

## Can an app deliver positive nutrition and health outcomes?

Philip Calder Professor of Nutritional Immunology

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## To cover

- Some introductory points
- I will describe findings with two apps used in controlled trials in those living with obesity
- Sarah Berry will describe real world examples
- Clare Llewellyn will give a case study around infant feeding

A healthy diet is one that maintains or improves overall health. A healthy diet provides the body with essential nutrition: fluid, energy, macronutrients, micronutrients, other components (e.g. fibre)

Having a poor diet is one the biggest preventable risk factors to ill health, contributing to lower life expectancy and earlier onset of disease. People most at risk of diet-related ill health include the disabled, those on lower incomes, those in deprived areas, those from some minority ethnic backgrounds, and vulnerable people such as the homeless.

Can have "too much" (e.g. calories, less healthful nutrients), "too little" (more healthful nutrients), or both at the same time (double burden)

Poor diet is responsible for much ill health in the UK



But .... the majority of the population does not adhere to a good diet

Can apps help people to achieve better dietary adherence (and through that better health)?

Offered alongside other help, rather than instead of



# preventenics

A project coordinated by:





#### Aim:

Test the effectiveness of the PREVENTOMICS platform to reduce body weight and waist circumference and induce favourable changes in metabolic profile compared to dietitianled dietary recommendations following 16-week intervention



- 60 people living with obesity (primary outcome available for 54 (90%))
- Testing app-based personalised dietary advice over 4 months
- Single centre
- Randomised to three groups
  - verbal dietetic advice to reduce energy intake and swap foods for similar, but healthier, choices - at start + monthly consultations (control group)
  - verbal dietetic advice plus app-based intervention (enabling monitoring) + feedback and personalised advice + monthly consultations (personalised nutrition: PN)
  - verbal dietetic advice plus app-based intervention (enabling monitoring) + feedback and personalised advice + app-based behaviour change nudges + monthly consultations (personalised plan: PP)
- Primary outcome: weight circumference at 4 months

70% female

## Mean age 45 years

## Mean BMI 31 kg/m2

#### Appearance of study app





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## Summary of diet changes

- Sugar intake decreased in PP
- Refined and high GI carbohydrates intake decreased in all groups but bigger decrease in PN and PP
- Full fat dairy intake decreased in all groups but bigger decrease in PP
- Nuts and seeds intake increased in all groups but bigger increase in PP
- Fruit and veg intake increased in all groups but bigger increase in PN and PP

## Primary outcome: waist circumference



## Other relevant outcomes: body weight and BMI



## Example 2 – POWeR +

# An internet-based intervention with brief nurse support to manage obesity in primary care (POWeR+): a pragmatic, parallel-group, randomised controlled trial

Paul Little, Beth Stuart, FD Richard Hobbs, Jo Kelly, Emily R Smith, Katherine J Bradbury, Stephanie Hughes, Peter W F Smith, Michael V Moore, Mike E J Lean, Barrie M Margetts, Chris D Byrne, Simon Griffin, Mina Davoudianfar, Julie Hooper, Guiqing Yao, Shihua Zhu, James Raftery, Lucy Yardley

Lancet Diabetes Endocrinol 2016; 4: 821–28



- 818 people living with obesity (primary outcome available for 666 (81%))
- Testing 24 web-based weight management sessions over 6 months
- Involved 56 primary care practices in central and south England
- Randomised to three groups
  - evidence-based written dietetic advice to swap foods for similar, but healthier, choices and increase fruit and vegetable intake, in addition to 6 monthly nurse follow-up (control group)
  - web-based intervention (advice, encouragement, reminders, goal setting etc.) and face-to-face nurse support (POWeR+F) – 24 sessions and up to seven nurse contacts over 6 months
  - web-based intervention and remote nurse support (POWeR+R) 24 sessions and up to five emails or brief phone calls over 6 months
- Primary outcome: weight loss at 12 months

#### **TABLE 1** Baseline characteristics

	Group					
Characteristic	Control: brief verbal and online healthy eating advice	POWeR+F: access to website and brief face-to-face support	POWeR+R: access to website and brief remote support			
Female, n/N (%)	185/279 (66.31)	175/269 (65.06)	160/269 (59.48)			
Age (years), mean (SD)	52.69 (13.25)	53.70 (13.21)	54.74 (12.95)			
Smoker, n/N (%)	24/279 (8.6)	21/269 (7.81)	25/269 (9.29)			
Diabetes mellitus, n/N (%)	48/279 (17.20)	46/268 (17.16)	42/270 (15.56)			
Orlistat use, n/N (%)	3/270 (1.11)	5/262 (1.91)	5/266 (1.88)			
Comorbid condition, n/N (%)	48/281 (17.08)	55/269 (20.45)	55/272 (20.22)			
Deprivation score,40 mean (SD)	14.32 (10.45)	13.73 (10.28)	13.29 (10.17)			
Weight (kg), mean (SD)	104.38 (21.11)	102.40 (16.87)	102.93 (18.26)			
BMI (kg/m²), mean (SD)	37.10 (5.97)	36.66 (5.36)	36.28 (5.65)			

#### TABLE 20 Portions of foods eaten per day for complete cases

	Group, crude mean (SD)					
	Control		POWeR+F		POWeR+R	
Food	Baseline	12 months	Baseline	12 months	Baseline	12 months
Sweets	1.14 (1.33)	0.89 (0.87)	1.39 (1.66)	0.71 (0.98)	1.24 (1.61)	0.86 (1.32)
Cereals	1.92 (1.17)	1.67 (0.98)	2.02 (1.26)	1.45 (0.97)	1.97 (1.43)	1.40 (0.90)
Fatty foods	2.72 (1.85)	2.15 (1.67)	2.86 (2.01)	2.06 (1.45)	2.65 (1.83)	1.97 (1.32)
Salty snacks	0.33 (0.62)	0.19 (0.31)	0.33 (0.54)	0.16 (0.23)	0.31 (0.54)	0.15 (0.22)
Sweet drinks	0.49 (1.20)	0.22 (0.59)	0.38 (0.88)	0.11 (0.30)	0.48 (1.17)	0.24 (0.63)
Fruit and vegetables	3.70 (2.28)	4.63 (2.70)	4.02 (2.57)	4.46 (2.55)	3.85 (2.22)	4.63 (2.40)
Low-fat dairy	1.29 (1.44)	1.23 (1.36)	1.64 (1.51)	1.45 (1.53)	1.43 (1.64)	1.53 (1.54)
Ratio of high- to low-fat foods	2.66 (8.27)	1.54 (8.00)	1.52 (6.41)	1.43 (5.53)	2.39 (7.74)	1.39 (4.59)

All groups: Less sweets, cereals, fatty foods, salty snacks and sweet drinks and more F&V – no differences between groups

#### TABLE 2 Mean weights (kg) at 6 and 12 months for complete cases

	Weight (kg), mean (SD); <i>n</i>					
	Time point	Time point				
Group	Baseline	6 months	12 months			
Control	104.38 (21.11); 279	101.91 (19.35); 136	101.73 (19.57); 227			
POWeR+F	102.40 (16.87); 269	97.55 (15.99); 148	98.56 (15.95); 221			
POWeR+R	102.93 (18.26); 270	98.30 (18.34); 155	99.72 (18.88); 218			
	Greater (2.9	weight loss than control and 2.4 kg, respective	ol group ely)			

Clinically important weight loss ( $\geq$  5%) at 12 months

## Control 18.5%

## POWeR+F 29.2%

POWeR+R32.4%

## **Conclusions & caveats**

- Giving people healthy eating advice (in a trial setting) can improve diet
- "Apps" used alongside AHP support (as provided in these trials) might bring about greater dietary change
- "Apps" used alongside AHP support (as provided in these trials) are more effective than simply providing advice in inducing weight loss – POWeR+ shows this can be sustained in some people
- PREVENTOMICS was an intensive (?trial-only) intervention but shows that behaviour change nudging can be effective when added on to personalised advice



## The application of novel technologies and community science in the future of diet-related disease prevention



**Professor Sarah Berry** 

King's College London Dept. Nutritional Sciences

## New era in health.....

Remote clinicalDigitalCommunityDataTraditionaltestingtoolsscienceScienceScience

## What is possible with....

## Digital Devices – Community Science – Data Science



**COVID** Symptom Study

An App combining biological science and data science; at pace to impact health & policy



#### >5.3 million community scientists improved health

Predicts "Symptomatic COVID" via algorithm using specific clusters of symptoms

- Changed WHO definition of symptoms

#### Generated a goldmine of data on:

- Symptoms longitudinally
- Social economics, deprivation, demographics, ethnicity, co-morbidities, exposures, long covid, vaccines
- Diet quality, Diet Habits & Lifestyle



Estimate of Symptomatic Covid-19 in the UK





Can we apply this to deliver positive nutrition & health outcomes?

Digital Devices – Community Science – Data Science





The ZOE Health Study is a longitudinal cohort of 1 million active users, leveraging the power of large-scale community science to discover the nutrition and lifestyle interventions that work in a real-world setting



Intervention trials – feasibility in our noisy lives!

## The Big IF Study

The largest-ever community experiment into Intermittent Fasting.

148,257 joined

#### Intervention trials – *user experience*



## The Big IF Study



YOUR STUDY RESULTS







#### ENERGY LEVELS

0 - Not at all / 5 - Neutral / 10 - Extremely



#### MOOD LEVELS

0 - Very sad / 5 - Neutral / 10 - Very happy



#### SYMPTOM BURDEN

The measurement (or calculation) of your Symptom Burden is based on the number and severity of symptoms which you reported each day



Thanks for taking part! As part of The Big IF Study, we'll send you a detailed personalised results analysis in a few months time.

#### Send us your feedback

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## The Big IF Study



#### People felt better!



Can we overlay this with remote clinical testing to prevent dietrelated disease ?

Remote clinical testing



PREDICT n~200,000 zoe

Ongoing program to measure Individual responses to food & lifestyle interventions We are complicated! ......Unravelling the variability in **who** we are, **what** we eat, **how** we eat and **why** we make those choices is challenging!



PREDICT study data acquisition – scale, breadth, resolution & precision to measure responses to food and unravel the best diet for you



~5 million Meals logged



~500,000 Standardised meals consumed



~180,000 Metabolomic measures



~90 million CGM glucose readings



**~180,000** TAG readings



~180,000 Metagenomic measures Can these learnings be translated into an app to change diet to improve health?





## Does this app-based approach improve diet and health versus standard approaches?





## Does this app-based approach improve diet and health versus standard approaches - Yes





#### ZOE METHOD

N=347

## Can we capitalise on 'hot topics' and make them accessible to all?

## MenoScale score

### The MenoScale – how to track symptoms to change symptoms

## Make sense of your menopause symptoms

Perimenopause and menopause are under-researched and often misunderstood. ZOE's MenoScale calculator scores your symptoms so you can better understand them.

Get your MenoScale score



To what extent have you been bothered by these as a menopause symptom in the past week?







#### Bms British Menopause Society

### The MenoScale – how to track symptoms to change symptoms

## Make sense of your menopause symptoms

Perimenopause and menopause are under-researched and often misunderstood. ZOE's MenoScale calculator scores your symptoms so you can better understand them.

Get your MenoScale score



n=95,000 within 8 weeks

Data from 133 countries





Bms British Menopause Society

### The future holds a lot of potential













#### The challenges.....

- What are the prospects at a population level?
- What about the 'unseen' barriers?
- What about underserved groups?



Use of digital apps to support underserved groups

Case study: infant feeding

**Professor Clare Llewellyn** 

**University College London** Department of Behavioural Science & Health





#### Childhood obesity is one of the

heath challenges of our time

more than double children living in the most vs. least deprived areas

1 in 10 children in Reception (4-5 years) currently

OHID. Patterns and trends in child obesity in England. November 2024

#### **Obesity risk**

### fancy, with rapid weight gain



Major risk factor for childhood obesity: Rapid weight gain during first 2 years

**Highest risk of rapid weight gain**: Formula fed (up to 40%)

 $\rightarrow$  Likely reason is overfeeding

6-8 weeks:

~half exclusively formula fed

~2/3 partially formula fed

Zheng, et al (2018) Obes Rev; 19:321-32; Wjlaan (2011) Int J Obes (Lond) 35: 963-70; OHID. Breastfeeding at 6 to 8 weeks after birth: annual data April 2023 to March 2024

# Public health challenges in supporting formula feeding best practices

## 01

Undermining breastfeeding

02

Increasing pressure on healthcare services 03

Groups who would benefit most are harder to engage

## 04

Non-evidence based sources of information

# **Solution**: digital formula feeding support

01

Personalisation  $\rightarrow$  responds to need

02

Works alongside the NHS Greater reach

03

04

**Evidence-based** 

## BRIGHT: Baby Responsive Growth & Health Tracking



**Aim:** develop prototype for an app which supports parents in using best practices when formula-feeding, to reduce overfeeding and prevent rapid weight gain



**Target users:** parents/caregivers from disadvantaged backgrounds who are using formula to feed their babies



App: Baby Buddy, pregnancy & parenting app used by target users



**Approach**: adapt existing evidence-based behaviour change interventions using behavioural science









orents, by parents and health perfectionals

> Medical Research Council

## **BRIGHT TEAM**



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Nilushka Perera Jenny Mcleish Head of Evaluation Content Writer Impact and Policy & PM



#### Breastfeeding: getting started

Ask the midwife for help to get started with breastfeeding if you need it - don't be embarrassed!

SAVE VIDEO

Watch more form "Getting started" category



## Jaby™ buddy by best beginnings

the go-to FREE pregnancy and parenting guide





## 01 Responds to need

Different pathways for breastfeeding and formula-feeding

## **02** Works alongside the NHS

Embedded 30 Local Authorities

### 03 Wide reach

~500,000 UK users

## **04 Evidence-informed**

Adheres to recommendations



Breastfeeding: getting started Ask the midwife for help to get started with breastfeeding if you need it - don't be embarrassed!

SAVE VIDEO

Watch more form "Getting started" category



Good positioning tips form a midwife

## Jaby™ buddy by best beginnings

 British Society of Paediatric Dentistry

**PSYCH** 

SYCHIATRISTS

the go-to FREE pregnancy and parenting guide

## 03 Wide reach

### In localised areas, Baby Buddy is reaching users in communities with the greatest need:



Baby Buddy users are families we most want to reach

#### BB has been designed to be accessible to all:

- Reading age 9 & 300 videos
- Free to download & use and no ads

**Person-Based Approach**: method for developing effective behavioural health interventions that successfully engage users and support better health outcomes



Key challenges identified using the PBA 24/7 access to useful, detailed support

Info easy to find & understand, quick to read/watch

Overfeeding happens for many complex reasons

Tailored support valued

Parents who use formula feel stigmatized

Appropriate positioning alongside existing healthcare

### **BRIGHT prototype addresses key challenges**



## **Furning their head away**

## **Releasing the teat**

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CC

Creating UK's first healthcare professional endorsed demonstration video for how to formula-feed, featuring a parent and baby

#### Prototype for personalised care at scale



"I've kind of been overfeeding...That was... a learning curve for me. I've noticed that it's really worked. So, it's helped me. It's helped him as well"

"Having this information in Baby Buddy would have saved me probably a solid week's worth of research that I did on my own"

[BRIGHT was] "as good as sort of speaking to... your health visitor or something"

#### Prototype for personalised care at scale



## 

#### Prototype for personalised care at scale



## 



Apps can bring about dietary change and impact health (Preventonomics, POWeR, Zoe studies)

Challenges:

- Engaging underserved populations
- Appropriate positioning alongside existing healthcare provision

## Can an app deliver positive nutrition and health outcomes?