

Oral Health As Life-Course Infrastructure For Brain Health: A Framework For Integrating Dental Measures Into Longitudinal ADRD Studies

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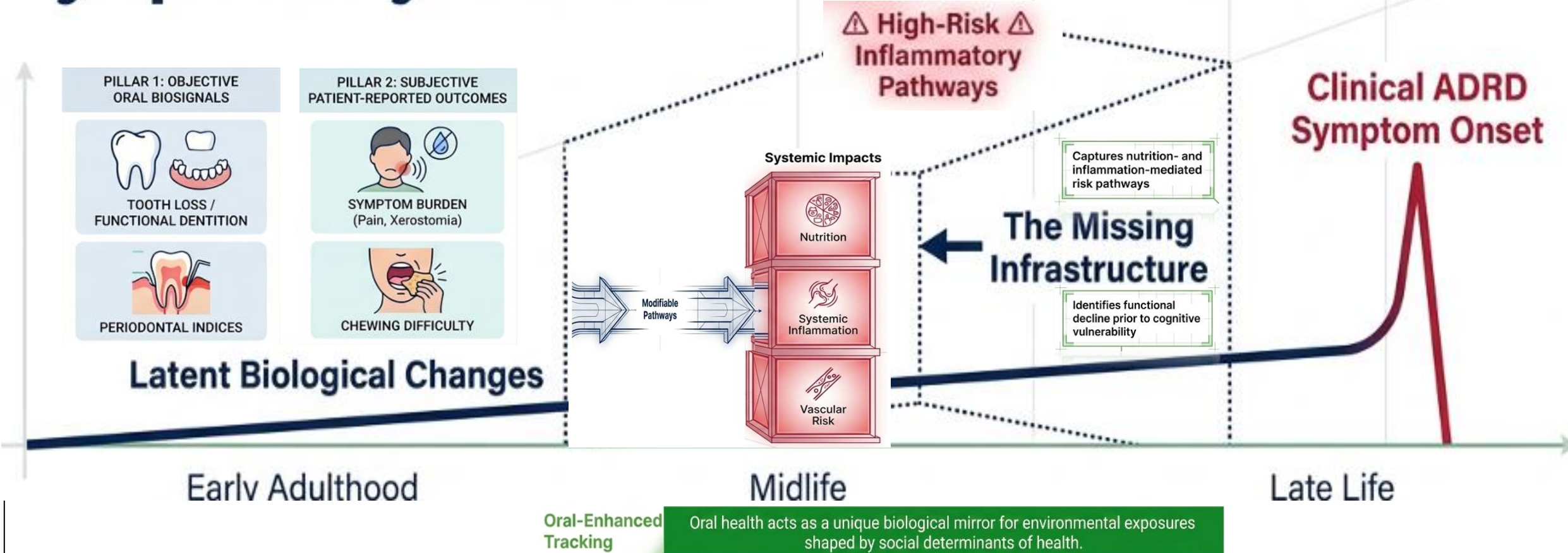
Background

Oral diseases and Alzheimer's Disease and Related Dementias (ADRD) are major public health concerns that share biological, behavioral, and social risk pathways.

- ~3.74 billion people worldwide are affected by oral diseases.
- ADRD are long-latency conditions where biological changes happen decades before symptoms emerge.
- Yet oral health remains largely absent from ADRD biomarker and risk assessment frameworks despite its potential as a modifiable contributor to brain health.

Gap: The lack of standardized oral measures in ADRD research limits investigation of oral biosignals as scalable, low-cost indicators of early disease vulnerability and modifiable prevention targets.

Biological changes precede ADRD symptoms by decades



Harmonizing oral signals with established biomarker frameworks.

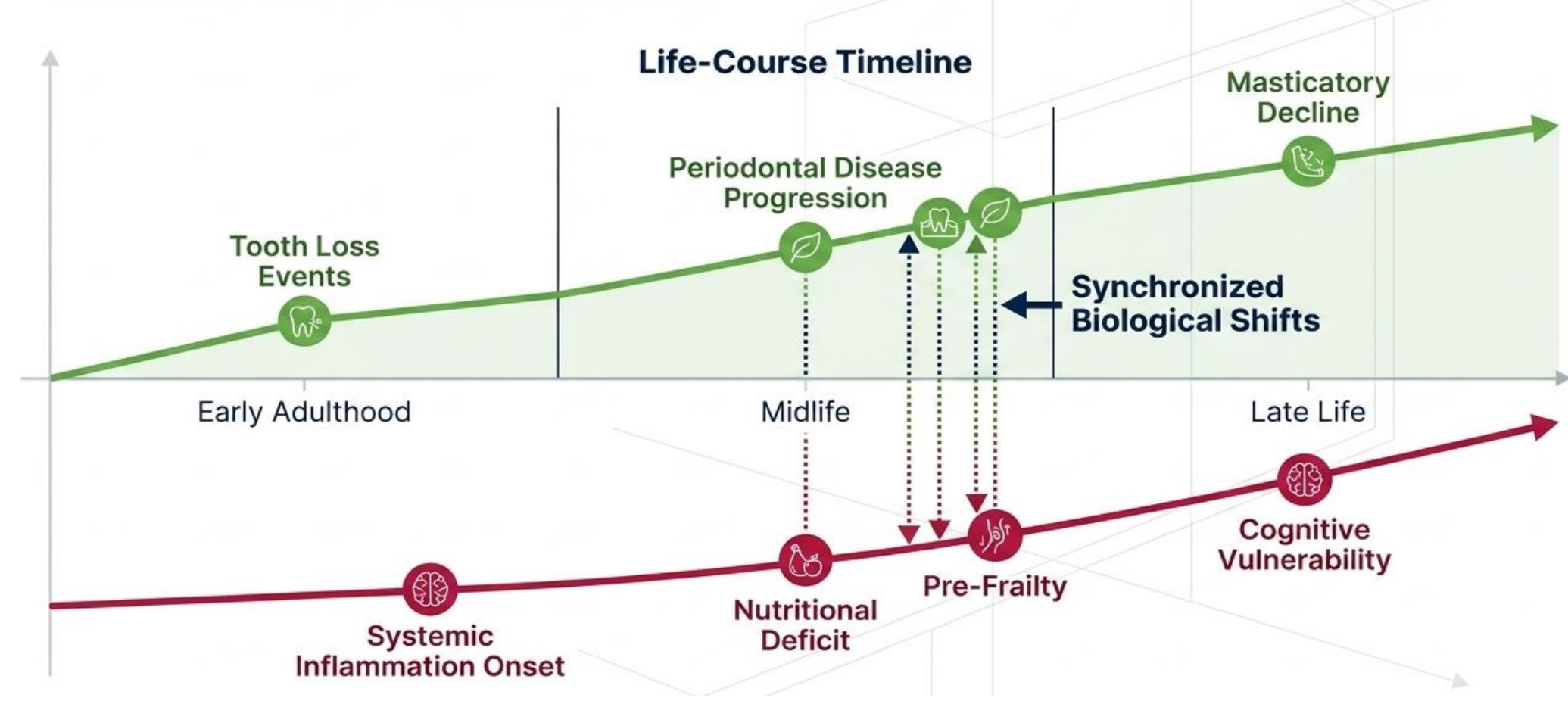
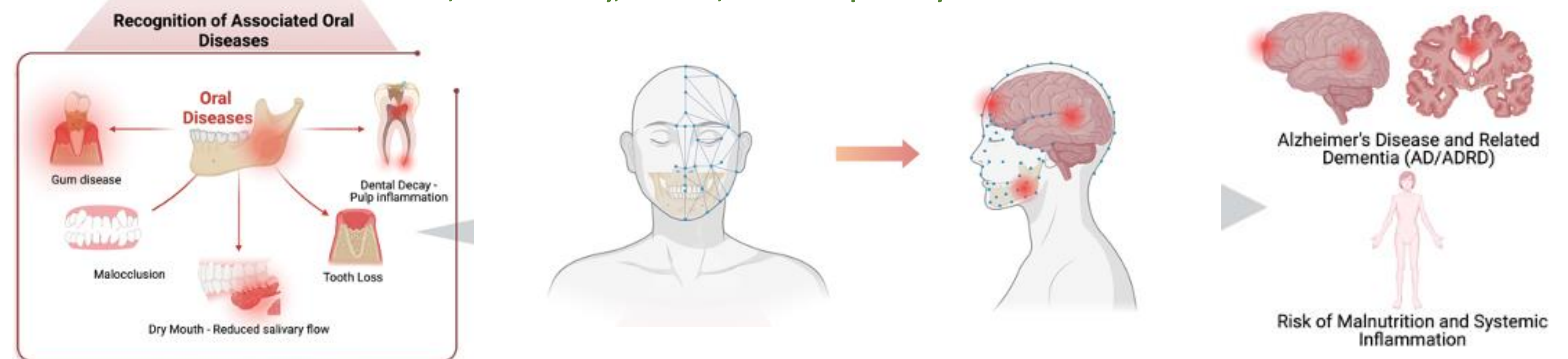


Figure 1: The Minimum Oral Module (MOM): A Conceptual Framework for Integrating Oral Health into Longitudinal ADRD Studies

Oral health is not simply an outcome of aging; it may represent a measurable, modifiable, and equity-sensitive biosignal linking nutritional, inflammatory, vascular, and social pathways to ADRD risk across the life course.



Methods: Framework Development

Data Sources: Leveraged data from the NIH-funded **Health and Aging Brain Study–Health Disparities (HABS-HD)** and nationally representative **US National Health and Nutrition Examination Survey (NHANES)** to identify relevant oral, nutritional, inflammatory, and neurological measures.

Approach: Guided by a scoping review and life-course models of cognitive aging to build a pragmatic framework for longitudinal ADRD research.

Core Construct: Requires at least one oral health indicator or validated proxy integrated alongside neurological and nutritional biomarkers.

Goal: Enable integrated modeling of oral health, biomarker profiles, and social-environmental vulnerability to identify modifiable pathways influencing ADRD risk across the life course.

Discussion & Implications For ADRD Research

A Scalable Biosignal: This framework positions oral biosignals and oral function outcomes as low-cost, scalable, and repeatable indicators of ADRD vulnerability.

Capturing Cumulative Vulnerability: Beyond reflecting localized disease, oral function outcomes captures a lifetime of cumulative exposures. It reflects cumulative exposures related to healthcare access, nutrition, chronic inflammation, caregiving support, and social vulnerability across the life course.

Spotting the Inflection Point: Integrating these indicators from midlife and beyond improves the detection of nutrition- and inflammation-mediated risk pathways. It allows researchers and clinicians to identify “functional inflection points” that precede clinical frailty and cognitive vulnerability.

Equity-Sensitive Modeling: Unlike many traditional biomarkers, oral biosignals capture the intersection of biological vulnerability and cumulative social exposures across the life course. Their integration into ADRD research may enhance biomarker discovery, improve risk stratification, and reveal modifiable pathways and actionable prevention targets long before ADRD clinical symptoms emerge.

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