Recalla

CARE Engine Framework Whitepaper

A voice-first cognitive biomarker framework for longitudinal monitoring and decision-support.

Document status: Public resource / technical preview. This document describes Recalla as a prototype-stage cognitive monitoring concept using voice-first cognitive biomarker signals. It does not present clinical validation or diagnostic claims.

Executive Summary

Recalla is a prototype-stage cognitive monitoring concept designed to transform short voice check-ins into structured, longitudinal cognitive trend signals. The CARE Engine framework organizes everyday voice data into four interpretable biomarker families: speech, language, memory, and engagement.

The purpose of this whitepaper is to describe the framework, technical architecture, safety boundaries, and validation direction. It does not present clinical performance results and should not be interpreted as evidence of diagnostic capability.

Problem Context

Cognitive change often unfolds gradually across everyday speech, recall, attention, and engagement. Formal assessments are essential, but they are usually episodic. Families and care teams may need a structured way to observe changes between formal reviews, without replacing clinical judgement.

Global dementia prevalence and care burden have made cognitive health monitoring a major public health issue. Public sources such as WHO and Alzheimer's Disease International describe dementia as a large and growing global challenge, while the FDA-NIH BEST resource provides standardized language for biomarker terminology.

What Recalla Is Building

Recalla is being designed as a monitoring and decision-support layer. It is not positioned as a diagnostic tool. Its intended direction is to help caregivers, clinicians, and care platforms review longitudinal cognitive trend information derived from repeated voice check-ins.

Layer	Purpose	Example Output
Voice Check-In	Collect short guided conversation inputs in a low-friction format.	Audio/transcript/timing record
Feature Extraction	Derive structured speech, language,	Feature vector

	memory, and engagement signals.	
Biomarker Families	Group features into interpretable cognitive signal families.	Speech, language, memory, engagement subscores
CARE Score	Create an illustrative longitudinal summary score for monitoring.	CARE Score and trend status
Review Output	Provide human-readable support for care conversations.	Caregiver dashboard, clinician summary, API-ready report

CARE Engine Architecture

1. Daily voice check-in through a guided question or conversation prompt.
2. Secure data capture with consent-first handling and clear explanation of use.
3. Feature extraction across speech, transcript, timing, recall consistency, and engagement signals.
4. Biomarker subscore generation across four signal families.
5. Longitudinal comparison against a personal baseline where available.
6. CARE Score and trend summary output for caregiver/clinician review.

Cognitive Biomarker Families

Family	Representative Signals	Interpretive Direction
Speech	Pace, pauses, hesitation, fluency, response timing.	Changes in rhythm or timing may be useful for longitudinal monitoring.
Language	Vocabulary richness, coherence, repetition, sentence structure.	Language structure can provide interpretable cognitive context.
Memory	Recall consistency, missed details, answer stability across check-ins.	Repeated prompts may reveal change patterns over time.
Engagement	Participation, completion, responsiveness, interaction consistency.	Engagement trends can add context to score changes.

CARE Score Concept

The CARE Score is an illustrative framework output intended to summarize multiple longitudinal signal families. In the public technical preview, any score is synthetic and not clinically validated.

In future validation work, the CARE Score would need to be tested against appropriate datasets, reviewed by clinical experts, and evaluated for reliability, bias, usability, and safety before any real-world health claim.

Data and Privacy Design Principles

- Consent-first data capture with clear explanation of how voice data may be used.
- Data minimization: collect only what is needed for the stated monitoring purpose.
- De-identification and access control where appropriate.
- No real patient data in public demos or GitHub materials.

- Human-in-the-loop review for any meaningful change signal.
- Clear non-diagnostic positioning across product, website, documentation, and outreach.

Validation Roadmap Summary

Stage	Objective	Evidence Produced
1. Internal feasibility	Test synthetic pipeline and report format.	Working demo, synthetic outputs, issue log.
2. Expert review	Review clinical framing, workflow, safety boundaries.	Advisor feedback, updated protocol, risk log.
3. Benchmark evaluation	Evaluate approved public/licensed datasets where permitted.	Benchmark report, limitations, bias notes.
4. Feasibility pilot	Assess usability and longitudinal check-in adherence.	Pilot report, adherence metrics, qualitative feedback.
5. Clinical validation	Formally test performance and clinical utility.	Ethics-reviewed study and validated claims if supported.

Limitations

- The framework is currently prototype-stage and does not claim clinical validation.
- Voice-based signals can be affected by language, accent, environment, mood, fatigue, device quality, and health context.
- The CARE Score concept requires careful validation before it can support any health claim.
- Clinical diagnosis and treatment decisions must remain with qualified healthcare professionals.

Conclusion

Recalla is designed to explore how everyday voice check-ins can become a structured, responsible, and longitudinal cognitive monitoring layer. The framework is intentionally positioned as monitoring and decision-support only, with clinical validation as a future milestone.

References and Background Sources

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