WholeMom

Designing a More Connected Maternal-Care Experience

A conceptual system for coordinating care across pregnancy, postpartum, mental health, infant care, connected health, and return-to-work needs.

DOROTHY ADU

MS Healthcare Systems Engineering | Systems Test & Validation

THE THROUGHLINE

Translate a fragmented care journey into a traceable system concept - from stakeholder needs and workflows to requirements, architecture, risk, and validation.

01 / THE SYSTEM PROBLEM

Care is delivered in pieces. The patient experiences the whole journey.

WholeMom began with a systems question: what would coordinated maternal care look like if the experience were designed across transitions rather than around isolated services?

PREGNANCY	DELIVERY	POSTPARTUM	MENTAL HEALTH	INFANT CARE	RETURN
Prenatal care	Labor & delivery	Physical recovery	Screening & support	Mother + baby	Work & childcare

CORE INSIGHT

When services, information, appointments, and follow-up are disconnected, the mother can become the de facto system integrator - carrying the coordination burden between care teams and life transitions.

STAKEHOLDER LENS

Mother / Caregiver · OB / Clinical Team · Nursing · Mental Health · Pharmacy

DESIGN GOAL

Create a connected-care concept that helps patients and care teams coordinate information, monitoring, communication, appointments, and support while preserving clinical oversight and considering privacy, accessibility, and implementation feasibility.

EVIDENCE BASE

Research, personal experience, and stakeholder interviews were used to identify gaps and inform the system need. Stakeholders included nurses, pharmacists, and mental-health professionals.

02 / SYSTEMS APPROACH

From lived experience to a traceable engineering model

The capstone applied an incremental systems-engineering process rather than jumping directly to a feature list or interface.

1. **DISCOVER**
   Research + stakeholder interviews
2. **DEFINE**
   CONOPS + operational requirements
3. **DECOMPOSE**
   Functions + performance requirements
4. **DESIGN**
   Conceptual hardware / software / people
5. **DECIDE**
   Trade study + risk management
6. **VALIDATE**
   Test & evaluation + system specification

TRACEABILITY WAS THE CONNECTIVE TISSUE

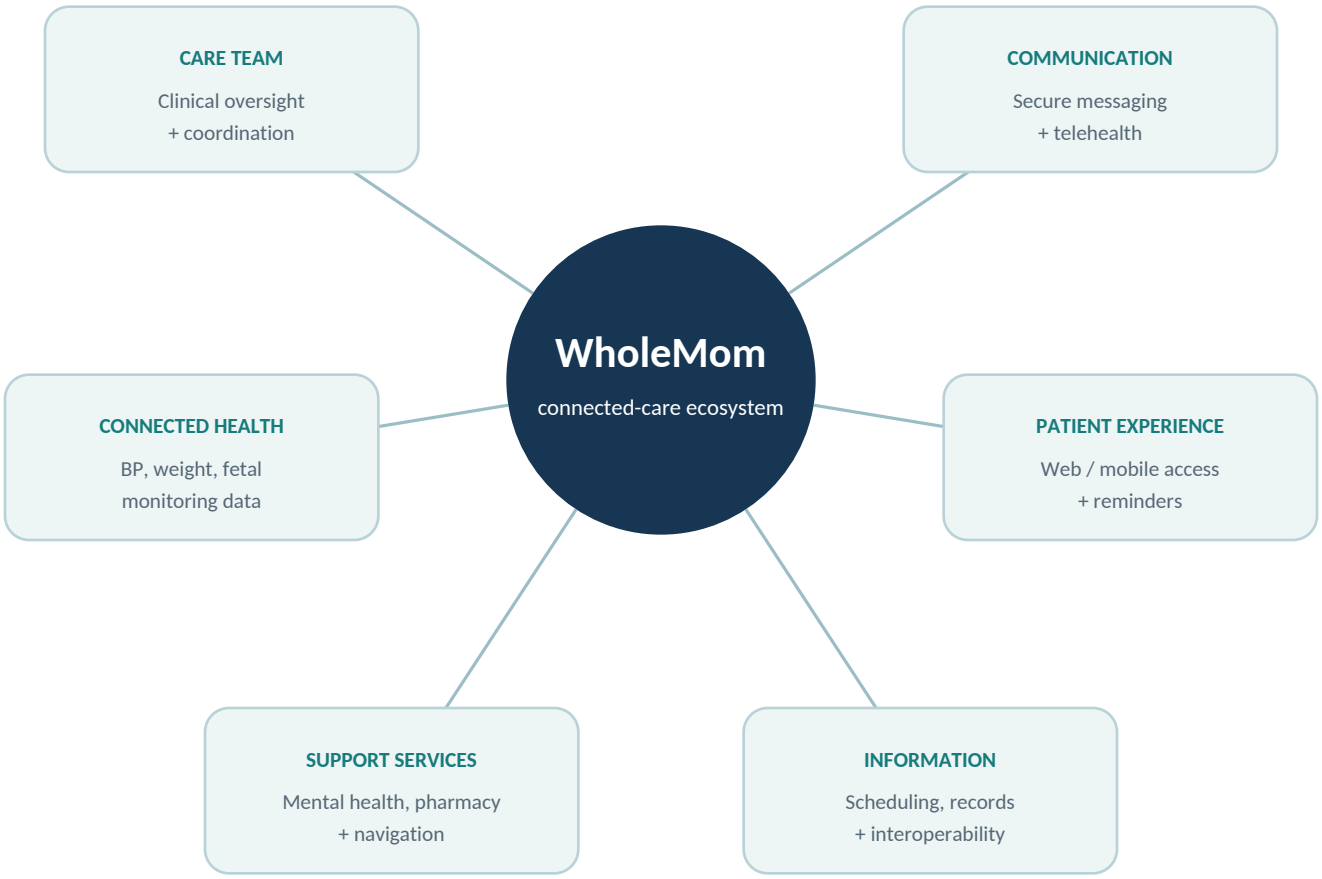
Stakeholder need -> operational requirement -> function -> physical component -> verification evidence

Requirements and models were managed in Innoslate to maintain links back to user objectives.

03 / CONNECTED-CARE CONCEPT

Designing the ecosystem around coordination, not a single encounter

The conceptual design allocated system functions across software, hardware, and people - with interfaces that support care coordination and remote interaction.



DESIGN PRINCIPLES

- **Keep clinical oversight**
- **Support remote monitoring**
- **Make status visible**
- **Design for usability + access**

04 / REQUIREMENTS & TRACEABILITY

Turning stakeholder needs into testable system expectations

Operational requirements were decomposed into functional and performance requirements, KPPs, and a functional hierarchy through level three.

NEED

Reduce coordination burden and support continuity across the maternal-care journey.

REQUIREMENT

Define measurable behaviors for scheduling, communication, screening, device integration, security, performance, and usability.

VERIFICATION

Map each expectation to inspection, analysis, demonstration, or test so readiness can be evaluated with evidence.

SELECTED SYSTEM EXPECTATIONS

Care Coordination	Appointments, reminders, real-time updates, messaging and retrieval.
Clinical Support	PHQ-9 screening logic, telehealth, connected-device health data.
Trust & Resilience	Authentication, access control, security, backup / recovery and interoperability.
Experience & Performance	Usability, compatibility, concurrent use and response / retrieval performance.

WHY THIS MATTERS

The value of requirements is not the document itself. It is the shared line of sight from what a user needs to what the system must do - and eventually to the evidence that shows whether it works.

05 / RISK, TRADE-OFFS & VALIDATION

Engineering the concept for decisions and evidence

The project tested design choices and defined how critical behaviors would be evaluated before broader implementation.

TRADE STUDY

Compared four tablet devices for healthcare-team interaction against WholeMom requirements and functionality.

DECISION DISCIPLINE > PREFERENCE

RISK MANAGEMENT

Tracked six initial risks, identified new risks, defined mitigations, and documented movement through waterfall charts.

MAKE UNCERTAINTY VISIBLE

FOCUSED TEST & EVALUATION PLAN: TP-001

Evaluate the ability of WholeMom to integrate with digital health devices and accurately measure health data.

1

TEST ENVIRONMENT

Realistic system / network conditions

2

EQUIPMENT

Connected health devices + clients

3

OPERATORS

Defined test roles and procedures

4

CRITERIA

Acceptance thresholds + metrics

5

EVIDENCE

Results traced to requirements

SCOPE BOUNDARY

This was a conceptual systems-engineering capstone, not a deployed clinical product. The project developed one focused trade study and one detailed test-plan area. Broader implementation would require formal stakeholder review, SME refinement, usability testing, regulatory review, training, and pilot deployment.

06 / OUTCOME & REFLECTION

A traceable concept - and a systems way of thinking

The final system specification combined requirements analysis, functional analysis, conceptual design, trade study, risk management, and test planning into a blueprint for further development.

TRACEABLE

User objectives linked to requirements, functions, components, and planned verification.

HUMAN-CENTERED

The care journey and coordination burden stayed visible alongside technical architecture.

IMPLEMENTABLE NEXT STEPS

Usability testing, pilot deployment, training, regulatory review, SME refinement, and formal stakeholder review.

WHAT THIS PROJECT CHANGED FOR ME

I approach healthcare technology as a system - not simply a product. Reliability depends on understanding the people, workflows, interfaces, requirements, risks, and operational conditions around the technology.

CAPABILITIES DEMONSTRATED

- Healthcare systems engineering
- Systems thinking
- Workflow analysis
- Requirements engineering
- Functional decomposition
- System integration
- Risk assessment
- Trade studies
- Verification & validation
- Human-centered design

WholeMom was developed as an individual Johns Hopkins Healthcare Systems Engineering capstone, Summer 2023.