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Digital Health Interventions for Preventive Oral Care in Older Adults: A Narrative Review Through the Lens of the Prevention Paradox*

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Abstract

The global oral disease burden in older adults remains high despite a well-established preventive evidence base. Digital health interventions, including teledentistry, mobile health (mHealth), artificial intelligence (AI), and Internet-of-Things (IoT) devices such as smart toothbrushes, are increasingly proposed as solutions to bridge access gaps. Whether these technologies reach those most in need has rarely been examined through the lens of the Prevention Paradox. Despite a well-established preventive evidence base, the global burden of oral disease in older adults remains high, with disparities widening across socioeconomic, geographic, and functional strata. Digital health interventions, including teledentistry, mobile health (mHealth), artificial intelligence (AI), and Internet-of-Things (IoT) devices, are increasingly proposed to bridge access gaps. Whether these technologies reach the older adults at greatest risk, rather than those already well served, has seldom been examined. This narrative review synthesises peer-reviewed literature on digital health interventions for preventive oral care in older adults, interpreted through the Prevention Paradox and the PROGRESS-Plus equity framework. A structured Scopus search yielded 143 records; after applying inclusion and exclusion criteria, 71 records formed the working corpus, complemented by full-text analysis of 62 papers and three foundational theoretical sources. This narrative review addresses that gap by interpreting the digital oral health evidence through the Prevention Paradox and the PROGRESS-Plus equity framework, two lenses not previously applied jointly to this field. A structured Scopus search executed on 13 May 2026 yielded 143 records; after predefined inclusion and exclusion criteria, 71 records formed the working corpus, of which 62 were analysed as full text alongside three foundational theoretical sources, then thematically clustered and appraised narratively. Teledentistry has matured into a methodologically defensible field, with multiple validation studies showing high diagnostic accuracy and an umbrella overview of 30 systematic reviews documenting access and quality impacts. Evidence on mHealth, AI, and smart toothbrushes for older adults remains sparse but converging. eHealth literacy emerges as a mediating social determinant of digital uptake. No retrieved primary study framed digital oral health interventions explicitly within the Prevention Paradox.Teledentistry emerged as a methodologically maturing field, supported by multiple diagnostic-accuracy studies and an umbrella overview of 30 systematic reviews, although equity was its least examined domain. Evidence on mHealth, AI, and smart toothbrushes remained sparse but converging, and eHealth literacy recurred as a mediating determinant of uptake. Digital interventions are feasible and acceptable, but their population-level equity impact remains unproven and possibly paradoxical. Without deliberate equity-by-design anchored in PROGRESS-Plus stratification, digital interventions risk reproducing the inequities they aspire to resolve.No retrieved primary study framed digital oral health within the Prevention Paradox. Digital interventions appear feasible and acceptable, yet their population-level equity impact remains unproven and potentially paradoxical without deliberate equity-by-design anchored in PROGRESS-Plus stratification.

Keywords: teledentistry; mHealth; oral health; older adults; prevention paradox; digital divide; eHealth literacy

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Introduction

The United Nations declared 2021–2030 the Decade of Healthy Ageing, framing healthy ageing as a coordinated global priority (WHO, 2020). Within the WHO functional-ability framework, poor oral health, when compounded by sensory impairments, isolation, and depression, increases the risk of malnutrition and undermines intrinsic capacity in older adults (WHO, 2020). Dental caries, periodontal disease, tooth loss, and xerostomia are linked to systemic morbidity and reduced quality of life (Hui et al., 2026; Shivakumar et al., 2026). Despite codified preventive measures, the burden of oral disease has not decreased, with widening disparities across socioeconomic, geographic, and functional strata (Iyer et al., 2026; Shoaee & Sarafinejad, 2025). Conventional dental care is poorly adapted to older adults who are frail, institutionalised, cognitively impaired, isolated, or financially constrained. Ettinger et al. (2020) describe a tripartite stratification consequential for service planning: approximately 70% of older adults are functionally independent, 20% are frail and need help to reach services, and 10% are functionally dependent, either homebound or institutionalised. These proportions are approximate and vary across national contexts and frailty definitions. Mobility limitations, polypharmacy, workforce shortages in geriatric dentistry, and fragmentation between medical and dental services compound access barriers (Aquilanti et al., 2020; Hartshorn & Nair, 2023). In long-term care, oral health remains a low priority within nursing routines despite substantial unmet needs (Ako et al., 2024; Hartshorn et al., 2025).Digital health interventions have proliferated, accelerated by COVID-19 as both stress test and catalyst for remote care (Kui et al., 2022; León & Giacaman, 2020). Teledentistry, mHealth applications, AI-based diagnostics, and IoT-enabled oral hygiene devices each promise to extend preventive dentistry beyond the conventional clinic. Optimism about technological reach must, however, be tempered by Rose's (1985) observation: interventions effective at the individual level do not necessarily benefit groups at greatest risk. This is the essence of the Prevention Paradox.

This review addresses three questions. First, what is the current evidence across teledentistry, mHealth, AI, and IoT for preventive oral care in older adults? Second, what mediates equitable uptake, particularly digital divide and eHealth literacy? Third, do digital interventions, read through the Prevention Paradox and PROGRESS-Plus, resolve or reproduce structural inequity?

Theoretical Framework

The Prevention Paradox

Rose (1985) defined the Prevention Paradox as the observation that "a preventive measure which brings much benefit to the population offers little to each participating individual" (p. 38). He contrasted a high-risk strategy, targeting susceptible individuals, with a population strategy, controlling the causes of incidence. High-risk strategies are intuitive and individually motivating, but limited in population impact and palliative regarding underlying causes. Population strategies are more powerful structurally but generate small individual benefits, weak personal motivation, and an unfavourable benefit-to-risk ratio for any single participant. In geriatric dentistry, this insight reframes a recurring frustration: those at highest risk for caries, periodontal disease, and tooth loss, namely the frail, institutionalised, socioeconomically disadvantaged, and cognitively impaired, are simultaneously least likely to access preventive services. Conversely, healthier and better-resourced older adults disproportionately benefit from public dental campaigns and digital innovations alike, risking intervention-generated inequalities. Rose's (1985) imperative that "the prior concern should always be to discover and control the causes of incidence" (p. 32) applies directly: structural drivers of unequal oral health cannot be remedied solely by individual-level digital tools.

PROGRESS-Plus and the Bridge to the Paradox

O'Neill et al. (2014) defined the PROGRESS acronym as Place of residence, Race/ethnicity/culture/language, Occupation, Gender/sex, Religion, Education, Socioeconomic status, and Social capital, with "Plus" extending to age, disability, and time-dependent circumstances. They emphasised that "increasing the availability of an effective intervention within a country or region is not necessarily enough to reduce inequities. The intervention has to be accessible, acceptable, effective in, and used by the most disadvantaged group within that population to be truly effective at reducing inequities in health" (p. 57). Interventions can otherwise "inadvertently contribute to increasing inequities" (p. 57). Applied jointly, the two frameworks generate a sharper question than either alone: not merely whether digital oral health interventions work, but whether they preferentially benefit groups already well-served. A teledentistry programme may be feasible, accurate, and acceptable, and yet still widen inequity if its adopters are the digitally literate, urban, and privileged. Every empirical claim about digital effectiveness must therefore be read simultaneously as a question about reach, distribution, and social patterning of uptake. For the purposes of this review, equity impact is operationalised as the direction and distribution of an intervention's effect across PROGRESS-Plus strata: whether differential uptake, access, or outcome narrows, leaves unchanged, or widens the gap between the most and least advantaged older adults. A positive equity impact requires that the most disadvantaged subgroup is both reached by and benefits from the intervention at least as much as better-resourced groups; an intervention that raises average outcomes while disproportionately benefiting the already-advantaged is treated here as equity-neutral or equity-negative, even where overall effectiveness is high. Because few primary studies in this corpus report stratified uptake or outcome data, equity impact is assessed qualitatively, from the presence or absence of subgroup reporting, the social patterning of study samples, and explicit equity framing, rather than from quantitative equity metrics.

Methods

A structured Scopus search was executed on 13 May 2026 combining three TITLE-ABS-KEY blocks: (i) population terms (older adults, elderly, geriatric, nursing home, long-term care, frail elderly); (ii) intervention terms (teledentistry, telehealth, telemedicine, teleconsultation, remote/virtual dental); and (iii) oral health terms (oral health/hygiene/care, dental, dentist, caries, periodontal, denture, xerostomia, preventive dentistry). The search returned 143 records.

Inclusion: peer-reviewed articles or reviews (2015–2026) in English or German with substantive digital-oral-health-in-older-adults content. Exclusion: book chapters, books, conference papers, notes, editorials, and letters (n=24); records before 2015 (n=11); records without substantive oral health content despite keyword matches (n=35; two further records excluded on closer thematic review). The final relevant corpus was 71 records. One conference paper (Grzegorz Broda et al., 2021) was retained as a justified exception because it provides the only available empirical account of IoT device implementation in an aged-care setting; the evidence base for this technology type is otherwise absent from peer-reviewed journals.

Of these, 62 were available as full-text PDFs and read in detail. Thematic clustering was performed by the first author and assigned each record to a primary category: teledentistry (n=45), mHealth/apps (n=7), AI/ML (n=3), IoT/smart devices (n=2), digital divide/eHealth literacy (n=4), and cross-cutting reviews (n=10). Records spanning multiple themes were assigned to the category best matching their primary analytical focus. Each included study was informally appraised for methodological quality using the signals reported by authors themselves (sample size, study design, risk of bias statements, and review quality ratings where available); a minimal evidence-tier classification (Tiers A–C, detailed below) was nonetheless applied to signal the strength of evidence supporting each theme, while formal quality scoring was not applied given the heterogeneity of study designs and the narrative rather than meta-analytic intent. The synthesis was further grounded in Rose (1985), O'Neill et al. (2014), the WHO Decade of Healthy Ageing baseline report (WHO, 2020), and an umbrella overview of teledentistry systematic reviews (Kengne Talla et al., 2025). Synthesis followed SANRA-oriented narrative principles and is thematic rather than meta-analytic.

To provide a minimal and transparent quality signal across this heterogeneous corpus, each full-text study was assigned to one of three evidence tiers reflecting study design and the risk-of-bias or quality information reported by the original authors. Tier A comprised systematic and umbrella reviews and diagnostic-accuracy studies validated against a reference standard (for example, Kengne Talla et al., 2025; Queyroux et al., 2017; Kandala et al., 2024). Tier B comprised observational, cross-sectional, and acceptance or feasibility studies with defined samples and instruments (for example, Iyer et al., 2026; Ng et al., 2024; Karamehmedovic & Melbye, 2026). Tier C comprised qualitative, pilot, single-site, and conference reports offering contextual or hypothesis-generating evidence (for example, Jagde et al., 2021; Hartshorn et al., 2025; Grzegorz Broda et al., 2021). This tiering characterises the strength of evidence underlying each thematic cluster rather than scoring individual studies, and is interpretive rather than a validated appraisal instrument. The strongest tier is concentrated in teledentistry, whereas the mHealth, AI, and IoT clusters rest predominantly on Tier B and Tier C evidence, a distribution that should temper the weight placed on claims in those emerging domains. Where original authors reported formal quality assessments, these are carried into the findings; for instance, Kengne Talla et al. (2025) rated 83% of their 30 included reviews as critically low to low methodological quality, and Chau et al. (2023) judged the available mHealth evidence as fair to poor.

Table 1: Evidence-tier classification of the studies included in the synthesis

#	Study	Cluster	Design (as derivable from the manuscript)	Tier
1	Kengne Talla et al. (2025)	Cross-cutting / Teledentistry	Umbrella overview of 30 systematic reviews	A
2	Queyroux et al. (2017)	Teledentistry	Multicentre diagnostic-accuracy study (Tel-e-dent) vs direct examination as gold standard	A
3	Ako et al. (2024)	Teledentistry	Diagnostic-agreement study: video-based vs in-person OHAT	A
4	Kandala et al. (2024)	Teledentistry	Diagnostic-agreement study: in-person vs asynchronous teledentistry (kappa 0.74-0.78)	A
5	Kharbot et al. (2025)	Teledentistry	Accuracy & reliability study of intraoral 3D scans	A
6	Aquilanti et al. (2020)	Teledentistry / Cross-cutting	Systematic review	A
7	Chau et al. (2023)	mHealth	Systematic review (5 studies)	A
8	Chau et al. (2025)	AI/ML	External-validation diagnostic-accuracy pilot (GumAI, n=44)	A
9	Thalib et al. (2022)	AI/ML	Review of teledentistry + AI (COVID-19)	C
10	Sharkawy et al. (2025)	Teledentistry	Diagnostic-accuracy pilot: mobile-photographic teledentistry vs clinical exam	B
11	Tan et al. (2021)	Teledentistry	Scoping review (25 articles)	B
12	Ben-Omran et al. (2021)	Teledentistry / Cross-cutting	Scoping review	B
13	Nakao & Kotani (2026)	Teledentistry	Scoping review (rural areas)	B
14	Mohamed et al. (2025)	Teledentistry	Scoping review (caries detection)	B
15	Kui et al. (2022)	Intro / framing	Integrative review	B
16	Hui et al. (2026)	Discussion / framing	Comprehensive review (interdisciplinary strategies)	B
17	Inquimbert et al. (2024)	Teledentistry	Five-year retrospective study (French e-DENT programme)	B
18	Okumura et al. (2024)	Teledentistry	Cross-sectional study (184 LTC facilities)	B
19	Ng et al. (2024)	Teledentistry	Cross-sectional acceptability survey (100 residents, 77 staff, 14 facilities)	B
20	Mariño et al. (2016)	Teledentistry	Cost-analysis / economic modelling (100 hypothetical residents)	B
21	Sulijaya et al. (2025)	mHealth	Cross-sectional usability study (periodontal app, Indonesia)	B
22	Karamehmedović & Melbye (2026)	mHealth	Cross-sectional acceptance study (TAM, n=85 caregivers)	B
23	Choi et al. (2025)	IoT	Cross-sectional survey (n=600)	B
24	Iyer et al. (2026)	Digital divide	Cross-sectional study (eHEALS, Riyadh)	B
25	Fung et al. (2024)	Teledentistry	Feasibility pilot (real-time teledentistry, aged care)	C
26	Hartshorn et al. (2025)	Teledentistry	Pilot implementation (asynchronous Virtual Dental Home, 2 facilities)	C
27	Beltrán et al. (2024)	Teledentistry (rural)	Descriptive rural teledentistry care experience (Mapuche community)	B
28	Beltrán et al. (2025)	Teledentistry (remote)	Descriptive teledentistry care model (satellite communication)	C

#	Study	Cluster	Design (as derivable from the manuscript)	Tier
29	Nurjono et al. (2025)	Teledentistry	Qualitative study (43 community healthcare workers)	C
30	Jagde et al. (2021)	Digital divide	Qualitative study (patient e-readiness)	C
31	Sidabutar et al. (2023)	mHealth	Descriptive observational (YouTube dissemination metrics, COVID-19)	B
32	Qi & Wu (2024)	AI/ML	Perspective / commentary (synergistic AI vision)	C
33	Grzegorz Broda et al. (2021)	IoT	Conference paper: design/implementation case (smartbrush installation)	C
34	León & Giacaman (2020)	Digital divide / framing	Commentary / perspective (COVID-19 and inequities)	C
35	Ettinger et al. (2020)	Discussion / framing	Narrative / expert clinical review (treatment-planning considerations)	C
36	Hartshorn & Nair (2023)	Intro / framing	Narrative / commentary (dental innovations for baby boomers)	C
37	Shivakumar et al. (2026)	Discussion / framing	Conceptual model proposal (interprofessional model)	C
38	Shoaee & Sarafinejad (2025)	Digital divide / framing	Causal layered analysis (futures/conceptual)	C

Tier A = systematic and umbrella reviews and diagnostic-accuracy studies validated against a reference standard;
Tier B = observational, cross-sectional, acceptance or feasibility studies with defined samples, and structured (non-graded) scoping or integrative reviews;
Tier C = qualitative, pilot, single-site, conference, narrative, commentary or conceptual reports providing contextual or hypothesis-generating evidence.
Tiers indicate the strength of evidence by design and are interpretive rather than a validated appraisal instrument. Foundational theoretical sources (Rose, 1985; O'Neill et al., 2014; WHO, 2020) are excluded as they are not appraised as empirical evidence.

Findings

Teledentistry: From Feasibility to Validated Practice

Three modalities dominate: real-time videoconferencing with an on-site auxiliary; asynchronous store-and-forward transmission of images or videos; and hybrid mobile-clinic models. Kengne Talla et al. (2025), in an umbrella overview of 30 systematic reviews, found that teleconsultation (43%) and telediagnosis (33%) dominated, and that effectiveness (73%), patient-centred care (47%), and efficiency (37%) were most extensively studied. Critically, equity was the least explored domain (10%), with patient safety also under-examined (27%); these are gaps directly relevant to the questions raised here. The authors further reported that 83% of the included reviews were of critically low to low methodological quality, underscoring that volume of evidence has not equalled quality of evidence.

Queyroux et al. (2017) reported excellent teledentistry–direct examination concordance for diagnosing dental pathology among nursing home residents in the multicentre Tel-e-dent study. Sharkawy et al. (2025) found mobile-photographic teledentistry achieved acceptable specificity for caries detection in Egyptian aged-care residents. Ako et al. (2024) demonstrated high agreement between video-based and in-person OHAT assessments in Japanese institutionalised older adults. Kandala et al. (2024) reported substantial inter-examiner concordance (κ=0.74-0.78) for surgery and removable-denture decisions between in-person and asynchronous teledentistry among people with special health care needs across 12 North Carolina facilities. Kharbot et al. (2025) showed intraoral 3D scans were perfectly accurate for missing teeth and reliable for restorations, but less so for caries and oral hygiene, suggesting scanner-based teledentistry as screening rather than definitive tool. Real-time teledentistry was user-friendly and cost-effective for Australian aged-care staff (Fung et al., 2024). Hartshorn et al. (2025) implemented an asynchronous Virtual Dental Home pilot in two Iowa long-term care facilities, reducing barriers to comprehensive care. Ng et al. (2024) surveyed 100 residents and 77 staff in 14 New Zealand facilities, finding three-quarters of residents perceived teledentistry as beneficial. Beltrán et al. (2024, 2025) documented rural and remote applications among Mapuche communities in Chile, including a satellite-communication model for highly isolated populations. Mariño et al. (2016) compared face-to-face and two teledentistry approaches for 100 hypothetical aged-care residents at 2014 Australian prices: asynchronous oral health assessment with treatment planning cost AU$32.35 per resident, face-to-face AU$36.59, and real-time remote AU$41.28. Asynchronous teledentistry emerged as the lowest-cost service model. Tan et al. (2021), in a scoping review of 25 articles, categorised facilitators and barriers across policy, community, organisational, interpersonal, and individual levels; recurrent barriers included technical issues, lack of funding, consent in cognitive impairment, and limited staff training. Nurjono et al. (2025) identified low awareness of oral health importance, low self-efficacy among workers, manpower shortages, and competition with other nursing duties as central impediments in a qualitative study of 43 Singaporean community healthcare workers. Okumura et al. (2024) found only two of 184 Japanese long-term care facilities had implemented teledentistry despite widespread perceived usefulness, a stark gap between recognised value and operational uptake. Inquimbert et al. (2024), analysing five years of the French e-DENT programme, demonstrated that patient mood and behaviour significantly affected diagnostic quality, underlining human and contextual mediators of technical performance. Aquilanti et al. (2020), Ben-Omran et al. (2021), Nakao and Kotani (2026), and Mohamed et al. (2025) reach convergent conclusions: teledentistry is accurate, cost-effective, and acceptable, but constrained by methodological heterogeneity, small sample sizes, and persistent evidence gaps for the most vulnerable older subgroups.

mHealth and Mobile Applications

Chau et al. (2023), in a systematic review of five studies, found mHealth interventions improved oral health management, behaviour, and knowledge among older adults with mixed effectiveness; study quality was fair to poor. Sulijaya et al. (2025) tested a periodontal-focused mobile application in Indonesia: usability differed significantly by education level (correlation coefficient 0.478, $p=0.025$), with undergraduates and late adults (36-45 years) rating it easier to use. Karamehmedovic and Melbye (2026) applied the Technology Acceptance Model to the SmartJournal tool among 85 Norwegian nursing home caregivers; perceived usefulness and ease of use jointly explained 41.8% of variance in intention to use. Sidabutar et al. (2023) demonstrated that asynchronous public-platform dissemination via YouTube reached over 150,000 viewers per oral-health video during COVID-19 in Indonesia, suggesting alternative reach where formal apps face adoption barriers.

Artificial Intelligence and Machine Learning

Qi and Wu (2024) articulated a synergistic vision in which AI simultaneously addresses oral health deterioration and social disconnection through chatbots, monitoring, and personalised recommendations, while cautioning about overreliance and digital exclusion. Chau et al. (2025) externally validated GumAI, an AI mHealth tool for gingivitis detection, among 44 older adults at three Hong Kong day-care centres: sensitivity 0.93, PPV 0.90, but specificity only 0.50, with the sensitivity-specificity sum (1.43) just below the conventional 1.50 high-value threshold. A specificity of this magnitude indicates that the tool correctly excluded disease in only about half of true-negative cases, which constrains its ability to rule out gingivitis. Because predictive values in screening depend on disease prevalence, this limited specificity is likely to reduce clinical applicability for exclusion, particularly in lower-prevalence settings. These results, drawn from a single small pilot, are best interpreted as early evidence of feasibility rather than of diagnostic readiness; independent replication in larger samples with pre-specified specificity thresholds would be needed before any clinical deployment. Thalib et al. (2022) systematically reviewed teledentistry plus AI in older-adult oral health during COVID-19, finding promise for diagnostics and prosthesis manufacture but scarce geriatric primary evidence.

Internet of Things and Smart Toothbrushes

Only two papers form this cluster, confirming a substantial evidence gap. Choi et al. (2025) surveyed 600 South Korean participants on smart toothbrushes: despite low familiarity (>85%), willingness to use or recommend was high (80% professionals, 87% public). Older adults showed greater willingness to pay for professional feedback, while younger users favoured interactive features and older adults preferred educational content. Grzegorz Broda et al. (2021) reported the design process for a smartbrush installation in Australian aged care, emphasising that residents' cognitive and physical limitations require careful adaptation of device, tablet interface, and charging infrastructure. The authors also note that aged-care teledentistry pilots have repeatedly proven cost-effective yet struggled to move beyond pilot status.

The Digital Divide and eHealth Literacy

Iyer et al. (2026) measured eHealth literacy (eHEALS) among dental outpatients in Riyadh and found significant associations with oral health behaviour, with age, monthly family income, and education emerging as key predictors. The authors framed digital access as a "super social determinant", arguing that as oral health services migrate online, those without digital literacy face compounding disadvantage. Jagde et al. (2021) found in a qualitative study that older participants and those with lower digital literacy expressed concern about loss of human contact in care relationships. Shoaee and Sarafinejad (2025), in a causal layered analysis of Iranian oral health disparities, documented the Golkhand Project, which integrated preventive oral healthcare into elderly and disabled rehabilitation services in 2023. This stands as an example of digital tools embedded within structural reform rather than deployed as standalone solutions. León and Giacaman (2020) framed COVID-19 as both an exacerbator of oral health inequities and an opportunity for emerging paradigms.

Discussion

Teledentistry studies overwhelmingly report on cohorts already enrolled in long-term care or community programmes. These populations, while clinically vulnerable, have cleared a structural threshold in that they already have institutional enrolment or programme inclusion. The hardest-to-reach older adults, those isolated at home, without caregivers, or marginalised by language or undocumented status, are largely absent from the published evidence. Beltrán et al. (2024, 2025) are notable exceptions demonstrating what targeted population strategies achieve, but explicit equity framing remains uncommon. Kengne Talla et al. (2025) found equity addressed in only 10% of 30 systematic reviews, which suggests that the field has not yet made equity central. Many rigorous diagnostic-accuracy studies focus on cognitively impaired, frail, or special-needs populations (Inquimbert et al., 2024; Kandala et al., 2024; Queyroux et al., 2017), a methodological commitment to high-risk groups consistent with Rose's high-risk strategy. Yet population-level diffusion has not followed: Okumura et al. (2024) found two of 184 facilities had implemented teledentistry, and Nurjono et al. (2025) documented systemic implementation barriers despite recognised value. This reveals a structural inversion of the Prevention Paradox worth unpacking.

The Prevention Paradox in this field thus inverts the classical concern in a way that deserves closer attention. Rose (1985) worried that population-strategy interventions would be undervalued because they offer small benefits to many individuals. In digital oral care, the opposite pattern has emerged: the individual-level evidence (high-risk strategy) is in reasonable shape, but the population-level infrastructure that would diffuse these tools across all older adults has not been built. What looks like a success story at the level of validation studies conceals a structural failure at the level of reach. The frailest and most isolated older adults do not receive teledentistry because validated tools remain locked in pilot programmes and well-resourced facilities. Rose's call to address the causes of incidence applies here not to individual behaviour but to the institutional and funding architecture that determines which older adults are ever reached by a digital intervention at all. Studies on eHealth literacy and e-readiness (Iyer et al., 2026; Jagde et al., 2021) identify systematic stratification: those with higher education, income, and prior digital exposure adopt and benefit more readily. A naive scale-up could amplify existing inequities. O'Neill et al. (2014) warn that interventions failing to be "accessible, acceptable, effective in, and used by the most disadvantaged group" (p. 57) can exacerbate inequities even where average effectiveness is high. The Sulijaya et al. (2025) finding of education-stratified usability is a microcosm of this risk. Karamehmedovic and Melbye (2026) further remind that even caregivers deploying digital tools must perceive usefulness and ease of use. This points to a workforce-level digital divide that extends beyond patients to the staff responsible for deploying digital tools. Shivakumar et al. (2026) proposed an interprofessional model integrating dentists, physicians, nurses, nutritionists, and caregivers, with technology as one of five pillars. Hui et al. (2026) argue medical-dental integration, caregiver engagement, nutritional intervention, and social support are co-essential with teledentistry. Ettinger et al. (2020) reinforce the heterogeneity argument: dental treatment planning must distinguish functional independence, frailty, and dependency as service-delivery contexts. These framings push back against techno-solutionism: digital tools are necessary but not sufficient.
Among 71 relevant records, none used the term "prevention paradox" in title or author keywords. This absence is itself substantive: the field has produced evidence about effectiveness without systematically asking whether interventions resolve or reproduce paradoxical population patterns. Explicit paradox-aware design, incorporating PROGRESS-Plus stratification in trial reporting, routine analysis of differential uptake by sociodemographic subgroup, and digital literacy measurement as a baseline covariate, should become a standard expectation rather than an optional add-on.

Interventions that delegate digital tasks to trusted intermediaries (hygienists, community health workers, family caregivers) rather than requiring direct patient digital proficiency (Hartshorn et al., 2025; Kandala et al., 2024) appear better suited to reaching the digitally excluded. Asynchronous modalities reduce dependence on broadband and synchronous coordination, and are most cost-efficient (Mariño et al., 2016; Mohamed et al., 2025; Nakao & Kotani, 2026). Targeted infrastructure innovations such as satellite communication (Beltrán et al., 2025) demonstrate that the digital divide is a designable parameter, not a fixed constraint. Embedding oral health digital tools within integrated care models (Hui et al., 2026; Shivakumar et al., 2026) addresses the workforce and motivational determinants that pure technological solutions cannot.

Limitations

The search was restricted to Scopus on a single date; parallel PubMed, CINAHL, and Embase execution would likely identify additional records. The language filter excluded Spanish, Portuguese, French, and Chinese literature. The document-type filter excluded conference papers, book chapters, and editorials. The Prevention Paradox framing is applied as an interpretive lens, not a hypothesis tested against pre-specified equity metrics, and the absence of explicit paradox framing in the primary literature constrains empirical equity claims. Narrative synthesis is inherently subject to selection biases that systematic reviews are designed to minimise. Several recently published syntheses (notably Javadi et al., 2025; Kallás et al., 2025) could not be retrieved in full text and are therefore not cited. A number of sources published in 2026 are cited throughout this review; as very recently published papers, their findings have not yet accumulated independent citations or replications, and readers should interpret them with corresponding caution pending further validation.

Conclusion

Teledentistry now has substantial evidence of diagnostic accuracy, feasibility, and acceptability across institutional, community, rural, and remote settings, consolidated in an umbrella review of 30 systematic reviews (Kengne Talla et al., 2025). mHealth, AI, and IoT applications are emerging but evidentially thin for older adults; smart toothbrush research is particularly underdeveloped. eHealth literacy and structural digital access mediate uptake and risk converting digital innovations into amplifiers of inequity rather than correctives. Applied to this field, the Prevention Paradox reveals a productive tension. The empirical literature has predominantly pursued a high-risk strategy, validating tools in clinically vulnerable subgroups, while the broader population strategy of systemic, equity-aware diffusion has not been pursued or measured. Without explicit equity-by-design that incorporates PROGRESS-Plus stratifiers in study design (O'Neill et al., 2014), routine measurement of differential uptake, intermediary roles that bypass individual digital literacy barriers, and infrastructure innovations that close access gaps, digital interventions risk reproducing the paradox they aspire to resolve. Rose's (1985) call to identify and control underlying causes of incidence remains the operative imperative. Whether the digital transformation of preventive oral care bends the curve of oral health inequity or compounds it will depend less on technological sophistication than on the equity logic embedded in its deployment.

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