Accepted poster at ISRII 2026, October 20-22, 2026 | Newcastle, Australia

PULSE: A Receptivity-Aware Scheduling Server for Digital Health Intervention and Data Collection Studies

Alexandre de Montleau[1], **Marcia Nißen**[1,2,3], **Tobias Kowatsch**[1,3,4*]

[1]Institute for Implementation Science in Health Care, University of Zurich, Zurich, Switzerland
[2]Eastern Switzerland University of Applied Sciences, St. Gallen, Switzerland
[3]Department of Management, Technology, and Economics, ETH Zurich, Zurich, Switzerland
[4]School of Medicine, University of St. Gallen, St. Gallen, Switzerland
**Corresponding author: tobias.kowatsch@uzh.ch*

Context: Digital health intervention and data-collection studies increasingly combine smartphone prompts and passive sensing, including micro-dialogs, ecological momentary assessments (EMAs), and digital biomarker protocols. Yet engagement breaks down when prompts arrive while participants cannot receive, process, or use the request. This gap between intended and actual engagement can cause missed support, delayed responses, skipped assessments, and sparse or biased data. Receptivity-aware timing may therefore matter beyond intervention delivery, including longitudinal sensing and data collection.

Methods: We developed PULSE (Personalized User-Level Scheduling Engine), a modular scheduling service implemented as a Model Context Protocol (MCP) server. PULSE estimates receptivity within a criticality window, either triggered by a vulnerable moment or the next valid assessment period. It combines historical app-interaction timestamps, participant metadata, and coaching or study metadata to build three timing distributions: population, tailored cohort, and personalized. A sufficiency rule selects the most personalized distribution supported by available data, enabling fallback under sparse data and personalization as interactions accumulate.

Intervention: The Digital Health Operating System (DHOS) detects a need to act, calls PULSE via MCP, and receives candidate timestamps within the criticality window. The response includes the recommended time, engagement probability, and a rationale explaining whether population, cohort, or personalized evidence was used and whether availability constraints were applied. The DHOS can inspect the distributions and test how recommendations change with cohort similarity, time resolution, data sparsity, and declared unavailability.

Results: The prototype demonstrates how timing decisions can be decoupled from intervention and assessment content and integrated as an interoperable service. PULSE can schedule intervention micro-dialogs, EMA prompts, study check-ins, or other participant-facing requests at moments when actual engagement is more likely to match intended engagement. This makes receptivity-aware scheduling transparent, adaptive, and evaluable across interventions and data-collection use cases.

Conclusions: PULSE translates a central but under-operationalized component of digital health studies into hands-on infrastructure: deciding when to prompt. By combining probabilistic scheduling, progressive personalization, and explainable outputs, PULSE supports novel agentic workflows and creates a foundation for testing whether receptivity-aware timing can shorten response latency, improve adherence to intervention and data-collection protocols, and thereby strengthen intervention effects and data quality.

Implications: This demonstration invites discussion of evaluation designs, data sufficiency thresholds, privacy-preserving integration, and reusable timing services for scalable digital health implementations.

Suggested submission type: Demonstration; **Suggested topics:** User Engagement & Design, Machine Learning and Artificial Intelligence, Mobile health, Next generation interventions & Technology, Passive Sensing, Wearables, and Implementation Science.