User-Centered Mobile Application Prototype for Lower-Limb Fracture Care

Min Jeoung Kang, RN, PhD

Brigham and Women's Hospital/Harvard Medical School

NENIC
New England Nursing Informatics Consortium

OPTIONS
OsteoPorotic fracTure preventION System

Nurses Transforming Healthcare ***Through Informatics***

Background

- More than 10 million Americans aged 65 and older have osteoporosis, expected to increase to 17 million by 2030
- Osteoporosis is a leading cause of fragility fractures with increasing cases

However,

- A gap in the continuity of care (Hospital → Skilled Nursing Facility (SNF) → community)
- Variation in the standard of care for patients with LLF in SNF

- Need for *evidence-based, coordinated care models* to support reduce the risk of future fractures as residents transition from SNFs back to the community.

OPTIONS Study (OsteoPorotic fracTure preventION System)

- **Goal: Develop and provide an evidence-based, trimodal intervention for older adults with LLF to improve bone health and prevent future fractures**

Exercise Programs

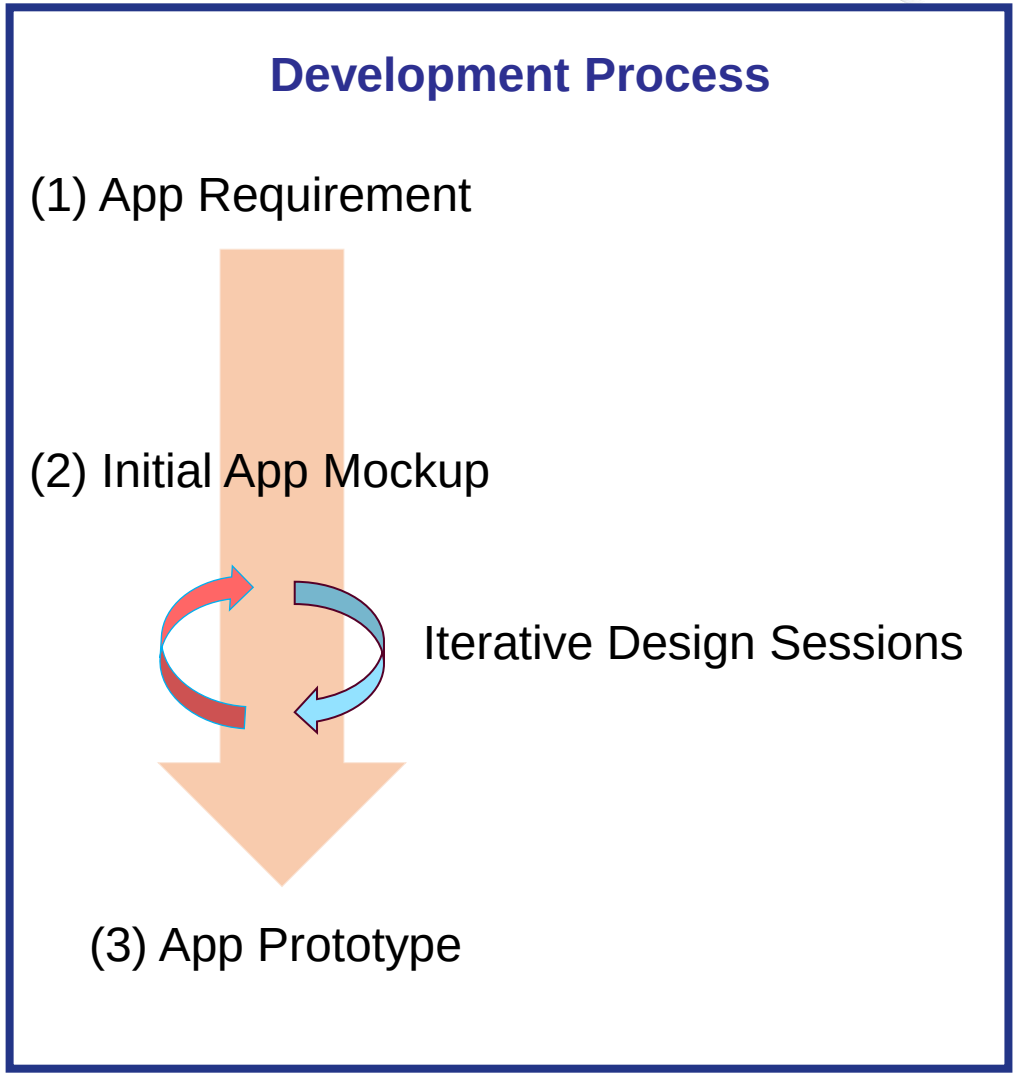
Healthy Nutrition

Bone health medications Management

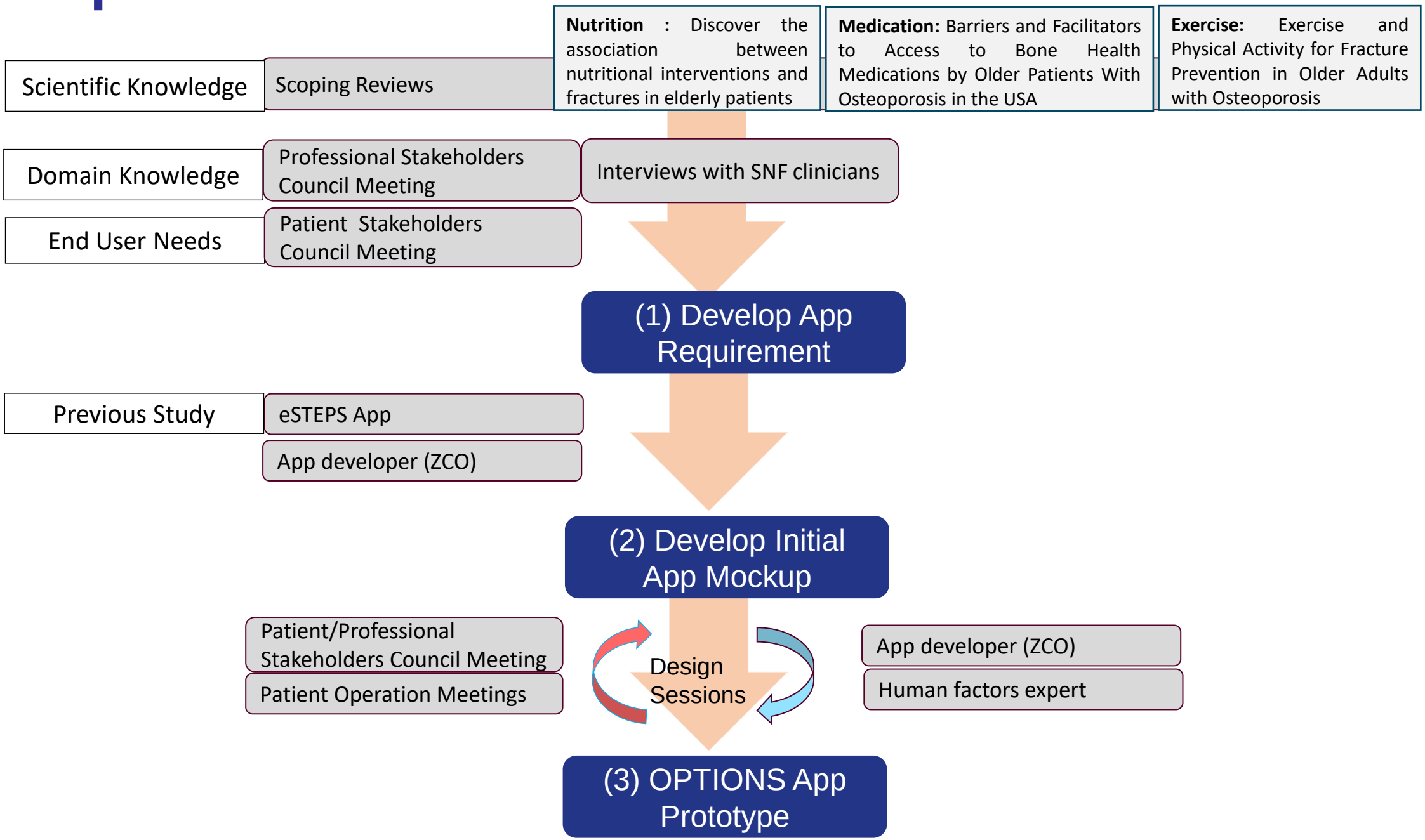
- **Strategies**
  1. Clinical decision support
  2. Clinician/staff education
  3. Resident and care partner resources (***Mobile Application*** & Workbook)

Methods

- Design Science framework :
  - Three iterative and interrelated cycles:
    - Relevance Cycle : Identify real-world problems and stakeholder needs
    - Rigor Cycle : Incorporate scientific knowledge and domain knowledge
    - Design Cycle: Iteratively create and refine the technological artifacts
  - Integrates scientific knowledge, clinical domain expertise, and end-user needs to develop user-centered app
- Study team: Multi-disciplinary teams
  - Exercise/ Nutrition/ Bone health medication team
  - App developer
  - Human factors expert



Development Process



Results

Domain	App Requirements
Exercise	1. Assess the user's health status. 2. Provide a tailored exercise program according to the health status (e.g., weight-bearing status, exercise intensity, exercise type). 3. Offer an exercise program with videos and handout materials for easily follow-along at home environment.
Nutrition	1. Track users' weight-loss trends and provide tailored education accordingly. 2. Screen users' nutritional status and provide customized education accordingly. 3. Assess users' eating habits and offer tailored education materials according to their scores.
Bone Health Medications	1. Provide education sessions (e.g., about osteoporosis, different types and side effects of bone medications etc.). 2. Implement a reminder function for bone health medication. 3. Assess the risk of another fracture.

Summary of feedback from user-perspective

- Ensure the app is simple and user-friendly
- Standardize the order and color coding for three key domains
- Aim for ***reading level equivalent to third-grade student***.
- Use short, clear, and positive language
- **Simplify the app design**
- **Ensure the app is self-manageable**
- Separate daily and weekly tasks
- Specify clear timeframes for **task completion**.
- Enhance user engagement
- **Visualize task progress**, personal health status, or improvements
- Provide **rewards or acknowledgements** upon task completion

OPTIONS Mobile App Prototype

Skip

Welcome to

OPTIONS

Exercise

Improve your strength, balance, and mobility with quick and easy exercises.

If you have any questions or would like to learn more, please email us at options@mgb.org

Skip

Welcome to

OPTIONS

Nutrition

Assess nutritional status and provide personalized resources to support bone healing and overall nutrition, helping to prevent malnutrition, a risk factor for fractures.

If you have any questions or would like to learn more, please email us at options@mgb.org

Skip

Welcome to

OPTIONS

Bone Medications

Strengthen your bones with the App reminders to stay consistent with bone health medications and supplements.

If you have any questions or would like to learn more, please email us at options@mgb.org

OPTIONS

Welcome to the Options App

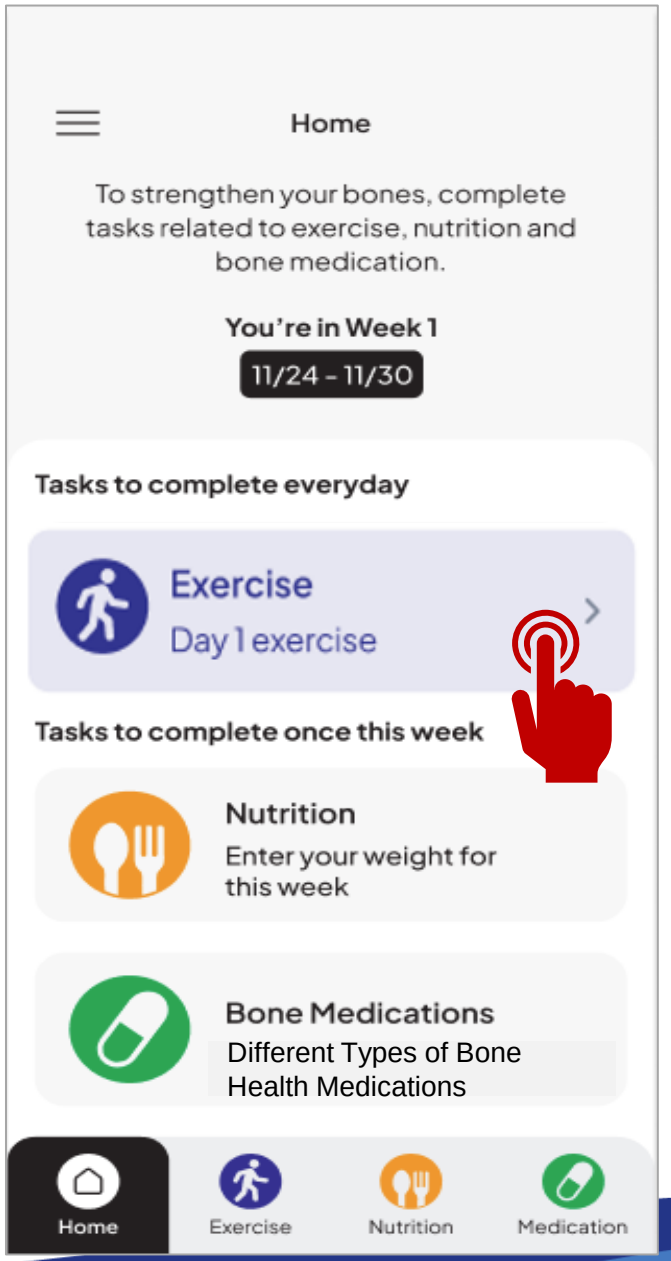
Let's first get some information from you so that we can personalize your daily, weekly and monthly tasks.

Get Started

OPTIONS App Core Functionality

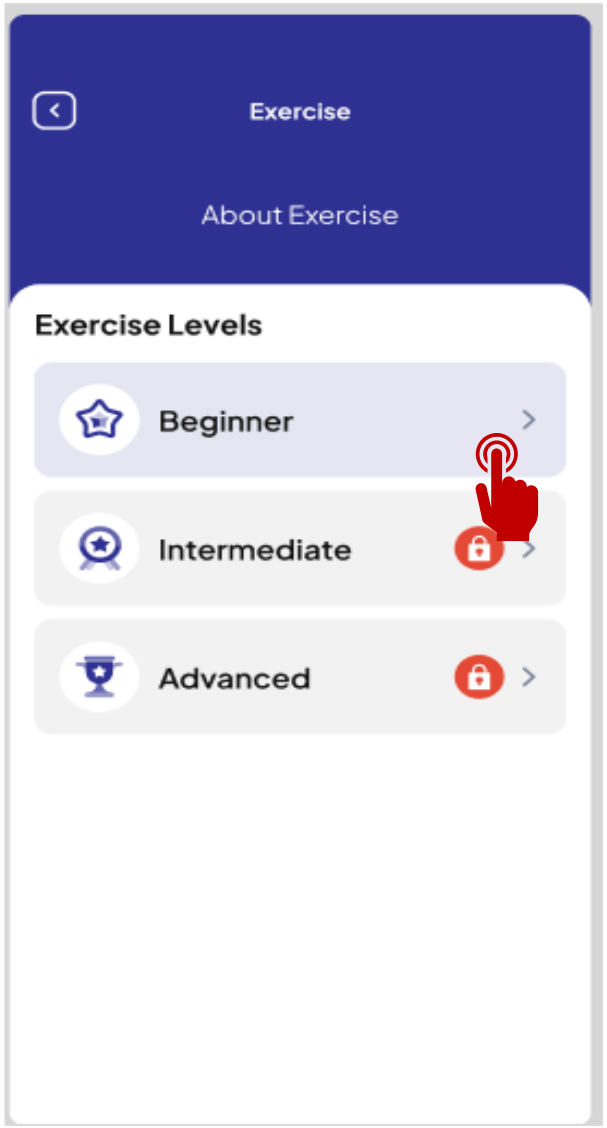
- Task Management
- Personalization
- Motivational Content
- Progress Tracking

(1) Task Management

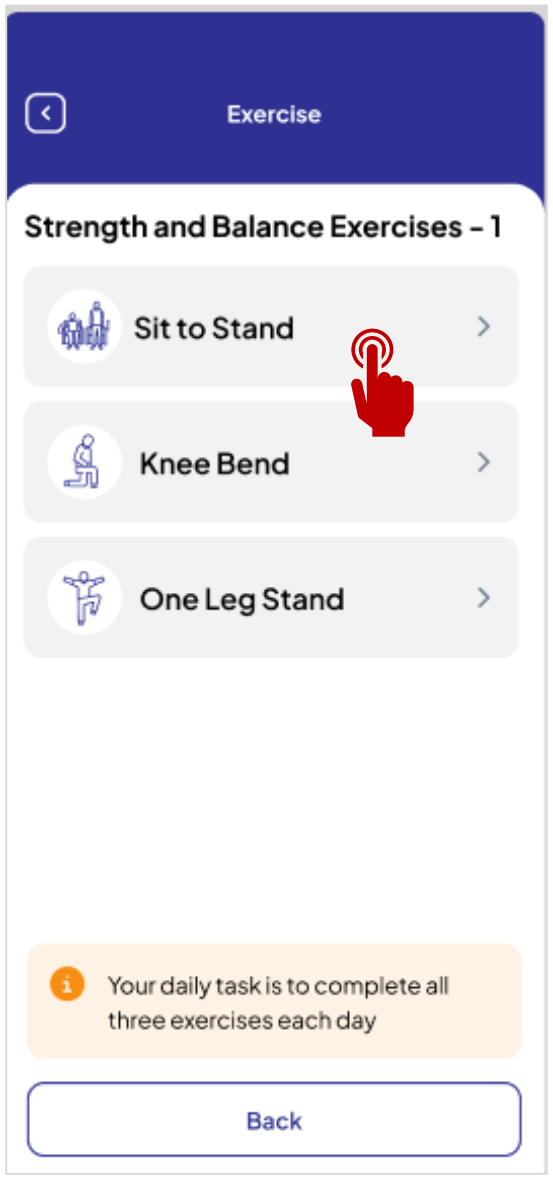


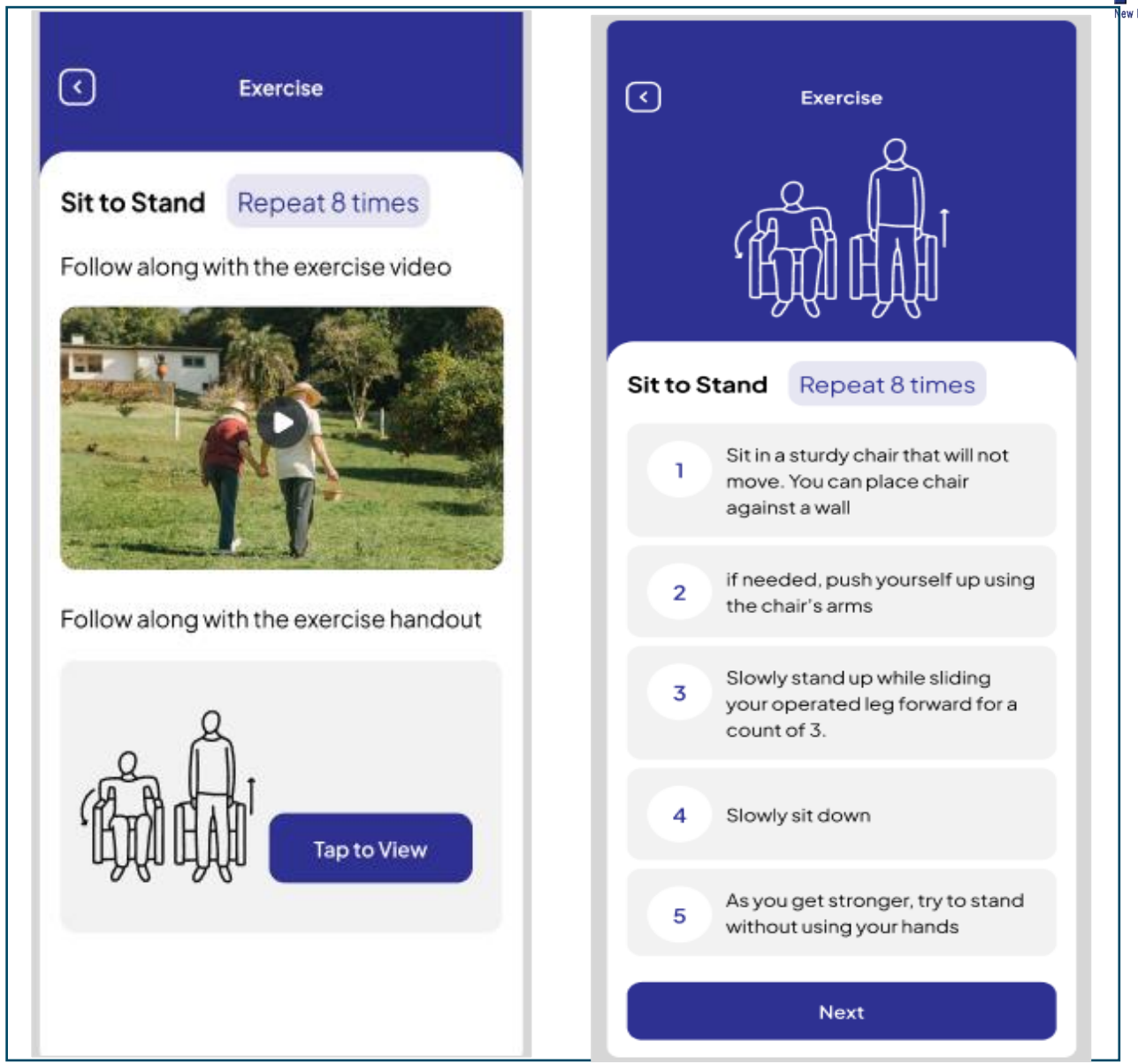
(2) Personalization

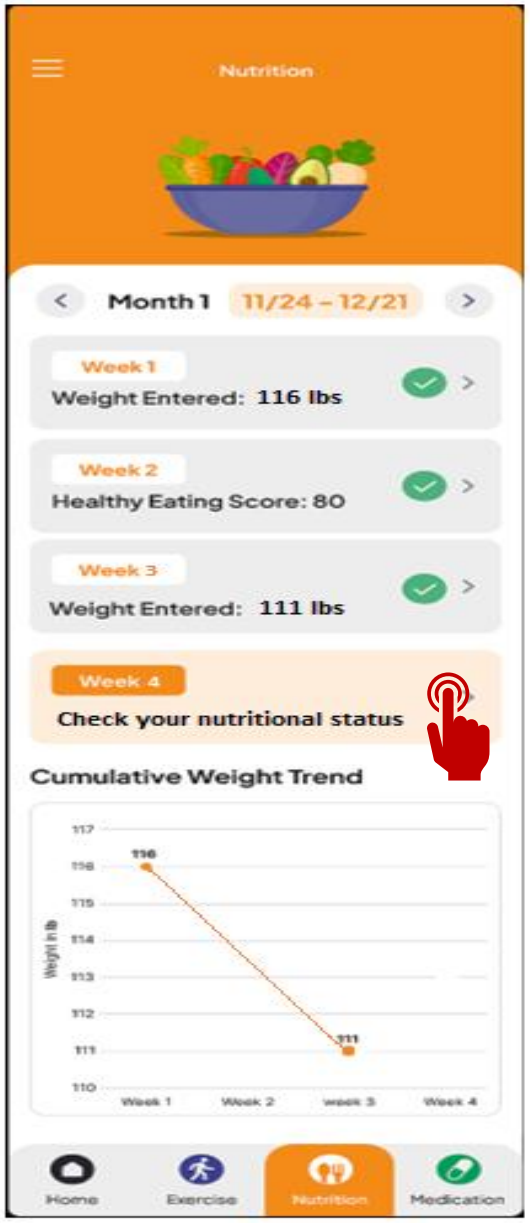
Exercise Levels

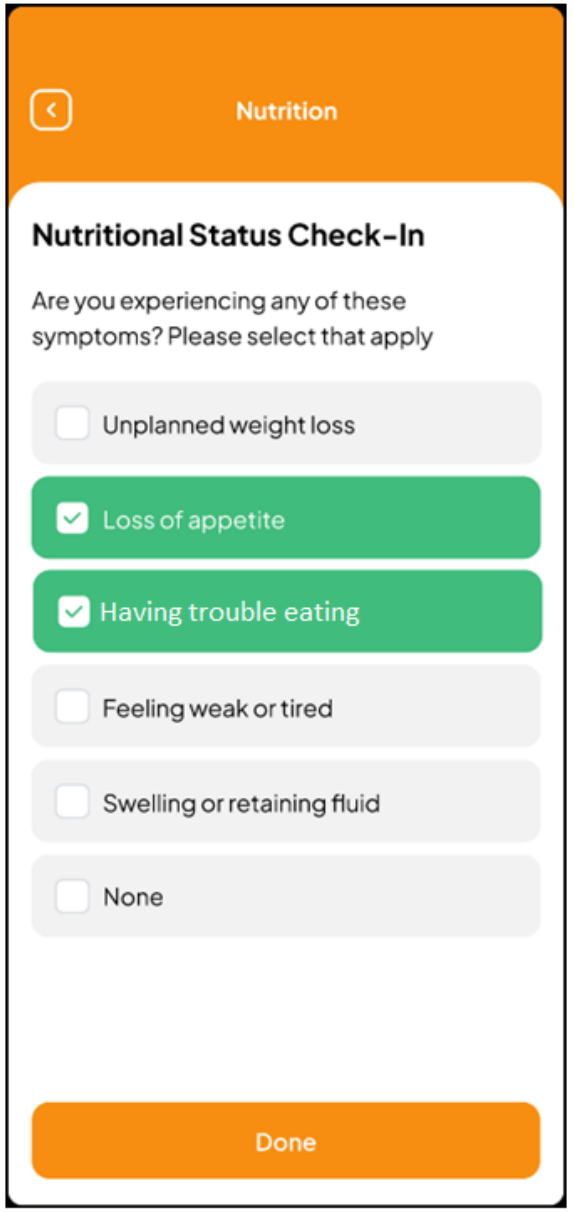


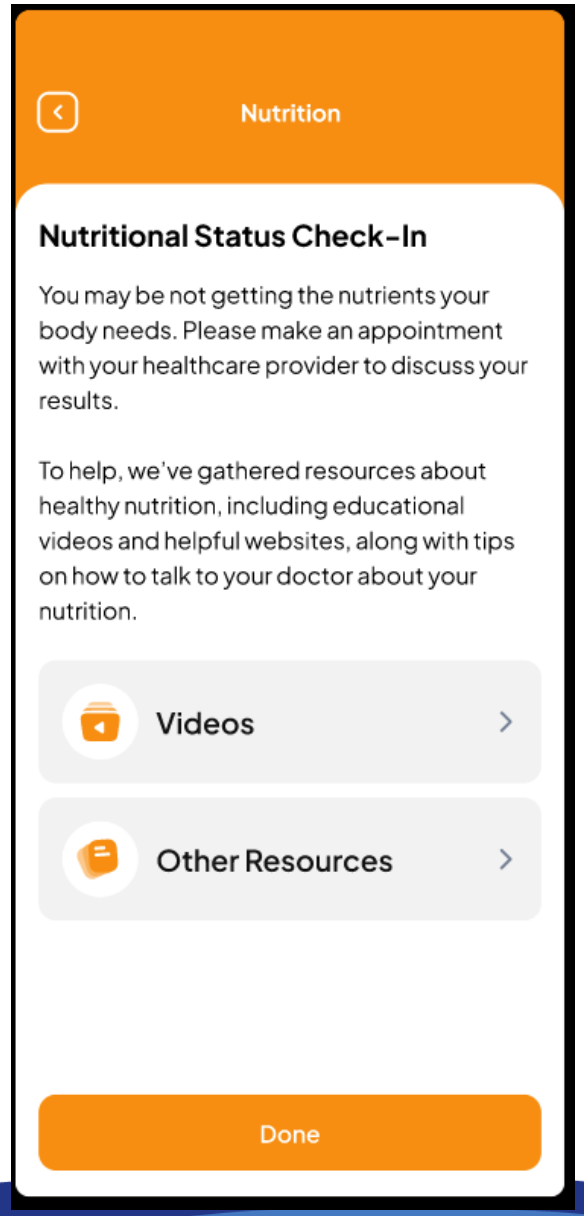
(2) Personalization



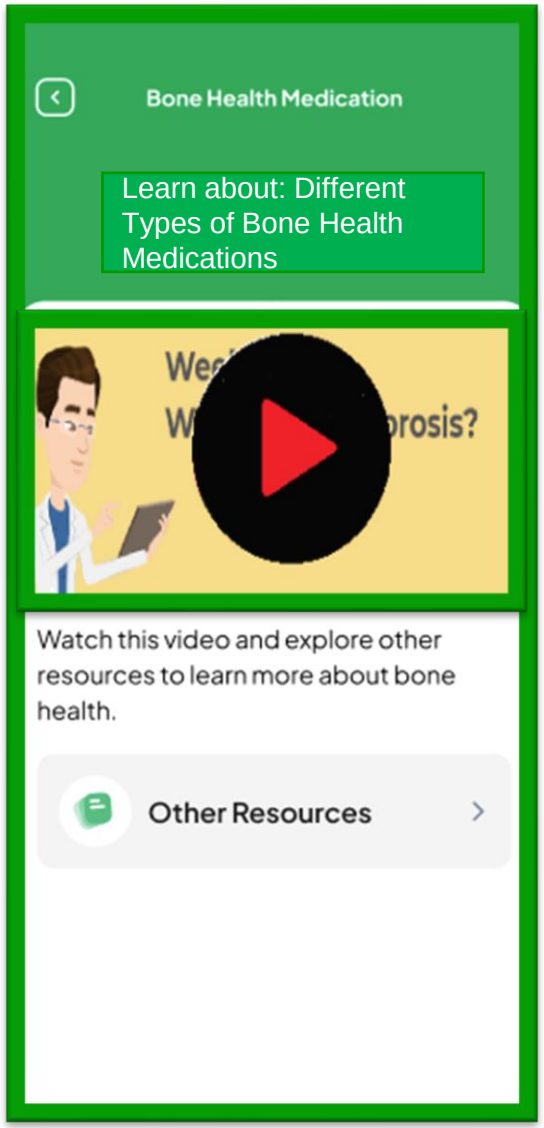


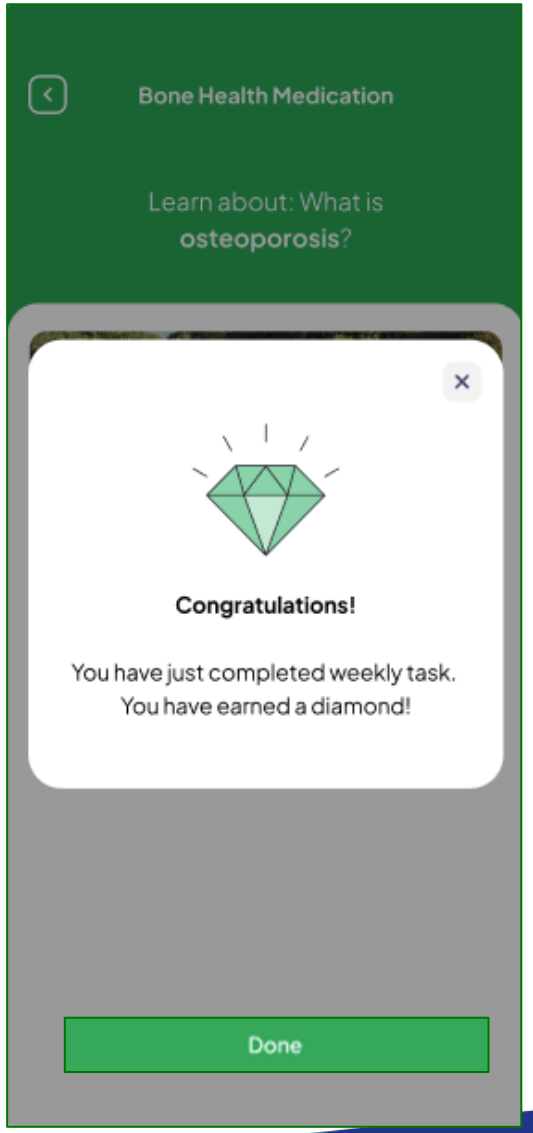

Nutrition
Month 1
11/24 – 12/21
Week 1
Weight Entered: 116 lbs
Week 2
Healthy Eating Score: 80
Week 3
Weight Entered: 111 lbs
Week 4
Check your nutritional status
Cumulative Weight Trend
Home
Exercise
Nutrition
Medication


Nutrition
Nutritional Status Check-In
Are you experiencing any of these symptoms? Please select that apply
Unplanned weight loss
Loss of appetite
Having trouble eating
Feeling weak or tired
Swelling or retaining fluid
None
Done

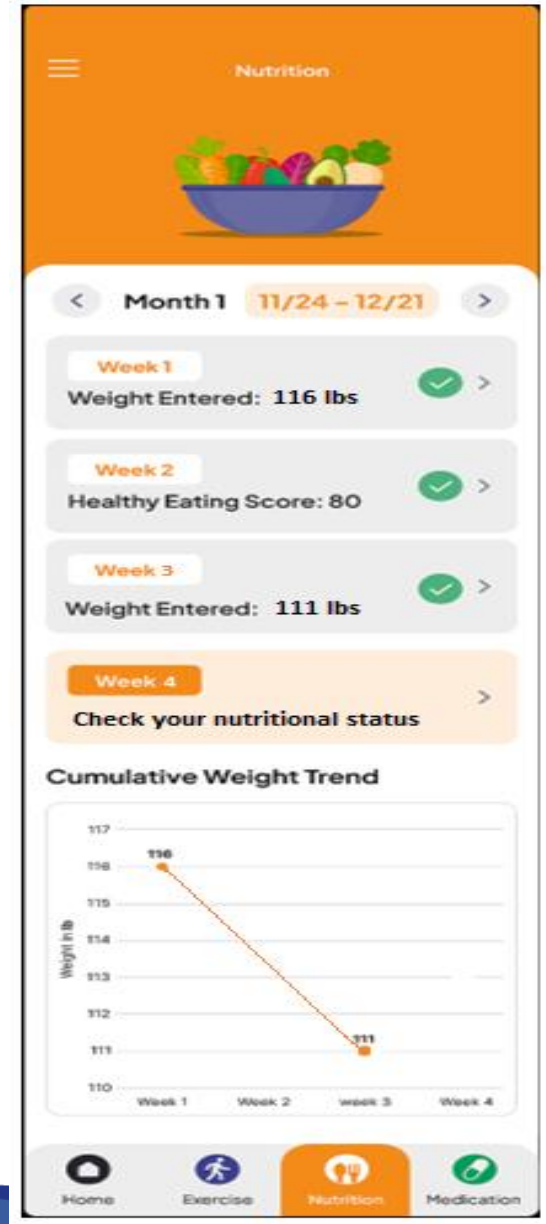

Nutrition
Nutritional Status Check-In
You may be not getting the nutrients your body needs. Please make an appointment with your healthcare provider to discuss your results.
To help, we've gathered resources about healthy nutrition, including educational videos and helpful websites, along with tips on how to talk to your doctor about your nutrition.
Videos
Other Resources
Done

(3) Motivational Content





(4) Progress Tracking



Study Team

- **Brigham Women's Hospital/Harvard**
  - **Patricia Dykes – MPI**
  - Martie Carney – Director of Patient Stakeholder Council
  - Min Kang – Informatics Coordinator
  - Nancy Latham – PT, Co-I
  - Stuart Lipsitz – Sr. Biostatistician
  - Rodrigo Valderrabano – Endocrinologist
  - Kumiko Schnock – Project Director
  - Michael Sainlaire – Data Manager
  - Alice Kim – Research Assistant
  - Baris, Veysel Karani – Research Fellow
  - Rosa Recio – Visiting Researcher

- **University of Maryland School of Medicine**
  - **Denise Orwig – MPI**
  - Ling Tang – Project Coordinator
  - Jay Magaziner – Director of Professional Stakeholder Advisory Board
  - Elizabeth Dennis – Registered Dietician
  - Jason Falvey – Physical Therapist
  - Tina Kramer-Merrikan – Outcome Assessor

- **Zco**
  - Randy Peterson
  - Michael Menon

- **Data Coordinating Center (Hebrew Senior Life/Harvard)**
  - Thomas Travison – Site-PI/Biostatistician
  - Alyssa Dufour – Biostatistician
  - Ilean Isaza – Program Manager
  - Dana Weisenfeld – Statistician
  - Timothy Tsai– Software Engineer

- **PointClickCare**
  - Britton Wagner
  - Richard White

- **University of Arkansas**
  - Simon Mears- Orthopedist

Thank you!

mkang6@bwh.harvard.edu

NENIC
New England Nursing Informatics Consortium

Nurses Transforming Healthcare
Through Informatics