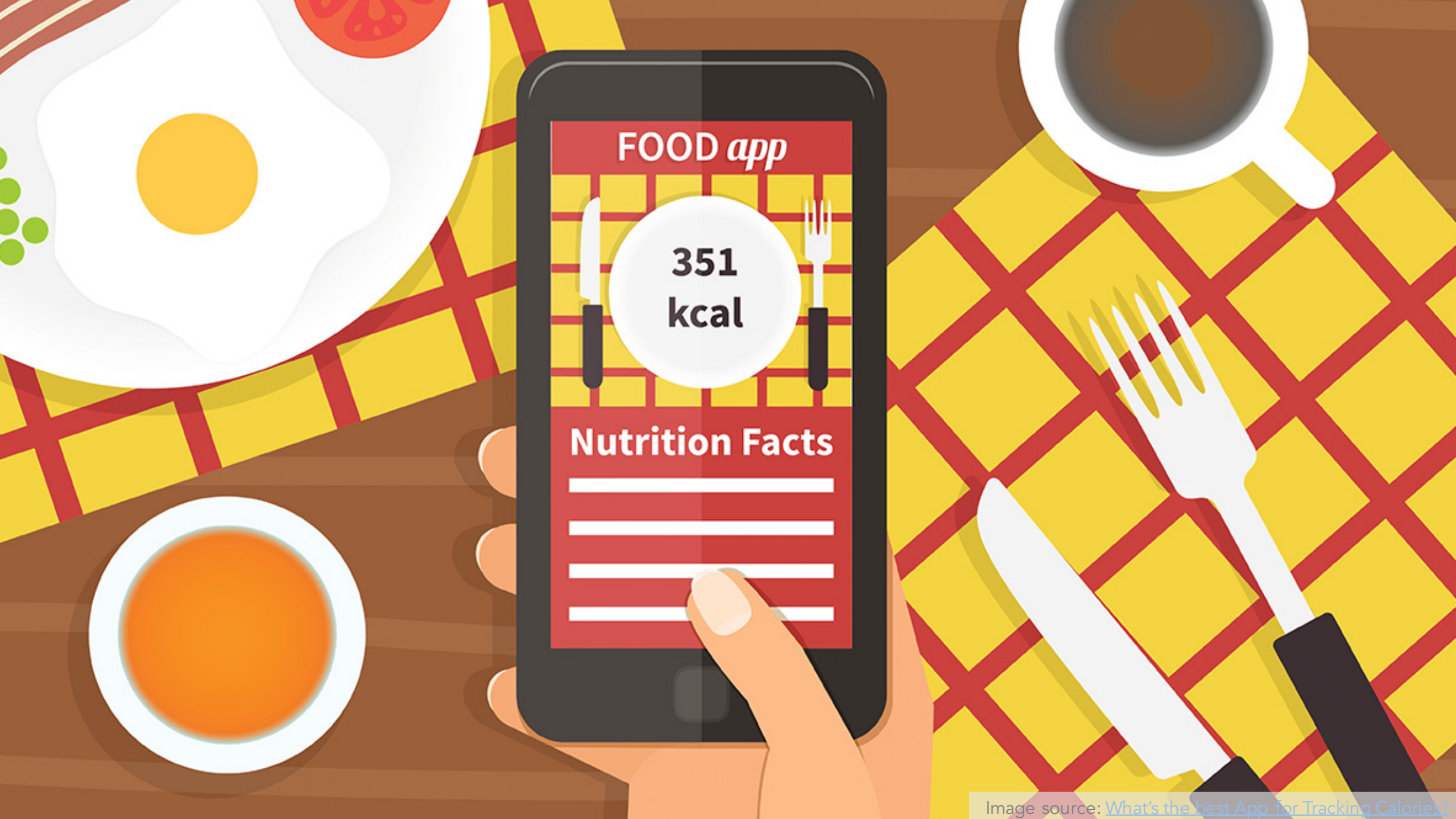


Co-Designing Food Trackers with Dietitians: Identifying Design Opportunities for Food Tracker Customization

Yuhan Luo, Peiyi Liu, Eun Kyoung Choe

College of Information Studies & Human-Computer Interaction Lab
University of Maryland, College Park





What do people track about their food?



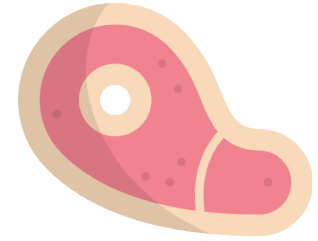
Regular meals



Snacks



Calories



Nutrition facts
(e.g., protein)



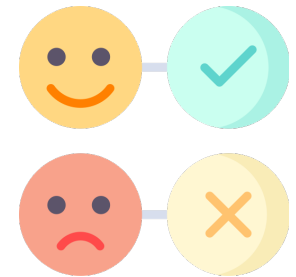
Time



Location



People



Feelings

[Grimes & Harper, 2008]

Health providers: the values of food tracking data

- Assess nutrient intake
- Perform diagnosis
- Provide treatment



[Gubney, 1997; Ma et al., 2003; Matthys, 2007]

Image source: [5 things your dietitian wants you to stop doing](#)

Patients: tracking needs vary by health conditions



Irritable bowel syndrome (IBS)¹
(Chung et al., 2015)



Obesity² (Ma et al., 2002)



Eating disorder³
(Eikey et al., 2016)

Image source: [1] [Abdominal pain for irritable bowel syndrome.](#)

[2] [Medical News Today](#)

[3] [WHERE DID MY APPETITE GO?](#)

The design of mainstream food tracking apps

← Add Food ✓

Strawberry Rhubarb Yogurt (Nosa)

Number of Servings 2

Serving Size 8.0 oz (227g)

Time 🔒

560

Cal

44%
62g
Carbs

35%
22g
Fat

21%
28g
Protein

Percent of Your Daily Goals 👑 Go Premium

Calories

Carbs

Fat

Protein

30%

1,880






🔒

🔒

🔒

View Nutrition Facts

MyFitnessPal

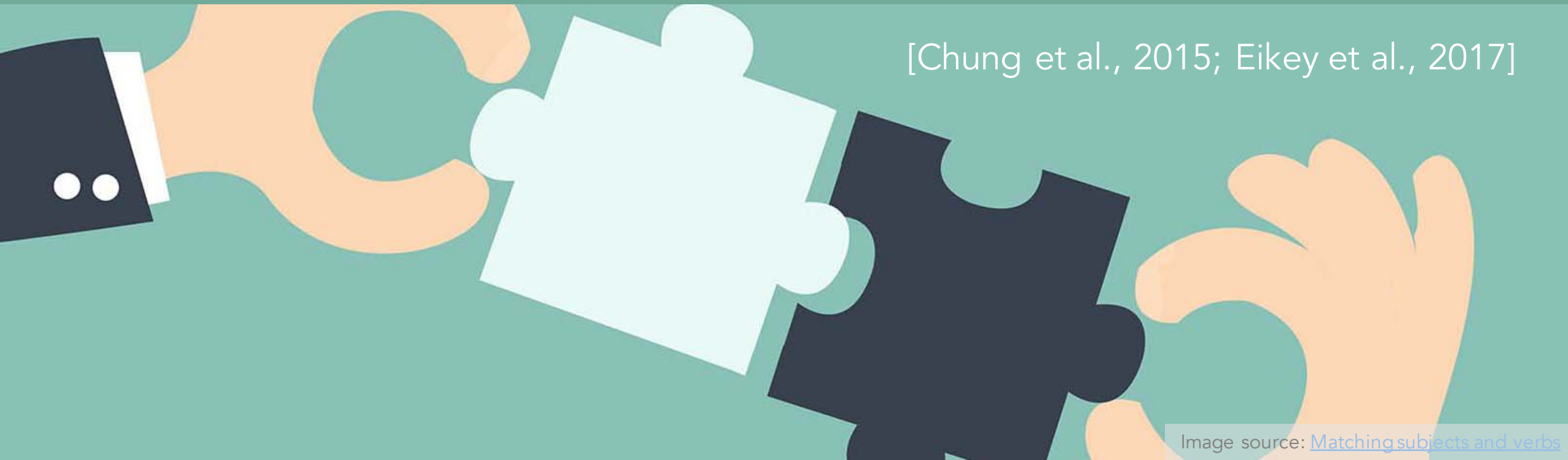
<div><div> Food Diary</div><div>How do I edit?</div></div>		
Breakfast	Servings	Calories: 360
<div> Starbucks Vanilla Latte w/ Nonfat Milk</div>	0.8 grande	160
<div> Kellogg's Cereal ~ Cracklin' Oat Bran</div>	3/4 cup	200
Lunch	Servings	Calories: 420
<div> Amy's Thai Red Curry</div>	1 container	420
<div> Acme Bottled Water</div>	12 fl oz	0
Total Calories		780

My Food diary

The mismatch between current tracker design & individuals' tracking needs:

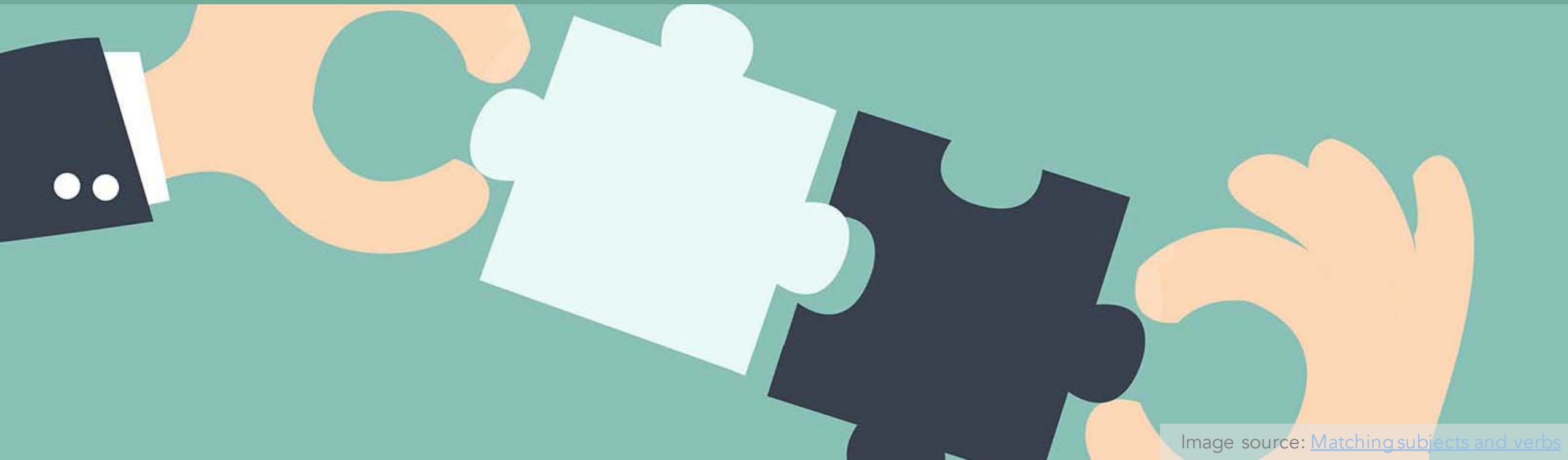
- Impeding the effective use of patients' data
- Unintended consequences (e.g., over-restricting)

[Chung et al., 2015; Eikey et al., 2017]



The opportunity:

Designing **customizable** tracking tools to support **diverse tracking needs & provider-patient collaboration**



Research Questions

RQ1. What do patients with dietary problems need to track to facilitate working with dietitians?
(Tracking needs)

RQ2. How to customize food trackers to support patients with various dietary problems? (Tailoring tracker design)

Co-design sessions: participants

Six **one-on-one** co-design sessions with six registered dietitians (female, age range: 27 to 68) who employ food diaries in their practices.

ID	Age	Practice years	Work environment	Expertise
P1	68	30	Private practice	WM, ED, diabetes, GI
P2	34	11	Medical center & private practice	WM, ED
P3	27	2	Eating disorder treatment center & private practice	WM, ED, GI
P4	43	20	Private practice & corporate wellness	WM, ED, diabetes, nutrition during pregnancy, digestive issues
P5	34	9	Eating disorder treatment center	ED, diabetes
P6	60	30	Private practice	WM, GI, ED, diabetes, pregnancy, rehabilitative, autoimmune, cardiac issues

WM = weight management, ED = eating disorder, GI = gastrointestinal distress

Co-design sessions: participants

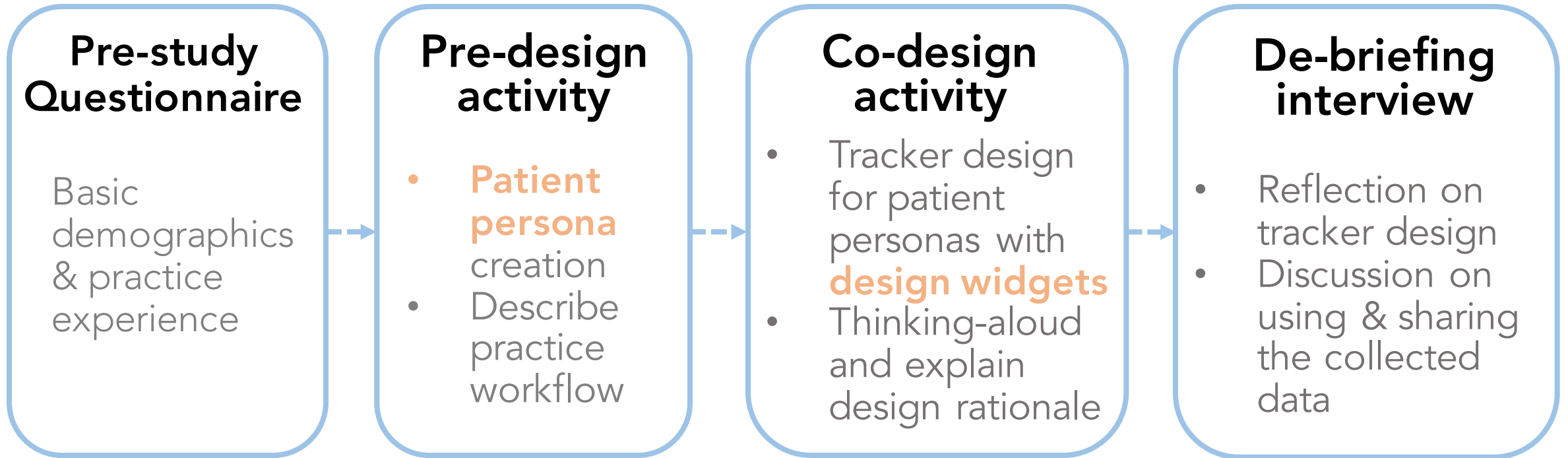
ID	Experience with existing food diaries
P1	MyFitnessPal, Fitbit, paper-based diary
P2	Recovery record
P3	Recovery Record, Healthie, email, paper-based diary
P4	MyFitnessPal, Cronometer, Lose It!, spreadsheet
P5	Recovery Record, 24-hour food recall
P6	Lose It!, 24-hour food recall, paper-based diary

[illegible]

Totals:		0	0	
Lunch				
Food	Carbs	Fat	Protein	
Sandwich	50			
Totals:	50	0		
Dinner				
Food	Carbs	Fat	Protein	
Steak	0	30	6	
Mashed Potatoes	55	1		
Vegetables	25			
Totals:	80	31	6	

Circle the day: Monday Tuesday Wednesday Thursday Friday Saturday Sunday						
Hours of Sleep: _____						
Time	Food Category	Notes: <i>What have you created at the restaurant or the place you ate in?</i>	Amount Portion	Calories kcal=1000	Mood Appetite	Main Activities Minutes (Desk work, walking, shopping, TV)
	1st Meal					
	Grains - Starch					
	Vegetables					
	Fruits					
	Dairy					
	Protein					
	Water, Tea, Coffee					
	Other Beverage					
	Other Item					
	2nd Meal					
	Grains - Starch					
	Vegetables					
	Fruits					
	Dairy					
	Protein					
	Water, Tea, Coffee					
	Other Beverage					
	Other Item					
	3rd Meal					
	Grains - Starch					
	Vegetables					
	Fruits					
	Dairy					
	Protein					
	Water, Tea, Coffee					
	Other Beverage					
	Other Item					
	Other Meal					
	Beverage					

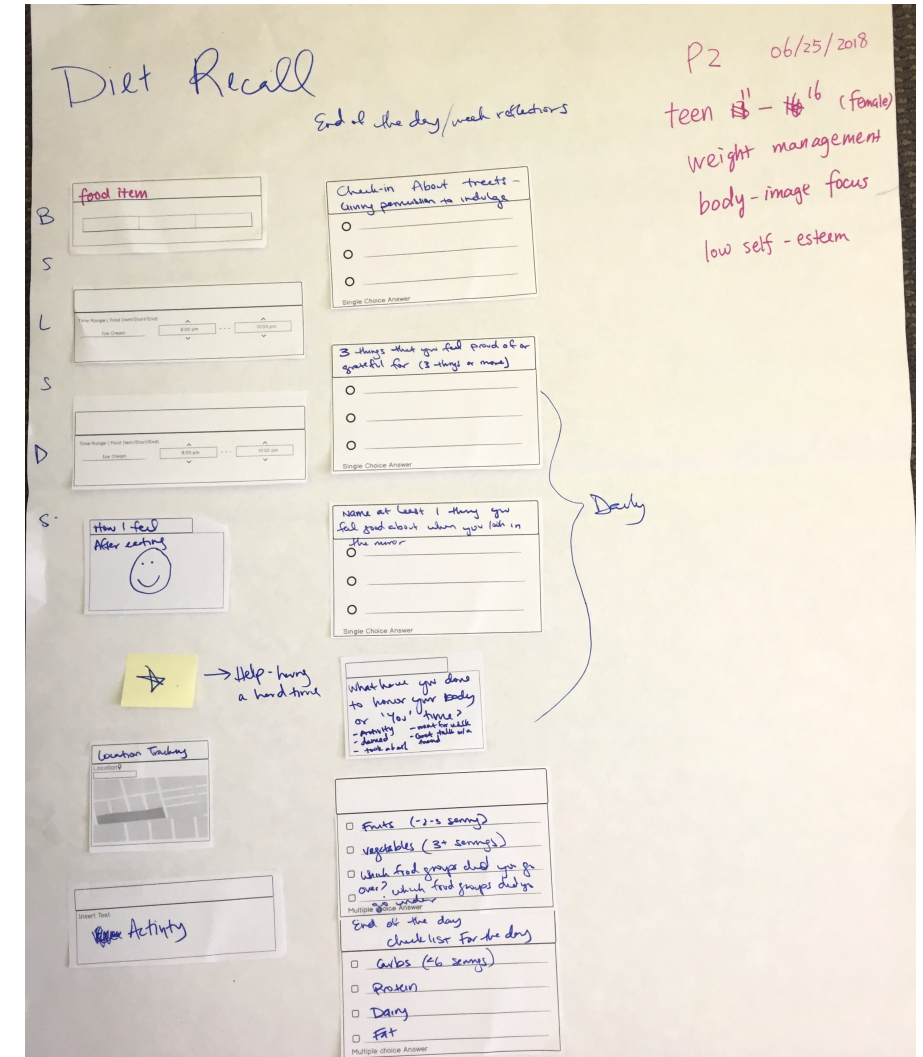
Co-design sessions: procedures



- [Kim et al., 2017]

Data analysis

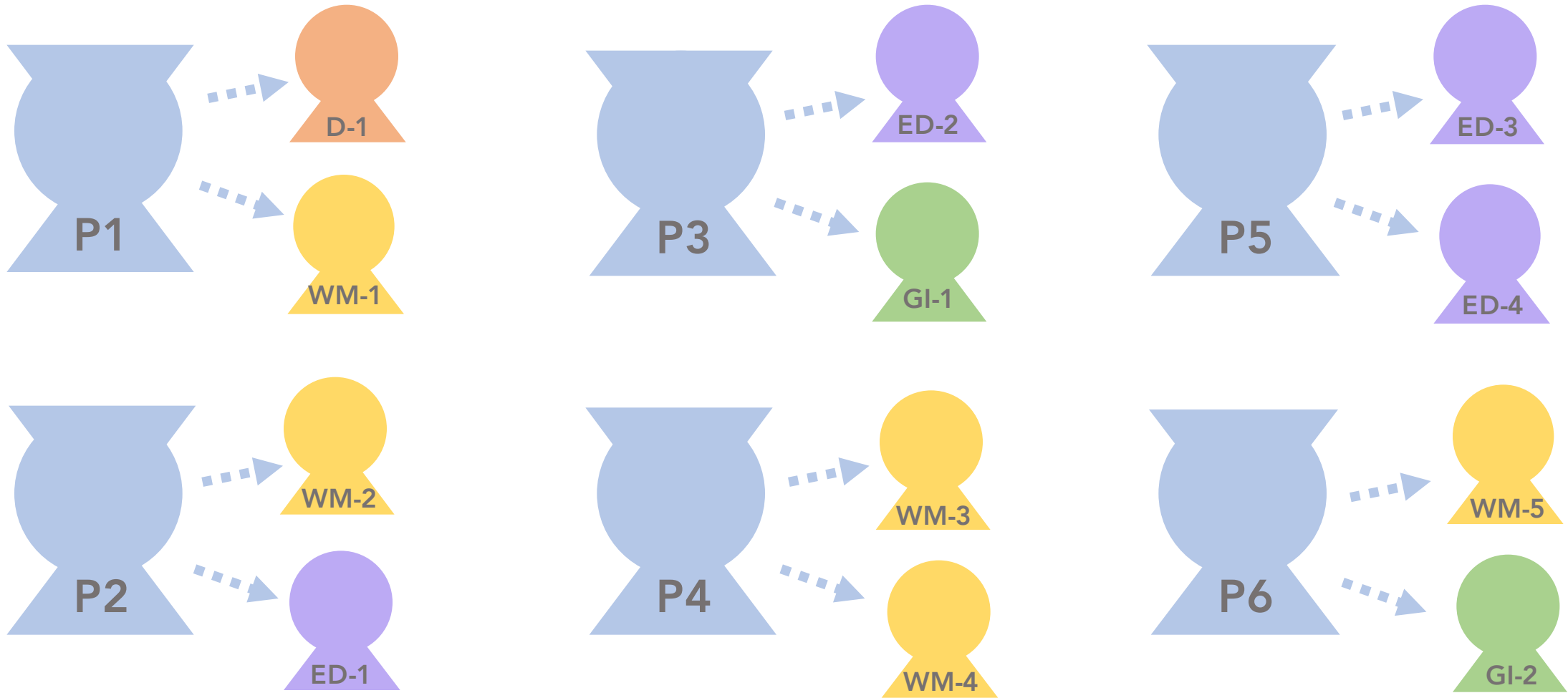
- 12 patient personas
- 12 paper-based prototypes
 - Digitizing the prototypes using sketch app
 - Extracting tracking items, tracking frequency & timings, data format
- Audio recordings of the co-design sessions (70 – 90 minutes / session)
 - Transcribing into text
 - Generating prominent themes (e.g., design rationale) using opening coding & affinity diagram (Preece et al., 2015)



Prototype created by P2

Findings Highlights

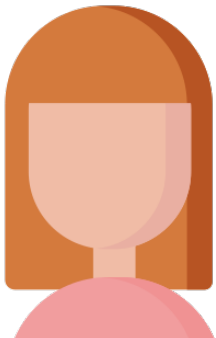
Patient personas



■ D = diabetes ■ WM = weight management ■ ED = eating disorder ■ GI = gastrointestinal distress

Patient persona examples

**ED-1
(P2)**



20
female

Symptoms

- Anorexia Nervosa
- Over-restrict diet
- Over-exercise

Goals

- Increase calorie intake
- Increase food variety

**ED-3
(P5)**



45
female

Symptoms

- Bulimia Nervosa
- Weight gaining
- Prediabetes
- Fatty liver

Goals

- Decrease calorie intake
- Increase protein intake

**WM-4
(P4)**



50
female

Symptoms

- In good health
- Over weight

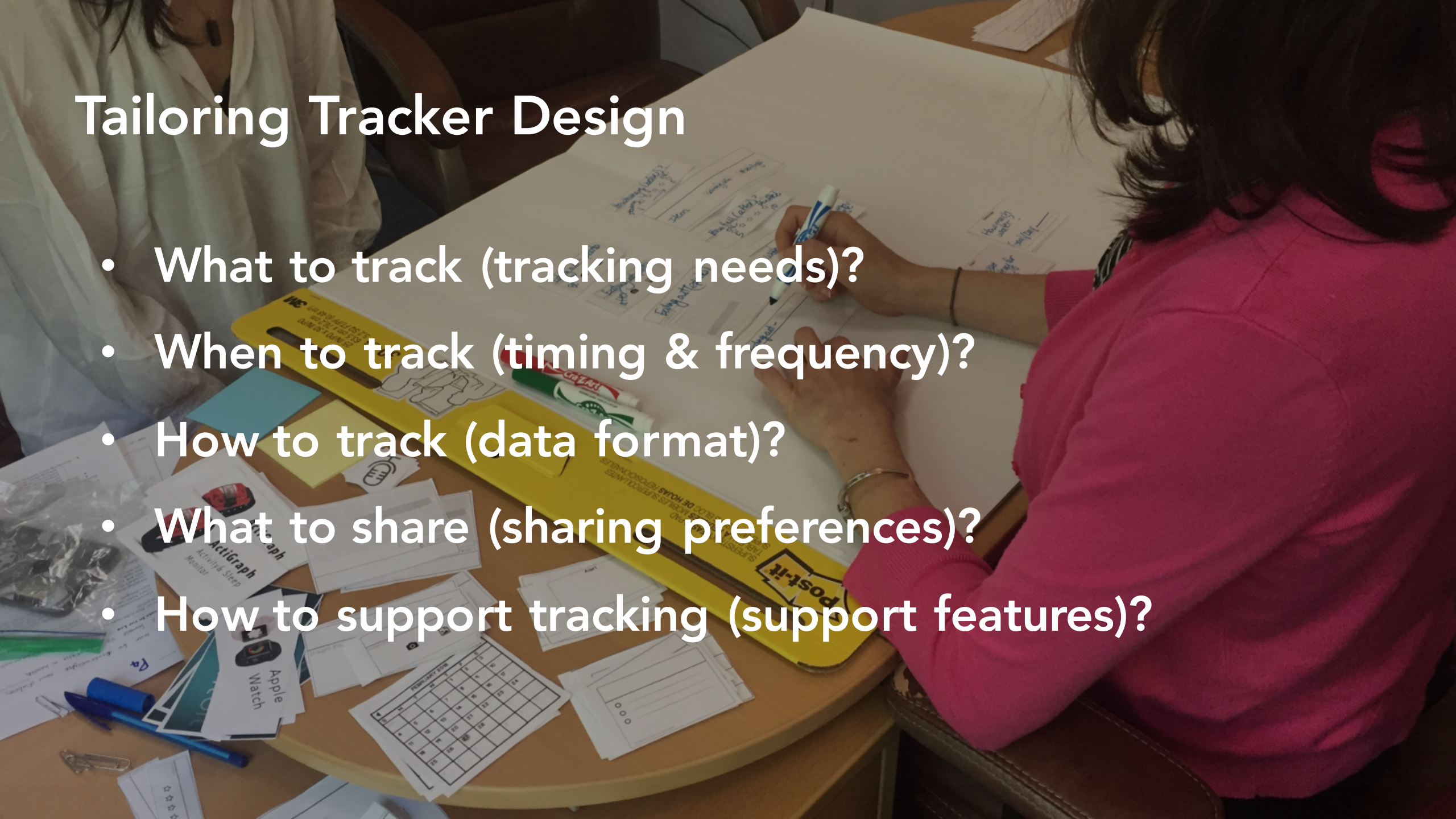
Goals

- Lose weight
- Decrease calorie
- Drink enough water

ED = eating disorder WM = weight management

Tailoring Tracker Design

- What to track (tracking needs)?
- When to track (timing & frequency)?
- How to track (data format)?
- What to share (sharing preferences)?
- How to support tracking (support features)?



Tailoring Tracker Design

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- How to support tracking (support features)?



ED-1: what to track?

**ED-1
(P2)**



20
female

Symptoms

- Anorexia Nervosa
- Over-restrict diet
- Over-exercise

Goals

- Increase calorie intake
- Increase food variety

Tracking needs	Tracking items
Food	Food items, meal type, time
Reflection	Body image, things to be proud of, self-care behavior, challenge food, emotion on food
Symptoms	ED-behavior
Activity	Exercise and duration
Physical status	N/A

ED-1: how to track?

ED-1
(P2)



20
female

Symptoms

- Anorexia Nervosa
- Over-restrict diet
- Over-exercise

Goals

- Increase calorie intake
- Increase food variety

Time

7:00am

when
eating
happens

Meal Type

Breakfast

Food Items



Enter food items

Emotion on Food

Enter your emotion on food

Body Image

once/week

Enter at least one thing you feel good about when you look in the mirror

Things You Feel Proud of

Enter at least three things you feel proud of

once/week

Self-care behaviors

- ☐ Dance
- ☐ Take a bath
- ☒ Go for a walk
- ☐ Talk with friends
- ☒ Praise myself
- ☒ Get myself a gift
- ☐ Watch a movie

once/day

+ Add a self-care behavior

Challenge Food

once/week

Enter challenge food you tried this week

Eating Disorder Behaviors

- ☒ Over Exercising
- ☒ Purge
- ☐ Bingeing
- ☐ Fears of choking or vomiting
- ☐ Intense anxiety

whenever
they occur

+ Add a new eating disorder behavior

Exercise

Enter the type of exercise you do


after
exercising

Duration

From 7:00am to 8:00am

WM-4: what to track?

WM-4
(P4)



50
female

Symptoms

- Overweight
- In good health

Goals

- Lose weight
- Decrease calorie
- Drink enough water

Tracking needs	Tracking items
Food	Food items, meal type, time, nutrition facts, portion size, location, water
Reflection	Hunger/fullness level, eating strategy
Symptoms	N/A
Activity	N/A
Physical status	N/A

WM-4: how to track?

WM-4
(P4)



50
female

Symptoms

- Overweight
- In good health

Goals

- Lose weight
- Decrease calorie
- Drink enough water

Time

7:00am

before eating

Meal Type

Breakfast

Hunger & Fullness Level (Before)

12345678910

StarvingSlightly HungryFullBinge Full

Food Items (Before)

Food Items (After)

after eating

Portion Size

Serving Size

1 serving

Hunger & Fullness Level (After)

12345678910

StarvingSlightly HungryFullBinge Full

Nutrition Facts

Calories (kcal)

1200

Carbs (g)

164

Fiber (g)

20

Fat (g)

48

Sodium (mg)

1280

Eating Strategy

|Enter your eating strategy of this meal

Water Intake





once/day

4

cups of water today


Tracking the same item using different format

Mood

-  Happy
-  Neutral
-  Sad
-  Angry

WM-5 (P6)

"A smiley face makes it simple and straightforward." (P6)

Mood 

- ☒ Happy
- ☒ Hungry
- ☐ Angry
- ☐ Sad
- ☒ Surprising
- ☐ Disgusting


+ Add a new Mood

ED-3 (P5)

Audio-recording may afford patients to record frank thoughts without feeling *"shame about the things they logged"*. (P5)

Tracking the same item using different format

Exercise



WM-5 (P6)

"One thing I can think of it's like Fitbit, because it also tracks your activity intensity." (P6)

Exercise

Duration

From to

ED-1 (P2)

"I very much against my clients with eating disorder having any kind of tracking device because it just it's too easy to become obsessed with it." (P2)

What to share (sharing preferences)?

Patients' sharing preferences are different depending on

- The sensitivity of the data
- Provider-patient relationship

"They may not want to share the information due to the feeling of shame and fear of judgment." (P5)

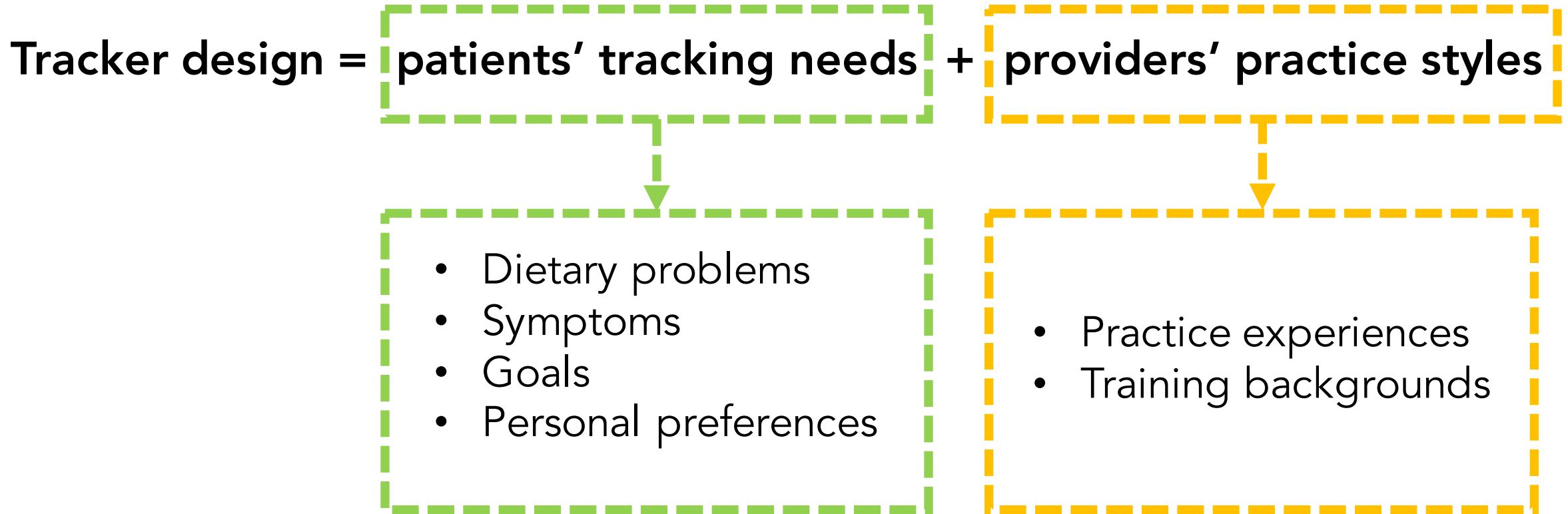
Sharing preferences can change during treatment

Patients may be "willing to share more with the clinicians as their shame might have decreased throughout the recovery." (P5)



Discussion

Customizing trackers to generate relevant data



Supporting provider-patient collaboration

Tracker design = patients' tracking needs + providers' practice style

Providers: revise
tracking items



Patients: adjust sharing
preferences

Customizing trackers to generate relevant data

Tracker design = patients' tracking needs + providers' practice style

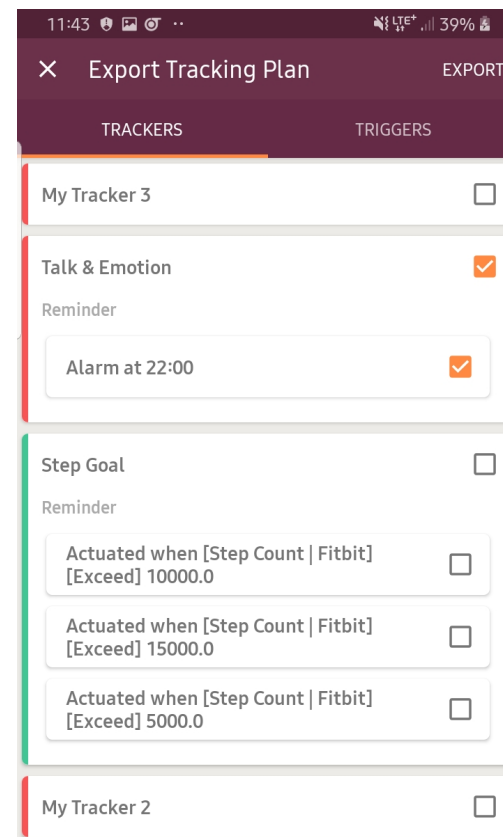
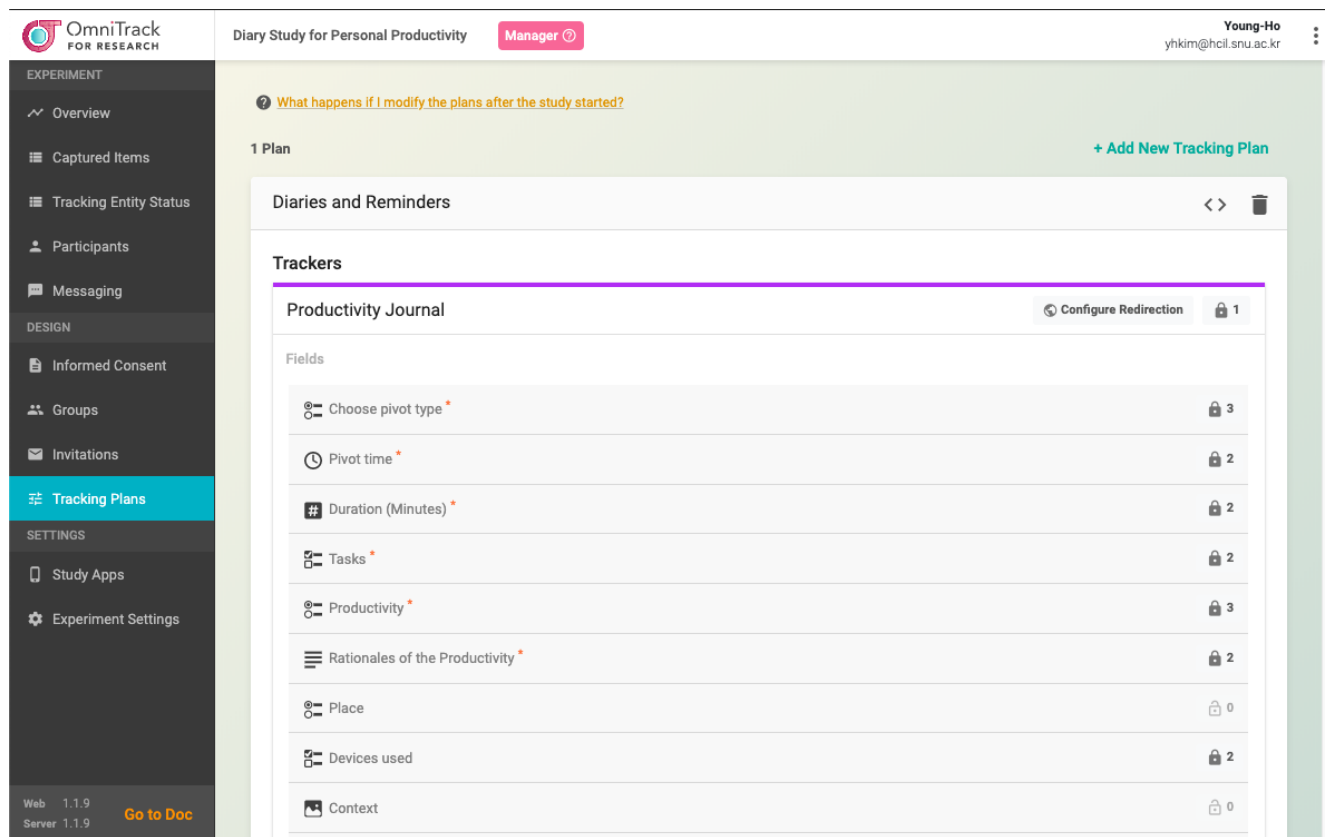
Creating "Tracking Template"



- Sharing with other providers
- Modification & adoption

Customizing trackers to generate relevant data

OmniTrack: a customizable tracking tool



[Kim et al., 2017]

Limitations and future work

Limitation

Patient personas may not perfectly capture patients' lived experiences

Future work

- Involving patients' into the design process
- Field study with providers and patients



Thank you!

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<https://www.terpconnect.umd.edu/~yuhanluo/>

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Appendix

Patient Personas

WM = weight management, ED = eating disorder, GI = gastrointestinal distress

ID	Created by	Age	Sex	Symptoms	Goals
D-1	P1	mid-50	M	Weight gaining, prediabetes (A1C = 7)	Not rely on insulin, maintain his job
WM-1	P1	30	F	Weight gaining, in good health	Identify what in her diet caused weight gaining
WM-2	P2	11-16	F	Overweight, body-image focus, low-self esteem, anxiety	Build self-esteem, make food choices she feels good about, increase food variety
WM-3	P4	60	M	Overweight, new diabetes (A1C = 8.5)	Decrease calorie, balance glucose level
WM-4	P4	50	F	Overweight, in good health	Lose weight, decrease calorie, drinking more water
WM-5	P6	45-50	F	Overweight	Get healthier, lose weight
ED-1	P2	20	F	Anorexia Nervosa, over-restricting eating, over-exercise	Increase calorie & food variety
ED-2	P3	22	F	Anorexia Nervosa & Orthorexia tendencies (non-diagnosed)	Regain menstrual cycle, overcome social isolation & preoccupations on food
ED-3	P5	18	F	Other specified feeding or eating disorder (OSFED), Anorexia Nervosa & Orthorexia, severe obsessive compulsive disorder	Increase life quality, overcome social isolation, increase calorie and food variety
ED-4	P5	45	F	Bulimia Nervosa, prediabetes, weight gaining, fatty liver	Decrease calorie, eat more protein
GI-1	P3	mid-40s	F	Gastrointestinal distress (GI), diarrhea, constipation	Identify the food that triggers her GI symptoms
GI-2	P6	45	F	Gastrointestinal distress (GI), sleep problem	Identify the food that triggers her GI symptoms

Tracking Needs

32 unique tracking items → 5 dimensions

Tracking needs	# of items	Examples
Food	7	Food items, time, location, portion size, meal type, nutrition facts, water
Reflection	12	Body image, things to be proud of, self-care behaviors, treats, food groups, emotion on food, mood, hunger/fullness level, hunger satisfaction rating, challenge food, thoughts, eating strategy
Symptoms	4	ED-behavior, GI-symptom, time, severity
Activity	6	Exercise type, time, duration, location, intensity, sleep
Physical status	3	Weight, glucose level, blood pressure

When to track (timing & frequency)?

Tracking needs	Tracking timing & frequency
Food	Before/during/after eating
Reflection	Together with food (e.g., hunger/fullness level), once a day/week (e.g., body image)
Symptoms	Whenever they occur
Activity	Once/twice a day, once a week
Physical status	Once a week

How to track (data format)?

Tracking needs	Data format
Food	Text/audio/photo, drop-down menu, auto-generated time, auto-tracked location, barcode, add button
Reflection	Likert scale, text, checklist, audio, emoji
Symptoms	Text, checklist, auto-generated time, Likert scale
Activity	Text, checklist, external tracker (fitbit), auto-generated time/location, rating
Physical status	External tracker (BP monitor, glucometer), clinical scale

How to support tracking (supporting features)?



Reminder:
water/snack intake
(D-1, WM-3, WM-4)



Warning: calorie watcher
(WM-1)



Positive reinforcement
(ED-3, ED-4)

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How to support tracking (supporting features)?



Communication:
commenting options
for providers (ED-2, GI-
1, ED-3, ED-4)



In-situ help:
emergency contact
(WM-2, ED-1)



External support: coping
skills, educational resources
(ED-3, ED-4, WM-5, GI-2)