.
21. Arany S, Eliav E, Medina-Walpole A, Caprio TV. Postgraduate dental resident education: a pilot in age-friendly "mentation" training. *Spec Care Dentist* 2023; 43: 765-771.
22. Tabrizi M, Lee WC. Linking current dental education to gerontological education to meet the oral health needs of growing aging populations. *Front Oral Health* 2023; 4: 1232489.
23. Tumosa N. Using the age-friendly health systems framework to track wellness and health promotion priorities of older adults in the global community. *Int J Environ Res Public Health* 2023; 20: 4617.
24. Weening-Verbree LF, Schuller AA, Zuidema SU, Hobbelen JS. A qualitative evaluation of the implementation of an oral care program in home care nursing. *Int J Environ Res Public*

Health 2023; 20: 2124.

25. Kaewkamnerdpong I, Harirugsakul P, Prasertsom P, Ve-
jithee W, Niyomsilp K, Gururatana O. Oral status is associ-
ated with chewing difficulty in Thai older adults: data from
a national oral health survey. *BMC Oral Health* 2023; 23: 35.
26. Åström AN, Özkaya F, Nasir E, Tsakos G. The dentist-pa-
tient relationship and oral health-related quality of life
among older adults: a cohort study. *Gerodontology* 2023;
40: 355-362.
27. Patel J, Wallace J, Doshi M, Gadanya M, Ben Yahya I, Rose-
man J, et al. Oral health for healthy ageing. *Lancet Healthy
Longev* 2021; 2: e521-e527.
28. Nitschke I, Ulbrich T, Schrock A, Hopfenmüller W, Jockusch
J. What counts for the old and oldest old?-an analysis of pa-
tient criteria for choosing a dentist-part ii: personal char-
acteristics and soft skills. *Int J Environ Res Public Health*
2022; 19: 8621.
29. Nitschke I, von Chlingensperg R, Schrock A, Hopfenmüller
W, Jockusch J. What counts for the old and oldest old? - An
analysis of patient criteria for choosing a dentist - part I:
awareness and selection criteria, infrastructure, and dental
office equipment. *Int J Environ Res Public Health* 2022; 19:
8307.
30. Tan LF, Chan YH, Merchant RA. Association between den-
tition and frailty and cognitive function in community-
dwelling older adults. *BMC Geriatr* 2022; 22: 614.
31. Dros C, Sealy MJ, Krijnen WP, Weening-Verbree LF, Hob-
belen H, Jager-Wittenaar H. Oral health and frailty in com-
munity-dwelling older adults in the northern Netherlands:
a cross-sectional study. *Int J Environ Res Public Health*
2022; 19: 7654.
32. Weening-Verbree LF, Schuller AA, Zuidema SU, Hobbelen
JS. Evaluation of an oral care program to improve the oral
health of home-dwelling older people. *Int J Environ Res
Public Health* 2022; 19: 7251.
33. Shiba T, Sasaki D, Xie J, Chen CY, Tanaka H, Nagai S. As-
sociation between mastication pattern, periodontal condi-
tion, and cognitive condition: investigation using large da-
tabase of Japanese universal healthcare system. *Big Data
Cogn Comput* 2025; 9: 43.
34. Nitschke I, Nitschke S, Haffner C, Sobotta BA, Jockusch J.
On the necessity of a geriatric oral health care transition
model: towards an inclusive and resource-oriented transi-
tion process. *Int J Environ Res Public Health* 2022; 19: 6148.
35. Kotronia E, Wannamethee SG, Papacosta AO, Whincup
PH, Lennon LT, Visser M, et al. Oral health, disability and
physical function: results from studies of older people in
the United Kingdom and United States of America. *J Am
Med Dir Assoc* 2019; 20: 1654.e1-1654.e9.
36. Persson J, Svensson A, Lindén IG, Kylén S, Hägglin C. Aspects
of expansive learning in the context of healthy ageing - a
formative intervention between dental care and municipal
healthcare. *Int J Environ Res Public Health* 2022; 19: 1089.
37. Kiuchi S, Matsuyama Y, Takeuchi K, Kusama T, Cooray
U, Osaka K, et al. Number of teeth and dementia-free life
expectancy: a 10-year follow-up study from the Japan ge-
rontological evaluation Study. *J Am Med Dir Assoc* 2024;
25: 105258.
38. Emery-Tiburcio EE, Berg-Weger M, Husser EK, Tumosa
N, Golden RL, Newman MH, et al. The geriatrics educa-
tion and care revolution: diverse implementation of age-
friendly health systems. *J Am Geriatr Soc* 2021; 69: E31-E33.
39. León S, Giacaman RA. Proposal for a conceptual frame-
work for the development of geriatric dentistry. *J Dent Res*
2022; 101: 247-252.
40. Tabrizi M, Lee WC. A pilot study of an interprofessional
program involving dental, medical, nursing, and pharmacy
students. *Front Public Health* 2020; 8: 602957.
41. Aquilanti L, Santarelli A, Mascitti M, Procaccini M, Rappelli
G. Dental care access and the elderly: what is the role of
teledentistry? a systematic review. *Int J Environ Res Public
Health* 2020; 17: 9053.
42. Lindmark U, Ernsth Bravell M, Johansson L, Finkel D. Oral
health is essential for quality of life in older adults: a Swed-
ish national quality register study. *Gerodontology* 2021; 38:
191-198.
43. Oliveira EJ, Alves LC, Duarte YA, Andrade FB. Life expectan-
cy with negative physical oral health impact on quality of

- life in older adults. *Cad Saude Publica* 2020; 36: e00119119.
44. Lee HP, Shiba K, Cnaan RA, Lee JH. Oral health and social engagement of older adults: a longitudinal study. *J Dent* 2026; 170: 106689.
 45. Ishikawa S, Konta T, Susa S, Ishizawa K, Togashi H, Ueno Y, et al. Association between presence of 20 or more natural teeth and all-cause, cancer-related, and cardiovascular disease-related mortality: Yamagata (Takahata) prospective observational study. *BMC Oral Health* 2020; 20: 353.
 46. Botero JE, Zuluaga AI, Suárez-Córdoba V, Calzada MT, Gutiérrez-Quiceno B, Gutiérrez AF, et al. Using machine learning to study the association of sociodemographic indicators, biomarkers, and oral condition in older adults in Colombia. *J Am Dent Assoc* 2023; 154: 715.e1-726.e5.
 47. Picca A, Lozanoska-Ochser B, Calvani R, Coelho-Júnior HJ, Leewenburgh C, Marzetti E. Inflammatory, mitochondrial, and senescence-related markers: underlying biological pathways of muscle aging and new therapeutic targets. *Exp Gerontol* 2023; 178: 112204.
 48. Sugihara N, Maki Y, Okawa Y, Hosaka M, Matsukubo T, Takaesu Y. Factors associated with root surface caries in elderly. *Bull Tokyo Dent Coll* 2010; 51: 23-30.
 49. Pina GMS, Lia EN, Berretta AA, Nascimento AP, Torres EC, Buszinski AFM, et al. Efficacy of propolis on the denture stomatitis treatment in older adults: a multicentric randomized trial. *Evid Based Complement Alternat Med* 2017; 2017: 8971746.
 50. Jing Y, Ren J, Qu J, Liu GH. Gene therapy strategies for aging intervention. *Cell Insight* 2025; 4: 100254.
 51. Ghanbari-Jahromi M, Bastani P, Jalali FS, Delavari S. Factors affecting oral and dental services utilization among elderly: a scoping review. *BMC Oral Health* 2023; 23: 597.
 52. Mak TN, Louro Caldeira S. The role of nutrition in active and healthy ageing: for prevention and treatment of age-related diseases: evidence so far. Luxembourg: Publications Office of the European Union; 2014. Available from: <https://publications.jrc.ec.europa.eu/repository/handle/JRC90454> [cited 2026 Jul 06].
 53. Thaweewannakij T, Suwannarat P, Mato L, Amatachaya S. Functional ability and health status of community-dwelling late-age elderly people with and without a history of falls. *Hong Kong Physiother J* 2015; 34: 1-9.
 54. Kossioni A, McKenna G, Müller F, Schimmel M, Vanobbergen J. Higher education in gerodontology in european universities. *BMC Oral Health* 2017; 17: 71.
 55. Shin YR, Park SY. The need for advancement in geriatric dentistry: evidence from South Korea's demographic and oral health trends. *J Korean Acad Geriatr Dent* 2024; 20: 59-64.
 56. Bakker MH, Vissink A, Raghoobar GM, Peters LL, Visser A. General health, healthcare costs and dental care use of elderly with a natural dentition, implant-retained overdenture or conventional denture: an 8-year cohort of Dutch elderly (aged 75 and over). *BMC Geriatr* 2021; 21: 477.
 57. Rupel K, Tettamanti M, Vella F, Fontanel G, Di Lenarda R, Biasotto M. What do we learn from the clinical and biological evaluation of the oral cavity in centenarians? *Maturitas* 2021; 145: 31-37.
 58. Adelnia F, Cameron D, Bergeron CM, Fishbein KW, Spencer RG, Reiter DA, et al. The role of muscle perfusion in the age-associated decline of mitochondrial function in healthy individuals. *Front Physiol* 2019; 10: 427.
 59. Friedman SM. Healthy aging: what do we mean, and how do we accomplish it? *Clin Geriatr Med* 2020; 36: xiii-xiv.
 60. Friedman SM. Lifestyle (medicine) and healthy aging. *Clin Geriatr Med* 2020; 36: 645-653.
 61. Muniak JD, Mulhausen P. How do geriatric principles inform healthy aging? *Clin Geriatr Med* 2020; 36: 559-567.
 62. Fang EF, Scheibye-Knudsen M, Jahn HJ, Li J, Ling L, Guo H, et al. A research agenda for aging in china in the 21st century. *Ageing Res Rev* 2015; 24: 197-205.
 63. Cosco TD, Howse K, Brayne C. Healthy ageing, resilience and wellbeing. *Epidemiol Psychiatr Sci* 2017; 26: 579-583.
 64. Bischoff-Ferrari HA, Molino CG, Rival S, Vellas B, Rizzoli R, Kressig RW, et al. DO-HEALTH: vitamin D3 - omega-3 - home exercise - healthy aging and longevity trial - design of a multinational clinical trial on healthy aging among European seniors. *Contemp Clin Trials* 2021; 100: 106124.

65. Tsakos G, Sabbah W, Chandola T, Newton T, Kawachi I, Aida J, et al. Social relationships and oral health among adults aged 60 years or older. *Psychosom Med* 2013; 75: 178-186.
66. Lorbergs AL, Prorok JC, Holroyd-Leduc J, Bouchard DR, Giguere A, Gramlich L, et al. Nutrition and physical activity clinical practice guidelines for older adults living with frailty. *J Frailty Aging* 2022; 11: 3-11.
67. Decker J, Kaloostian CL, Gurvich T, Nguyen P, Widjaja W, Cardona H, et al. Establishing an interprofessional perioperative brain health initiative. *J Am Geriatr Soc* 2020; 68: 2359-2364.
68. Daskalopoulou C, Stubbs B, Kralj C, Koukounari A, Prince M, Prina AM. Physical activity and healthy ageing: a systematic review and meta-analysis of longitudinal cohort studies. *Ageing Res Rev* 2017; 38: 6-17.
69. Coker E, Ploeg J, Kaasalainen S, Fisher A. A concept analysis of oral hygiene care in dependent older adults. *J Adv Nurs* 2013; 69: 2360-2371.
70. Al-Buhaisi D, Karami S, Gomaa N. The role of teledentistry in improving oral health outcomes and access to dental care: an umbrella review. *J Oral Rehabil* 2024; 51: 2375-2389.
71. Yang Y, Liang L, Cai J, You J, Liao X. Improving oral hygiene for better cognitive health: Interrelationships of oral hygiene habits, oral health status, and cognitive function in older adults. *J Adv Nurs* 2024; 80: 275-286.
72. Xie Y, Xia X, Tian X, Hu Y, Li Y, Tan X, et al. The association between cognitive impairment and oral health or oral hygiene behaviors among multiethnic older adults in Western China: a cross-sectional multicenter study. *BMC Public Health* 2025; 25: 259.