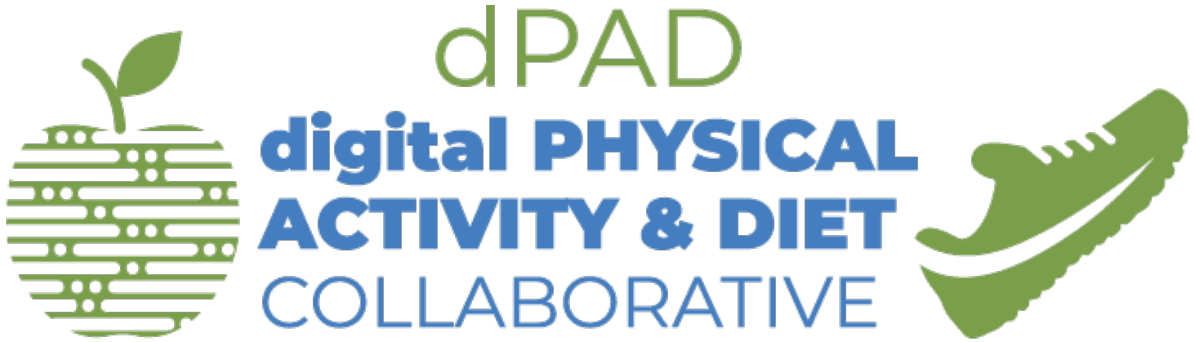
digital Physical Activity & Diet Collaborative

A Joint MD Anderson / UTHealth Core

2/3/2022



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The Digital Physical Activity and Diet (dPAD) Collaborative, a joint MD Anderson/UT Health Research Infrastructure Core

- **Introduction to dPAD**
  - Deanna M. Hoelscher, PhD, RDN
- **Digital Health and Fitness Collaborative**
  - Karen Basen-Engquist, PhD, MPH
  - MD Anderson Cancer Center
- **Digital Tools for Diet and Physical Activity Interventions and Data Collection**
  - Leah Whigham, PhD
  - UTHealth School of Public Health
- **Digilego: a multimodal analytics and intervention framework for personalized digital therapeutics**
  - Sahiti Myhneni, PhD
  - UTHealth School of Biomedical Informatics

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UTHealth/MDACC Population Health Initiative

- Funding to accelerate population health collaborations between the institutions
- Overall goal:
  - ***"achieve a measurable and meaningful reduction in the burden of chronic disease especially among the underserved in whom the impact of these illnesses and adverse outcomes are most consequential."***
- 3 types of funding opportunities:
  - **Quick Start**,
  - **Projects**, and
  - an **Impact Fund (dPAD)**

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Rationale

- The prevalence of overweight and obesity in Texas is a significant public health issue
- Need to scalable solutions to help Texans manage their weight through modifiable determinants: eating behaviors & physical activity
- Digital health tools can provide solutions, but research is needed for effective content, usable interfaces, context-specific tailoring, and expanding use of these tools among low-resource populations
- Development and testing of digital tools needs a team science approach that lends itself to this initiative

Aims

- To conduct a needs assessment to identify MD Anderson and UTHealth researchers with relevant interests and identify their needs for training, collaborators, and infrastructure
- To provide training and networking activities to support and connect digital health and obesity researchers
- To create core services based on investigator needs identified in Aim 1, such as:
  - An online resource clearinghouse and collaboration platform,
  - Consultation/navigation services, and
  - Technical services such as usability testing, measurement, accessing/pre-processing of digital device data.

Anticipated Outcomes

- Improve institutional ability to successfully compete for NIH and other funding, including partnerships with industry such as STTR/SBIR grants
- Enhance researchers' competitiveness for funding priorities identified in the *2020-2030 Strategic Plan for NIH Nutrition Research*, which focuses on precision nutrition, implementation science, and individualized approaches to weight management
- Resulting research would lead to highly scalable and cost-effective interventions to decrease obesity and subsequent disease and disability in Texas
- dPAD will interface with the newly formed Texas Network of Obesity Research (TeNOR), involving institutions across the state

Leadership

- MDACC
  - Dr. Karen Basen-Engquist, Lead
  - Dr. Susan Peterson
  - Thuan Le
- UTHealth
  - Dr. Leah Whigham, Co-Lead
  - Dr. Sahiti Myneni, Co-Lead
  - Dr. Deanna Hoelscher

Scope of Work

- Needs assessment survey (February 2022)
- Webinar series
- Digital health training
- Symposia (one virtual, one in-person)
- Provide core services
  - Website, see http://go.uth.edu/dPAD
  - Clearinghouse of resources
  - Fee-for-service
  - Limited amount of supplemental funds for researchers

Digital Health and Fitness Collaborative:

A dPAD precursor

Karen Basen-Engquist, PhD, MPH

Director, Center for Energy Balance in Cancer Prevention and Survivorship

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dPAD
digital PHYSICAL ACTIVITY & DIET COLLABORATIVE

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Digital Health and Fitness Collaborative

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- Funded by the Duncan Family Institute, 2018 – 2022
- Aims:
  - 1. Develop innovative technology-based weight loss intervention strategies/products (can address eating behavior, nutrition, physical activity)
  - 2. Test strategies in the context of an evidence-based weight management program in MD Anderson cohorts
  - Create a data resource for investigators focused on effects of intervention components; predictors of project participation; and the relationship between nutrition, physical activity, fitness, body composition, and cancer risk.

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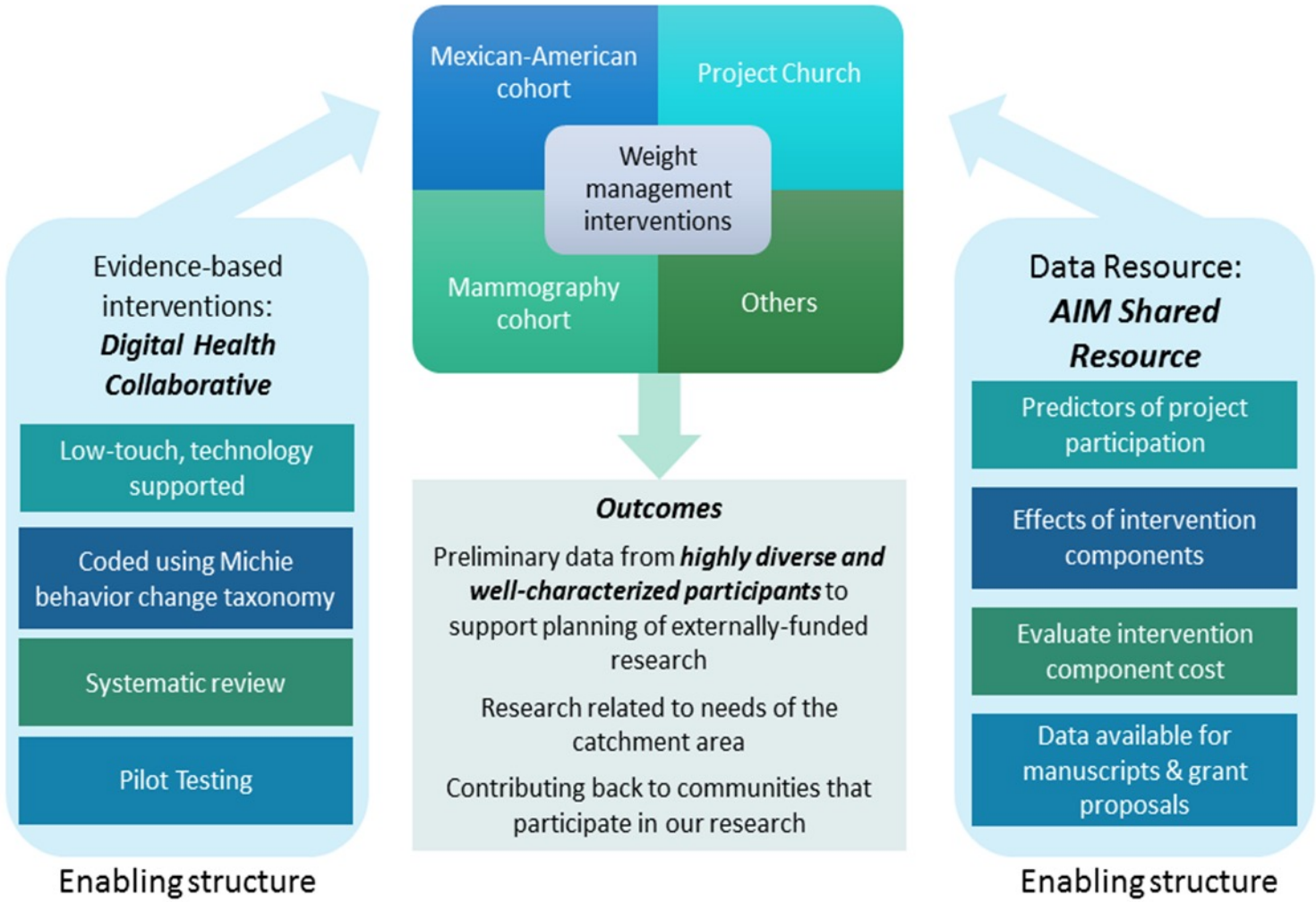

Faculty

- Karen Basen-Engquist, Susan Peterson, Yue Liao, Susan Schembre
  - Behavioral Science
- Susan Gilchrist, Abenaa Brewster, Sam Hanash
  - Clinical Cancer Prevention
- Larkin Strong, Scherezade Mama, Lorna McNeill
  - Health Disparities Research
- Carrie Daniel-MacDougall
  - Epidemiology

Development and Testing

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1. Digital weight loss intervention
2. Brief DPP videos
3. My Snack Tracker
4. Cooking video evaluation
5. Telehealth best practices
6. Text message intervention to reduce sedentary behavior

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Digital Weight Loss Program Pilot

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- Populations
  - Mexican-American Cohort: Family and/or friendship dyads
  - Project CHURCH: Men from predominantly African-American churches
  - Mammography cohort: Women undergoing mammography screening
  - High-risk breast: Women at increase risk of breast cancer, high Gail score or pre-invasive lesion
- Objectives
  - Primary: Evaluate intervention feasibility. Feasibility will be assessed by participant retention (program will be considered feasible if 75% complete the program) and participant satisfaction.
  - Secondary: Evaluate changes in weight, eating behavior, physical activity, quality of life, and behavioral determinants (e.g., motivation, self-efficacy, readiness) in participants in the digital health weight loss program.
  - Exploratory: Through interviews with participants, identify additional intervention strategies and products that will be helpful for these populations.

Cohort	Target Enrollment	% Target Enrollment	% completed
Mexican-American Cohort	20, 10 dyads	80%	ongoing
Project CHURCH	10	100%	90%
Mammography	10	100%	90%
High-Risk Breast	10	100%	90%

88% agree/strongly agree they would recommend the program to a family member

Mean weight loss = 9.3 lbs (SD =21.1)

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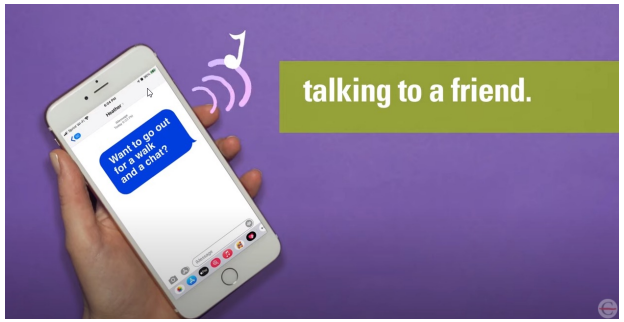
Brief Videos

- 1-2 minute videos related to weight management
- Can be provided with intervention materials, used in social media interventions
- Developed in collaboration with MD Anderson's Community Alliances Department

Portion control

Stress management



Meal planning

Physical activity

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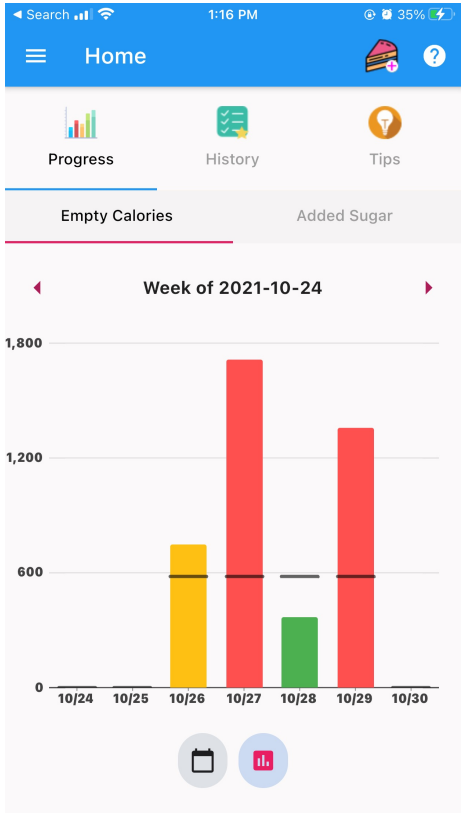
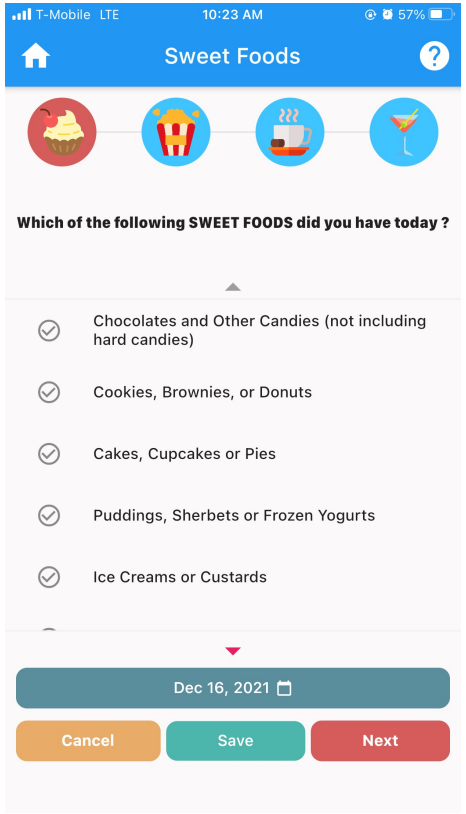
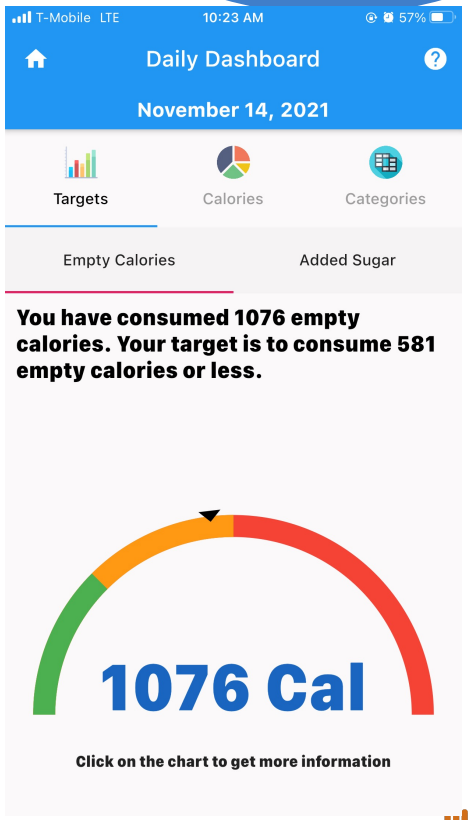
My Snack Tracker

- App for dietary self-monitoring, alternative to full diet tracking
- User records only energy dense, nutrient poor foods, receives feedback on sugar and “empty calorie” limits
- App development: AIM Shared Resource







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My Snack Tracker

- Usability testing with 15 people who've participated in a weight loss program, 9 people who have not
- Provided feedback on clarity of information, appearance, usefulness
- Many comments indicated better orientation to the purpose needed, as well as directions for navigating

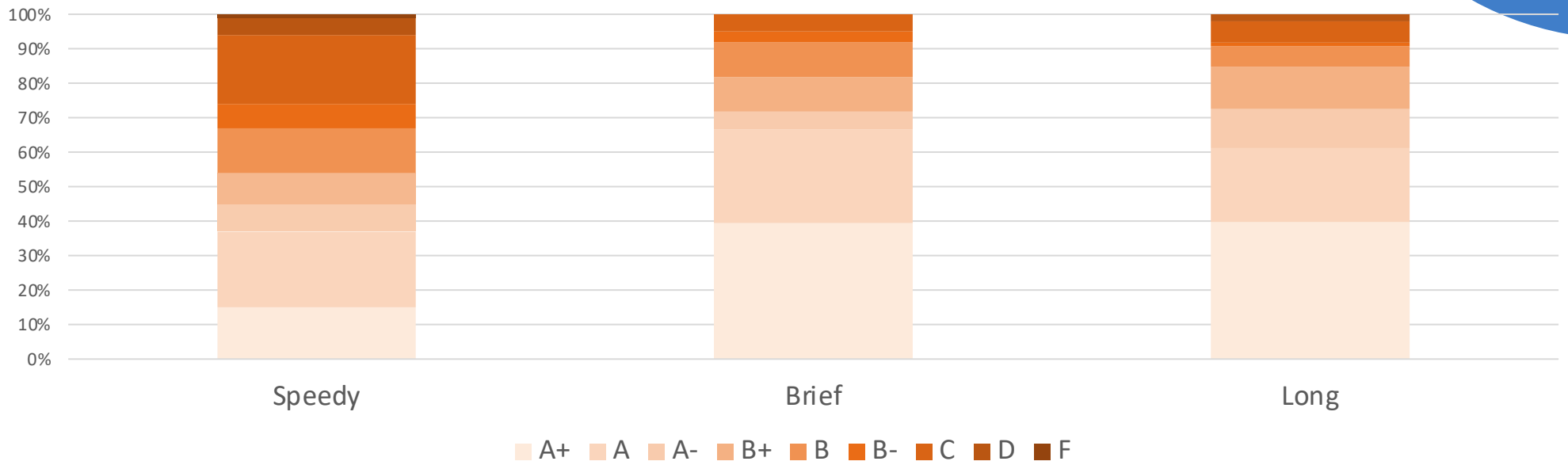
Comments on logging screens:

- I know we're talking about empty calories so…maybe add cheeses. Maybe for other packaged snacks specify more if you mean trail mix or something like that. [not finding a food they eat] (4)
- I like the scrolling scale. (2)
- The sliding, I'm more of a drop-down person. (4)
- There were some foods that I eat that are ethnic and I wouldn't know how to classify here so I just stuffed them under a category. [ethnic or customized snacks] (3)
- I would make the serving thing more noticeable because I didn't realize that said 2 cup handfuls. The need for a bigger font a different color because I just gazed over it.
- It wasn't instinct to click on one (the illustrations up top) than the other I thought it was a pretty border). Maybe a way to gray it out or animation to indicate next one next one. (3)
- The colors are fine but maybe if the previous and next were arrows that would be more aligned
- Maybe adding a scanning feature
- I'm confused it says 12 oz cup but if it was less than that like 8 oz what do I do, does it go to 8? So how would I measure an 8 oz cup?
- Is there a way to search a name brand food?

Cooking Video Evaluation

- Objective: identify preferences for different types of cooking videos
- Three video types:
  - "Speedy" – 1 min, cooking sped up, no talking, ingredients pre-prepped
  - "Brief" – 2-3 min, hosted, cooking in real time, discussed health benefits, ingredients pre-prepped
  - "Long" – 4-8 min, hosted, prep and cooking in real time, discusses prep techniques

Favorability of 3 types of cooking videos



Likes: recipe looks good, step by step instructions, seems simple, presentation appealing
Dislikes: too fast, didn't like some ingredients, no recipe

Likes: health benefit info, easy recipe, good length, easy to follow, good visuals, presenter a dietitian, short
Dislikes: food not appealing, didn't like the visuals, boring, unnecessary (simple recipe)

Likes: salad dressing ideas, lots of options, advice/guidance/info, entertaining host
Dislikes: too many options, host issues (licked fingers, tossed salad with hands, difficult to understand), too long and boring

New Projects

Telehealth best practices

- Interviewing participants in Zoom-delivered interventions about advantages and barriers
- Will be used to develop best practices guide

Text 2 Move

- Text messaging intervention to reduce sedentary behavior
- 3 arms:
  - Fitbit + activity responsive messages
  - Fitbit + generic messages
  - Fitbit alone
- Recruitment of participants through Community Alliances programs

Future Directions

Intervention tools

Preliminary data

Information/resources

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Digital Tools for Diet and Physical Activity Interventions and Data Collection

Leah D. Whigham, PhD, FTOS

Associate Professor, Department of Health Promotion & Behavioral Science

Director, UTHealth Center for Community Health Impact

The University of Texas Health Science Center at Houston | School of Public Health El Paso

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Center for Community Health Impact

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Mission: To impact health through creation of community-driven solutions informed by science in support of healthy eating, active living, and decreased obesity.

Strategy:

- Align with the needs of region - use Collective Impact Model
- All levels of the social ecological environment
- Functional cores of expertise

CCHI Functional Cores

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CCHI Partnership Areas

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Food Systems

Metabolic Health in Primary Care

Workplace Wellness

School Wellness

Built Environment

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Scalable Interventions

- Nutrition Therapy for Weight Loss
- Primary Care Obesity Management

SMALLCHANGES

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School of Public Health
El Paso

Center for Community
Health Impact

With funding from: HE&AL | PASO DEL NORTE HEALTH FOUNDATION
HEALTHY EATING & ACTIVE LIVING

Sign Up: Current Weight and Measurements

Enter current weight and measurements, for calculation of daily calorie requirements.

The recipes in the Change Plan are unique to person’s calorie requirements.

Create Change Plan

Oatmeal

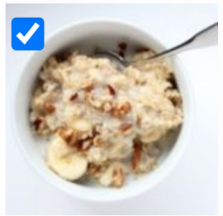
Basic-4 Cereal

Eggs, over-easy with toast.

McDonald's Breakfast

For each mealtime, from a list of foods, choose FOUR meal options that are closest to what is *currently* eaten.

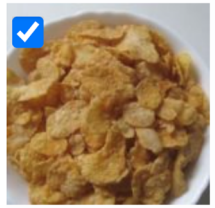
- [x] Oatmeal
- [x] Basic-4 Cereal
- [x] Eggs, over-easy with toast.
- [x] McDonald’s Breakfast



OLD FASHIONED OATMEAL

oatmeal 3/4 cup raw cooked with 1 1/2 cups 1% milk

Home-Made



KELLOGG'S ORIGINAL CORN FLAKES

corn flakes 1 1/4 cup, milk 1% 2 1/4 cup

Home-Made

HUEVOS A LA MEXICANA

corn tortilla 1 (6-inch), 2 eggs cooked, 1/4 onion, 1/4 tomato, 1 tbs cilantro and jalapeno mix, 1 tbs mozzarella cheese

MCDONALD'S HAM, EGG, AND CHEESE MCMUFFIN

egg McMuffin (ham, cheese, egg) with 1 hashbrown

Follow the Plan:

- Get a Flexcipe for each meal option.
- The ingredient amounts in the Flexcipe are specific to the calorie level, and they change as the person loses weight.
- Follow the “Flexcipe” as closely as possible.

HUEVOS A LA MEXICANA

Restaurant Breakfast 2200 Calories/Day Plan

Print Flexcipe

INGREDIENTS

TO MAKE 2 WEIGHT-LOSS PORTIONS :

Change Number of Portions:

- 4 eggs
- 1/2 onion
- 1/2 fresh tomato
- 1/4 jalapeño
- 4 tsp canola oil
- 4 tsp oregano (dry)
- 1/4 cup chopped cilantro
- 2 tsp salt
- 2 tbs mozzarella cheese

DIRECTIONS:

1. Saute onions, oregano, and jalapeno for 1-2 minutes
2. Add chopped tomatoes and cook for 2 minutes
3. Add in eggs and scramble them into the sauce

Each day, for each meal, choose any one option from the Change Plan.

BREAKFAST

Old Fashioned Oatmeal

McDonald's Ham, Egg, and Cheese McMuffin

Kellogg's Original Corn Flakes

Huevos a la Mexicana

AFTERNOON SNACKS

Mixed Nuts

Chicken Salad

Cheese-Only Quesadilla

2% Fat Cottage Cheese with Fruit

LUNCH

Ramen Noodles with Chicken and Vegetables

Hot Pocket (Chicken and Cheese) with Knorr Sopa De Fideos Con Pollo

Fideo

Beef Burrito with Fruit and Corn Salad

DINNER

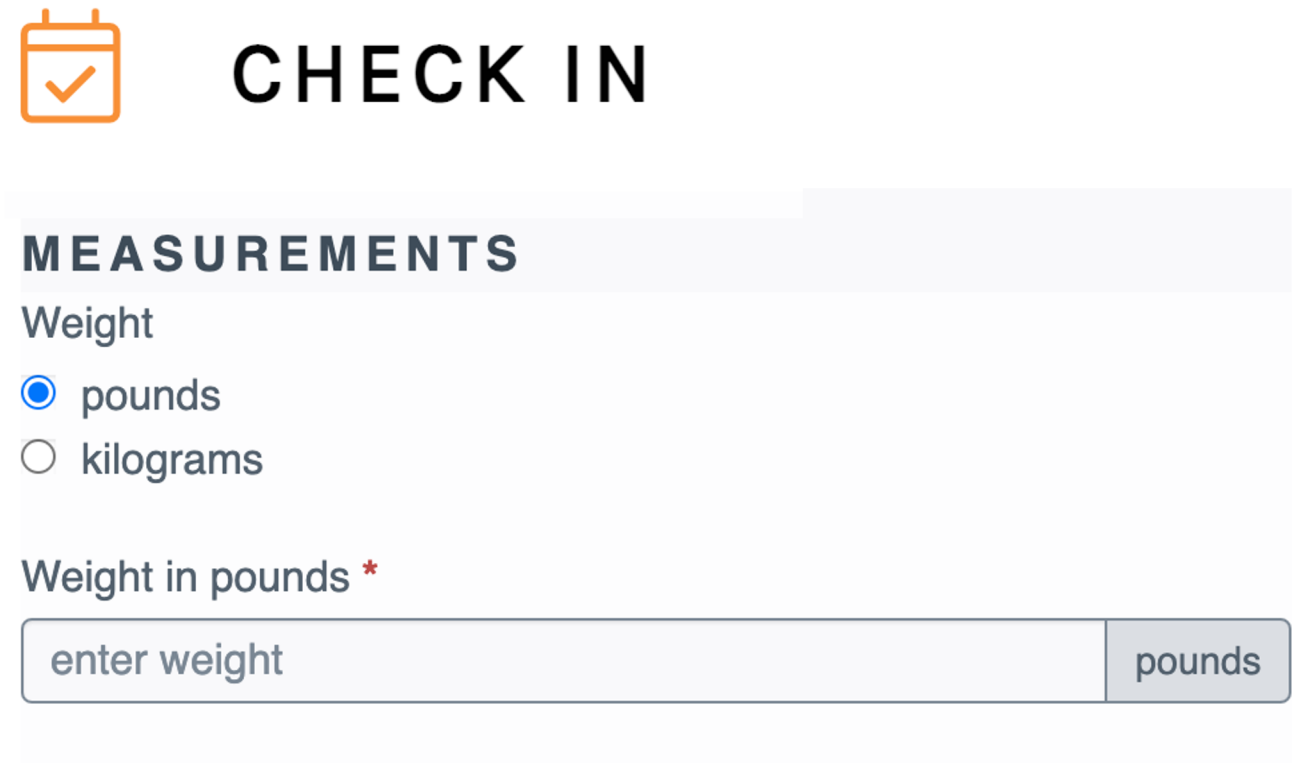
Milanesa

Little Caesars Pizza

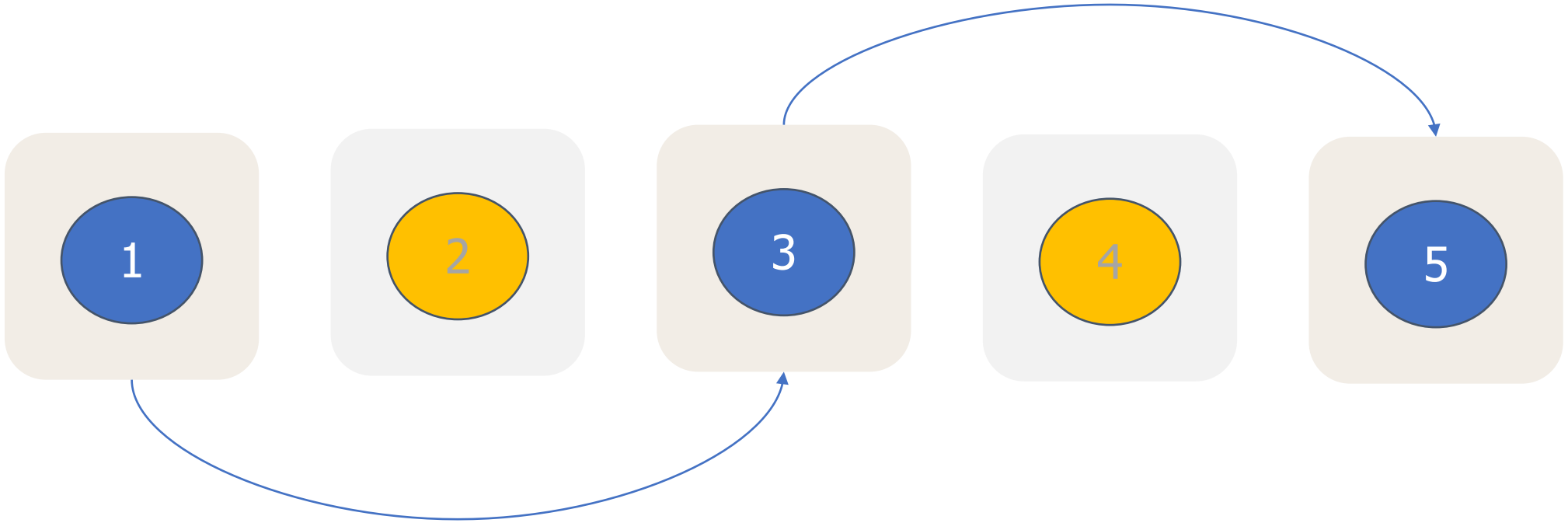
Chile Relleno

Chicken Flautas

Enter weight every week to track progress and enable Small Changes to automatically adjust Flexcipes.



Choose new options and get a fresh Change Plan every 2 weeks.



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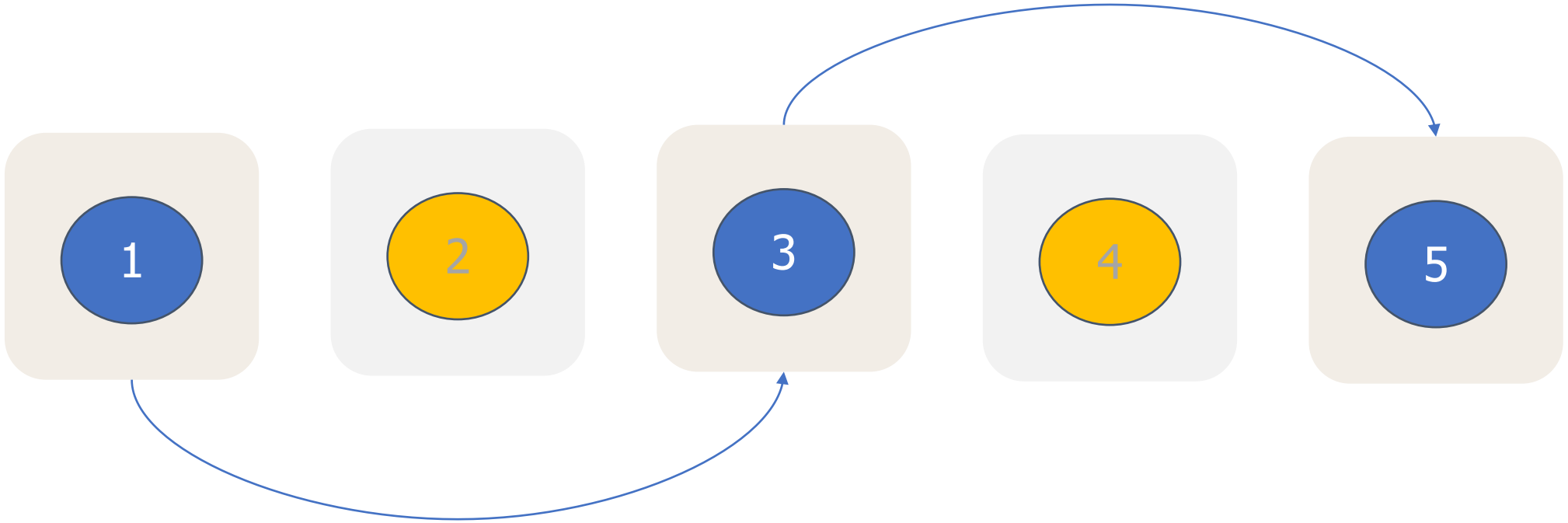


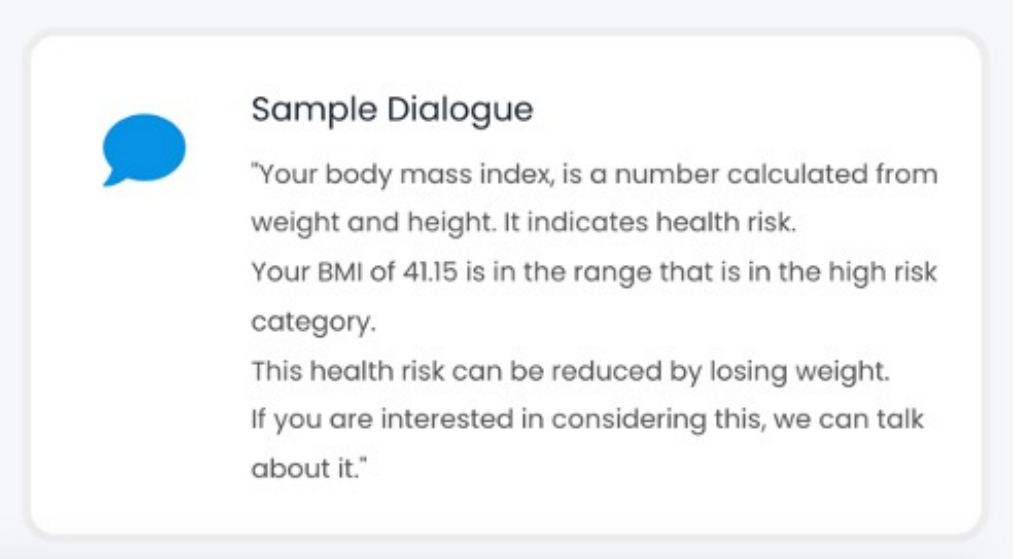
Small Changes lead to
Get Big Results

Scalable Interventions

- Nutrition Therapy for Weight Loss
- Primary Care Obesity Management

Primary Care Obesity Management

- Clinical decision support system (CDSS)
- EHR integration
- Features include:
  - dialog boxes
  - info boxes
  - physical exam adaptations
  - diagnostics reference



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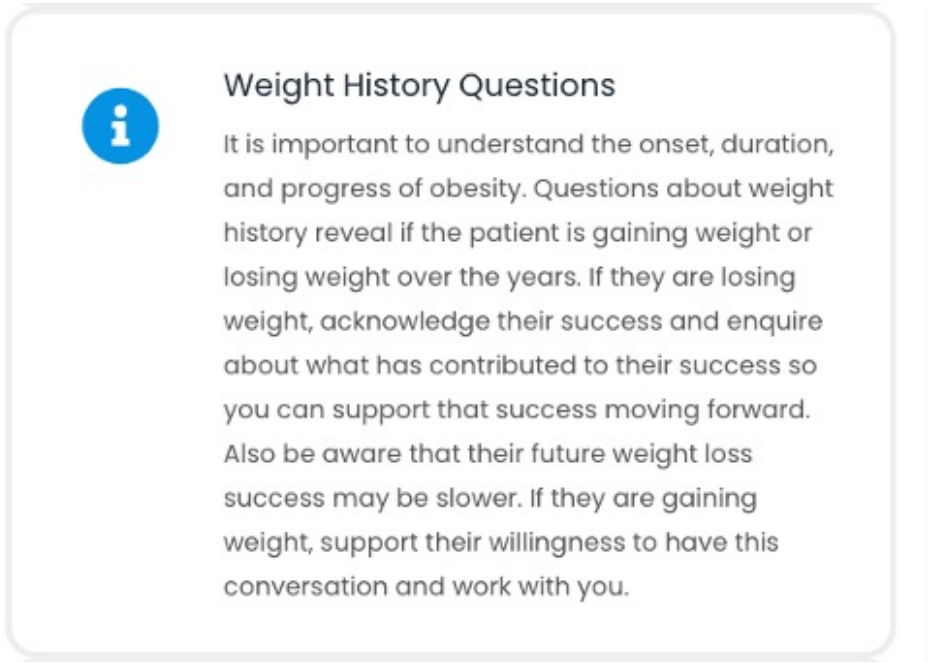

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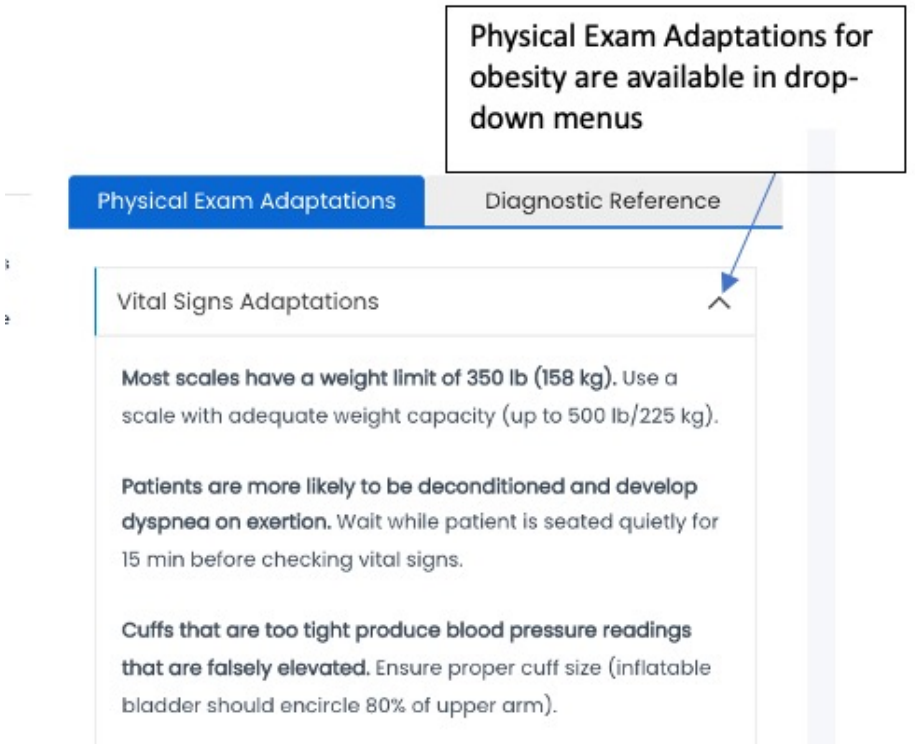

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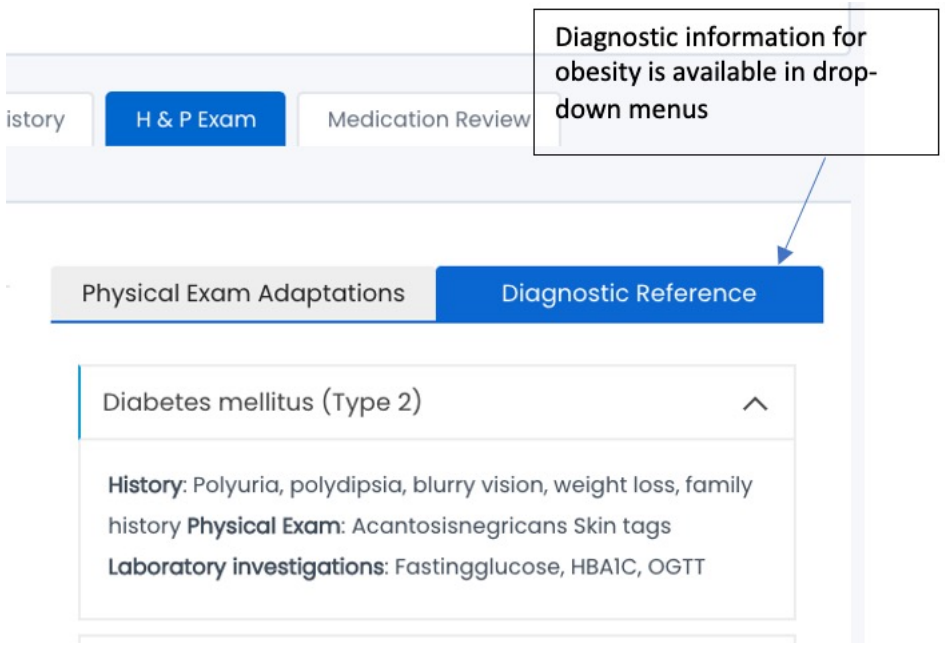


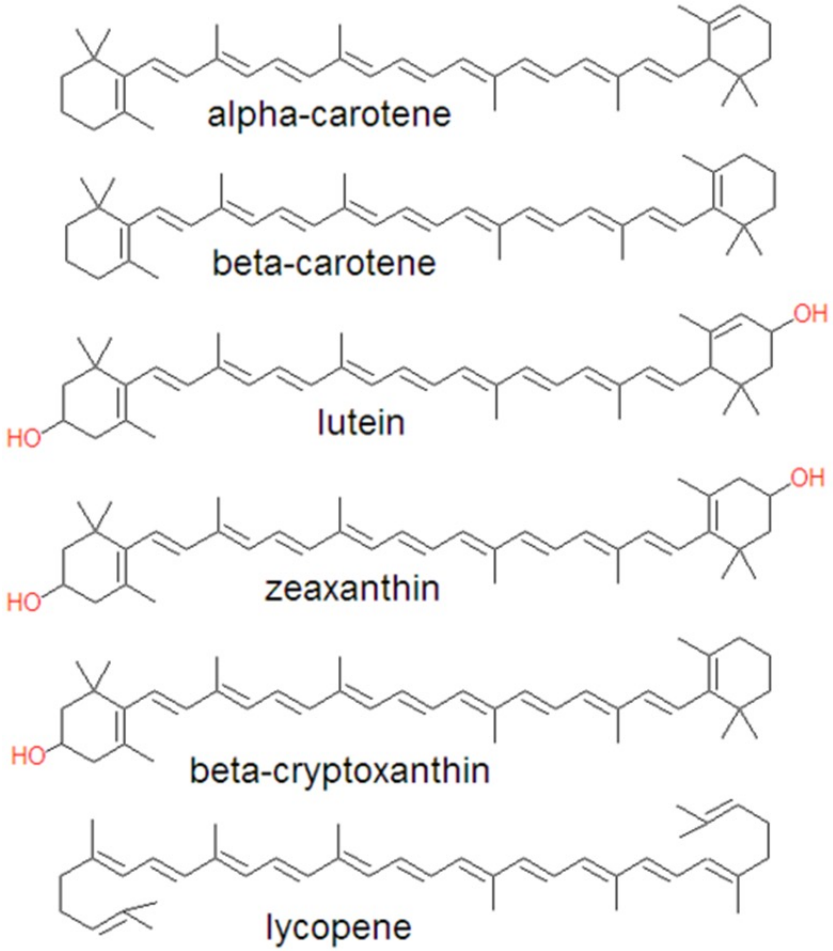
Primary Care Obesity Management

- Lifestyle
- Weight History
- Family History
- History and Physical Exam
- Medication Review
- Pharmacotherapy Guidance
- Diet therapy

Data Collection in the Community

- Fruit and Vegetable Intake
- Energy Balance

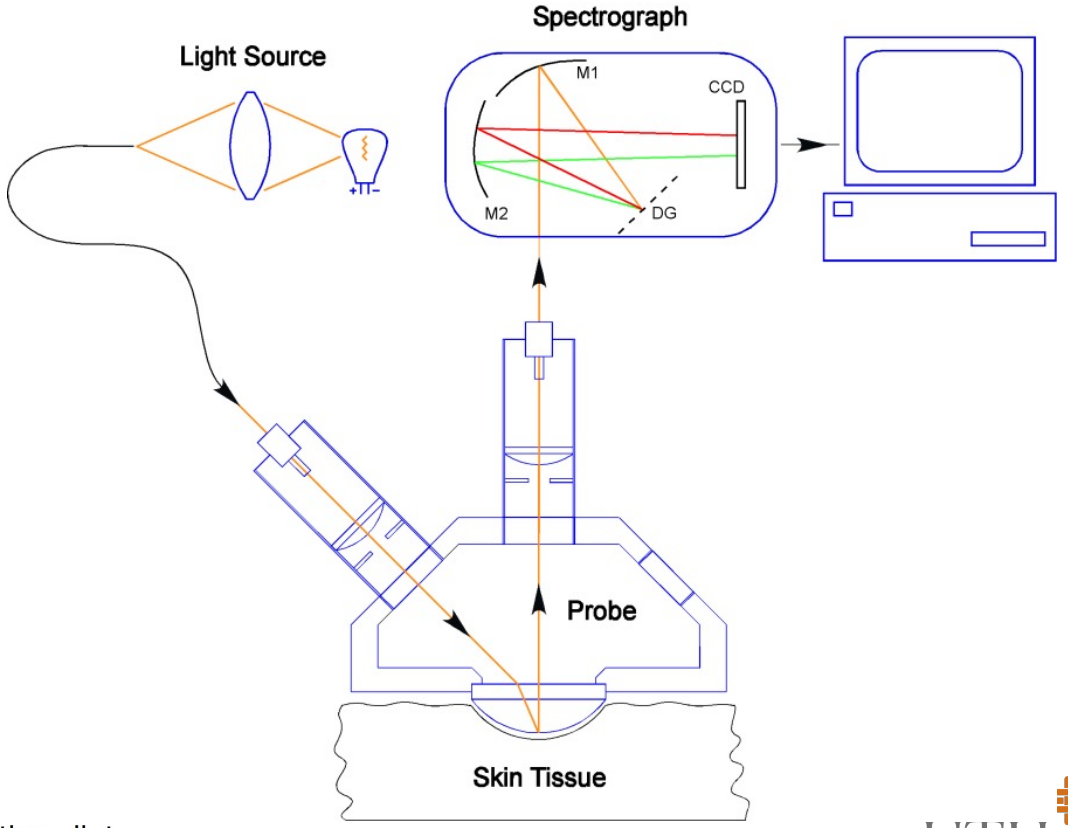
Carotenoids - Biomarker F&V intake



- Found primarily in fruits and vegetables
- Function as efficient antioxidants/optical filters
- Dietary intake – not synthesized in the body
- Long chain-like molecules with π-electron conjugated carbon backbone (conjugated dienes)
- Protect cellular DNA
- Biomarker of total fruit and vegetable intake

Reflectance Spectroscopy

- Non-invasive
- Self-calibrating
- 2 minutes



Skin and plasma carotenoid response to a provided intervention diet high in vegetables and fruit: uptake and depletion kinetics[1–5]

Lisa Jahns, LuAnn K Johnson, Susan T Mayne, Brenda Cartmel, Matthew J Picklo Sr, Igor V Ermakov, Werner Gellermann, and Leah D Whigham

Am J Clin Nutr 2014;100:930–7.

Putting Research into Practice

- Clean finger
- Avoid staining
- Use same finger across time
- Use non-dominant hand

Data Collection in the Community

- Fruit and Vegetable Intake
- Energy Balance

Proof of Concept Study

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Can breath carbon stable isotope ratios be used to track energy balance?

International Journal of Obesity (2014) **38,** 1248–1250

www.nature.com/ijo

SHORT COMMUNICATION

Breath carbon stable isotope ratios identify changes in energy balance and substrate utilization in humans

LD Whigham[1], DE Butz[2], LK Johnson[3], DA Schoeller[4], DH Abbott[5], WP Porter[6] and ME Cook[2]

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Where to find us

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Digilego: a multimodal analytics and intervention framework for personalized digital therapeutics

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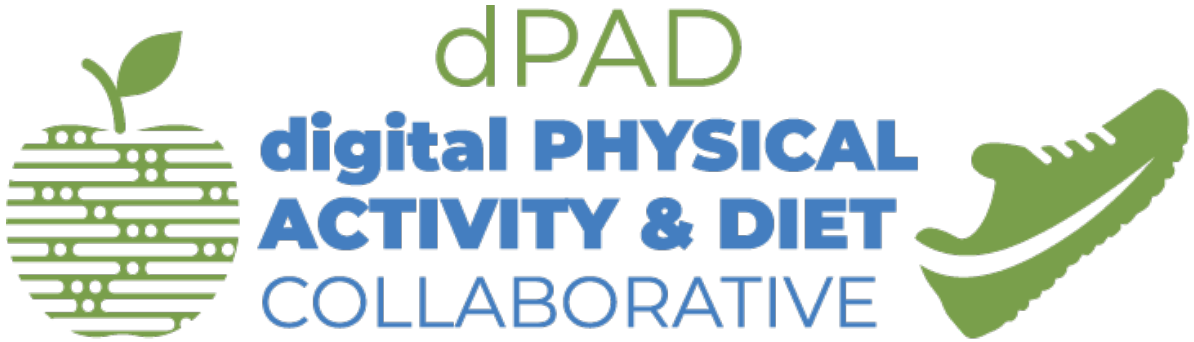

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Center for Digital Health and Analytics

Digital Health Solutions – Personal and Connected Health		Clinical Intelligence – Decision Support and Analytics		Clinical Excellence – Patient Safety and Quality	
Mobile Health	Devices, Sensors and IoT	Clinical Applications (FHIR Apps)	Cognitive Support Services (Situation Awareness)	Medical Errors	Quality Measures and Analytics
Telehealth and AI Agents (virtual assistants)	Patient Portals	Visual Analytics and Dashboards	Clinical System Analysis (Usability, Workflows)	Medication Safety	Predictive and Causative Analytics for Patient Safety
Personal Health	Social Networks and Health management	Knowledge Management (Decision Rules)	Process Automation and AI Integration	Diagnostic Safety	Error Management

Faculty

- Sahiti Myneni
  Digital health, social analytics
- Amy Franklin
  Human factors, cognitive psychology
- Deevakar Rogith
  FHIR integration, clinical analytics
- Meera Subhash
  Clinician, EHR implementation

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Towards modular digital solutions

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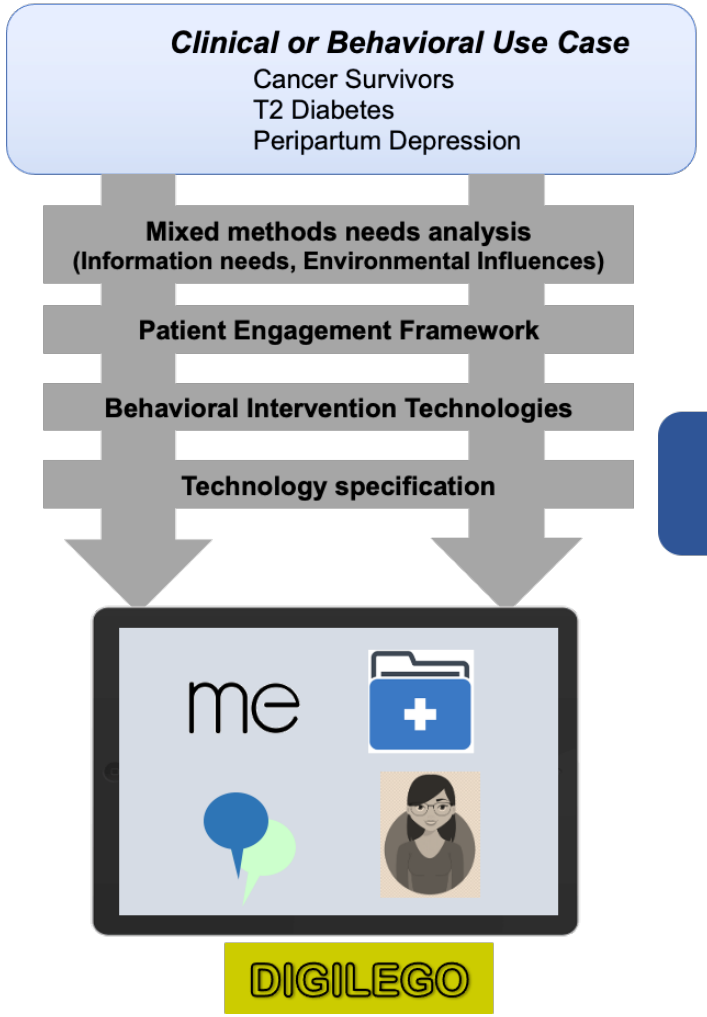

Digilego Framework

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Social media as a research resource

- Data harvesting
  - Nutrition
  - Dietary supplements
  - Type 2 Diabetes
  - High risk pregnancy management
  - Other risky health behaviors

- Areas of interest
  - Engagement predictors
  - What? How? Who?
  - Spread of information
  - Network silos

Methodological underpinnings

- Theory integration
  - Speech Act Theory
  - Social Cognitive Theory
  - Taxonomy of Behavior Change Techniques
- Computational methods
  - Transformer models
  - Temporal random indexing
  - Active learning
- Network Science
  - Network exposure
  - Ideology diffusion
  - Influence and impact measure

In the context of cancer survivorship

Agile, Adaptive, Integrative

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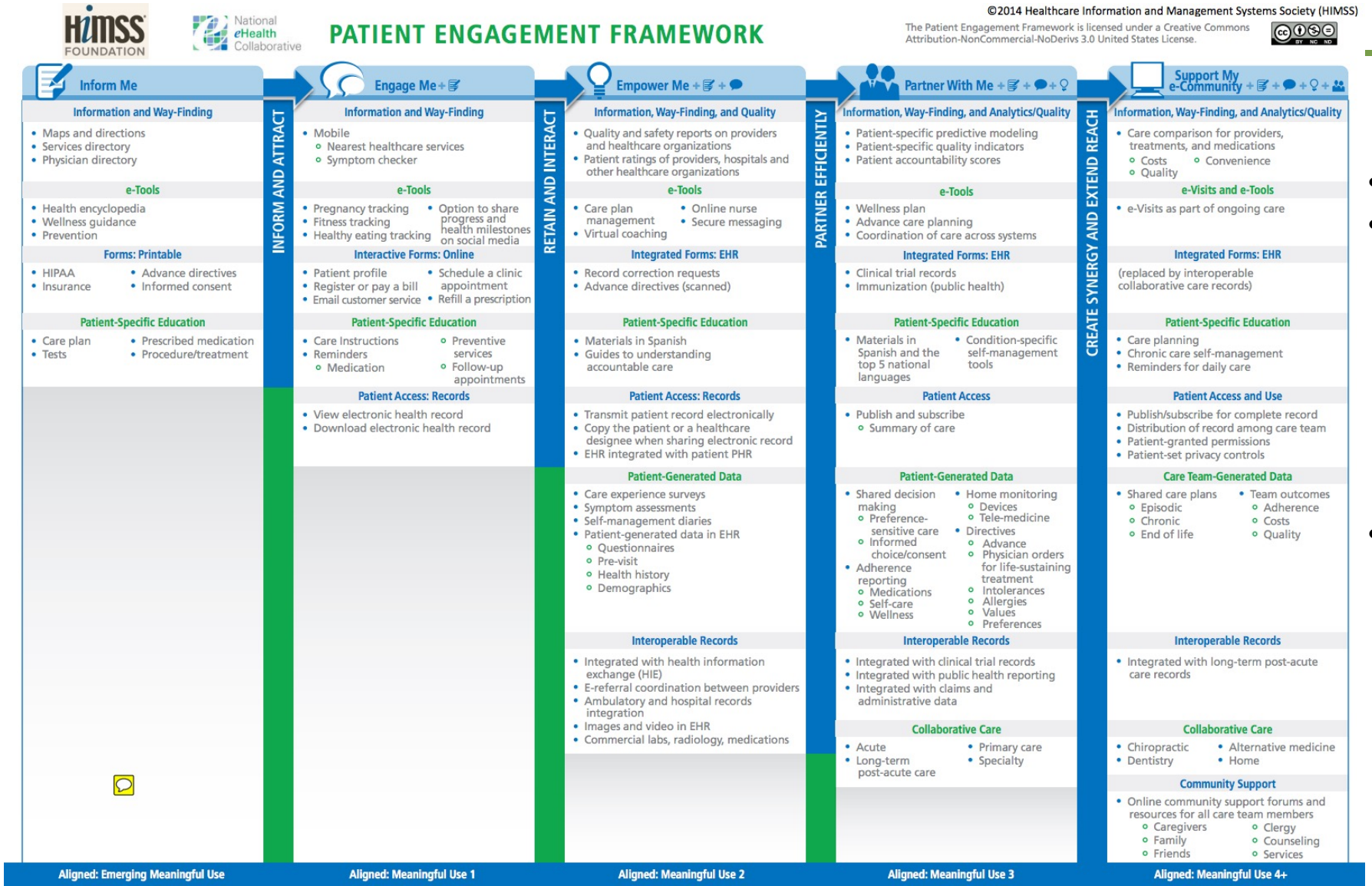
Step 1: Social media analysis

- 24,723 publicly available deidentified survivor interactions
- Semi-automated methods to extract content areas and need specifications
  - 1000 messages manually coded
  - Semantic vectors
  - Traditional Machine Learning
  - Deep learning variations
- Misinformation topics

Step 2: Engagement elements



- 5 cumulative phases, 9 features
- Several technology components
  - Access to EHRs
  - Trackers for self-monitoring
  - Collaborative care
  - Community support (Online social networks)
- Mapping to ontology
  - Implementable features
  - Characterize system granularity

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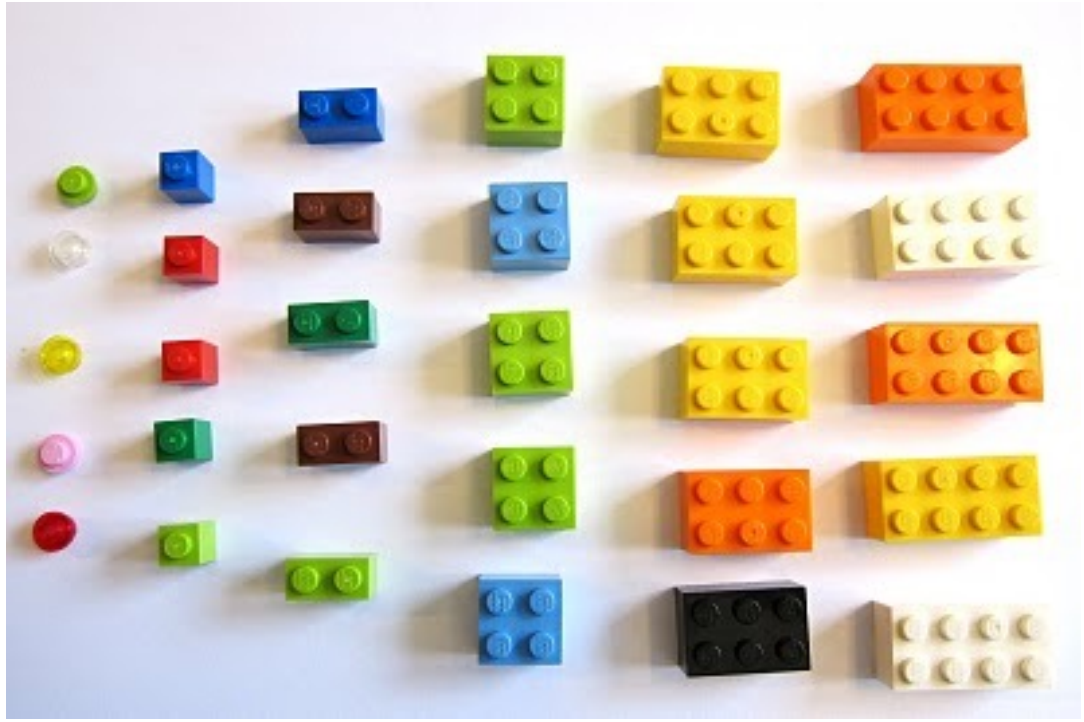
Step 3: Suvivor *Digilego*: Methods

- Our definition of ***digilego block:*** **individual and reusable connected health components**
- Behavioral Intervention Technology (BIT) model
  - Operational aim of each ***digilego block***
  - Integration with behavior change strategies
  - Define user interactions
  - Workflow alignment
  - Interfacing among ***digiliego blocks***
- Implemented using FHIR

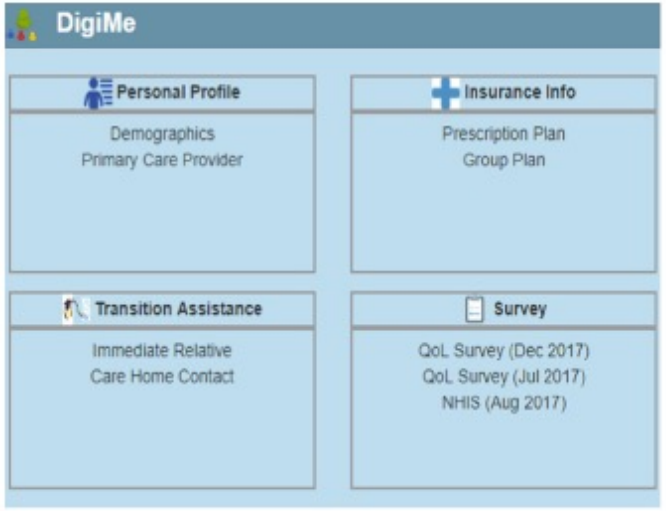


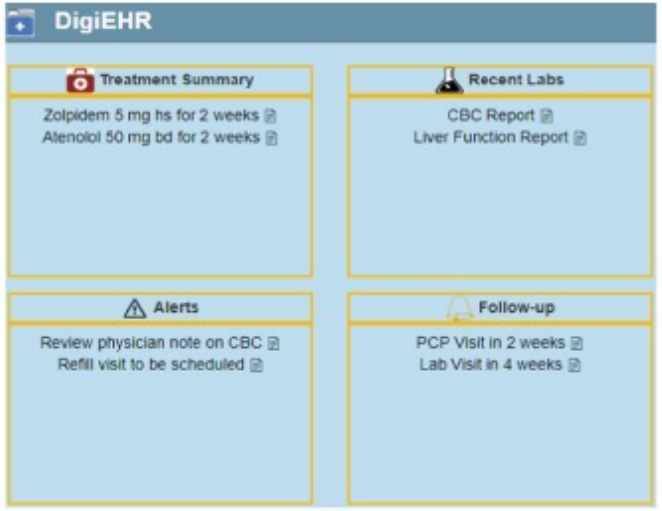
Results: Areas of interest

- Communication Topics
  - Treatment plan
  - Healthy living
  - Social engagement
  - Late effects, Remission
  - Medications
  - Alternative medicine
  - Insurance, Family, Medical will

Survivor Digilegos	Content specialty
	Insurance information
	Health behavioral trackers
	Treatment summary
LE	Personalized late effects summarization
	Follow-up care scheduling
	Personal profile
Patient-specific Education	Targeted health tips, education
	Transition assistance
WORK LIFE	Lifestyle tips; Care reminders
	Social Hub
?	Question corner

Results: Survivor *Digilegos*





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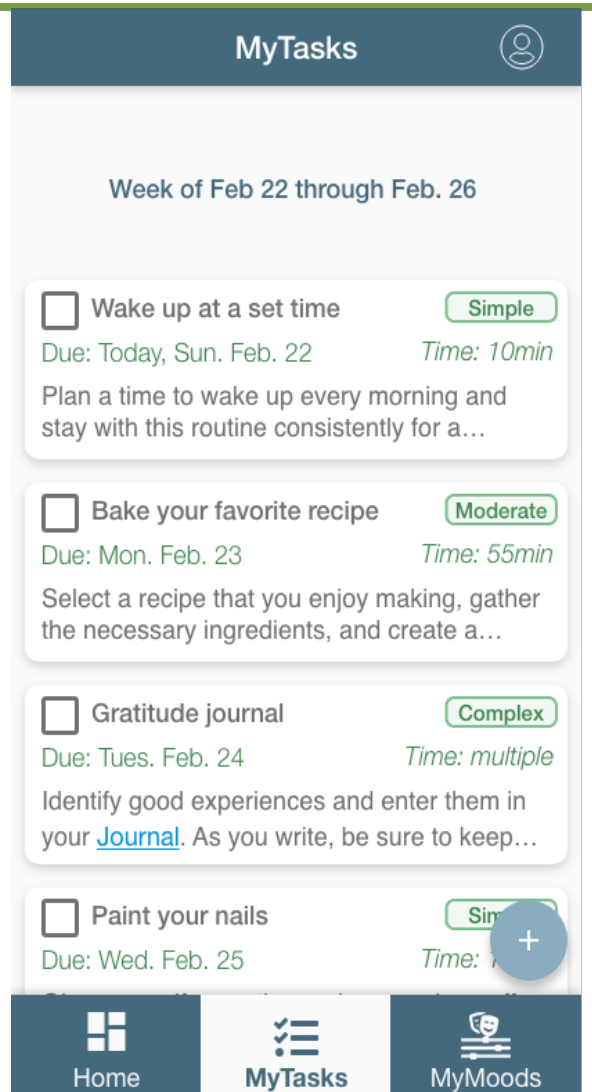
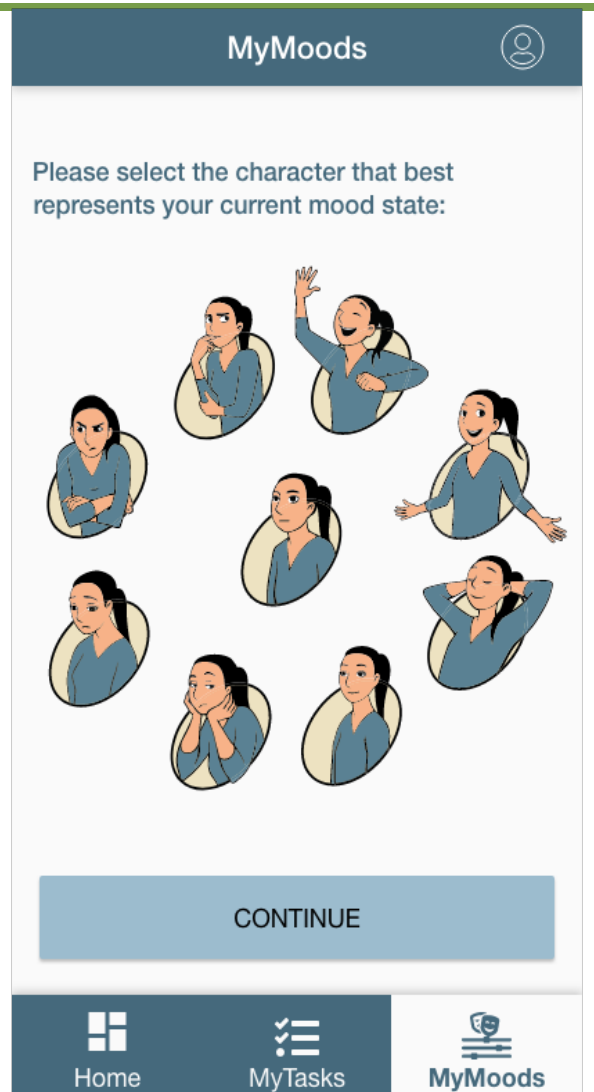
Preliminary evaluation

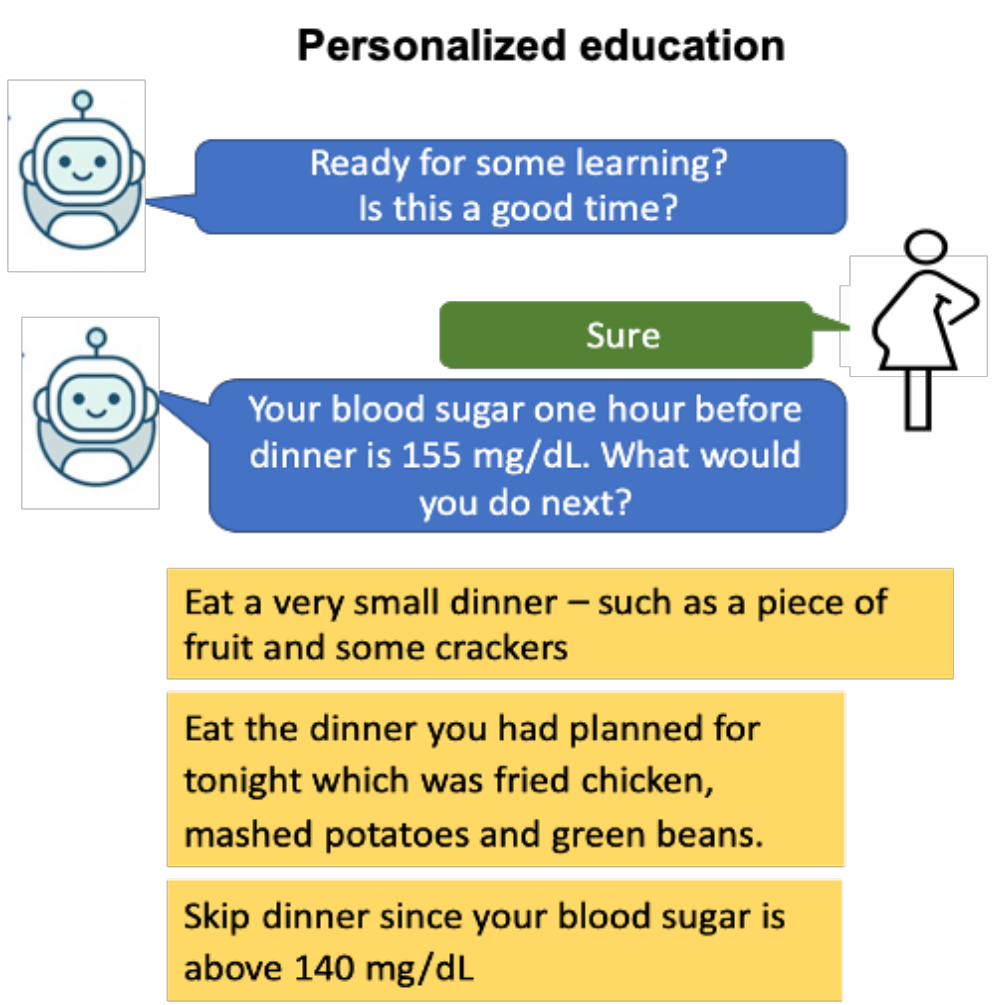
- 16 survivors used the prototype
- 5/5 rating for technology acceptance
- 75% indicated used of social media analysis improved their confidence that the system meets their needs
- 14 survivors voted favorably for all Digilego blocks
- Communication pathways for person and clinical contacts should be different.

Applications: stress management





Applications: high risk pregnancy



dPAD service opportunities

- Social listening
  - Preprocessed and deidentified datasets
  - Analytics: Trends, Topics, and more
- Mobile applications
  - Online forum
  - Q&A feature
  - Chatbot
  - Journaling
  - Education
  - Redcap integrative
  - Wearables

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Selected Publications

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- Zingg A, Singh T, Myneni S. Analysis of Online Peripartum Depression Communities: Application of Multilabel Text Classification Techniques to Inform Digitally-Mediated Prevention and Management. Frontiers in Digital Health. 2021;3:38.
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- Myneni S, Amith M, Geng Y, Tao C. Towards an ontology-driven framework to enable development of personalized mHealth solutions for Cancer survivors' engagement in healthy living. Studies in health technology and informatics. 2015;216:113.

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- Complete the needs assessment dPAD survey
- Attend the dPAD webinars
- Visit the dPAD website: http://go.uth.edu/dPAD
- Link dPAD to resources and projects at UTHealth and MDACC
- Contact us!
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