



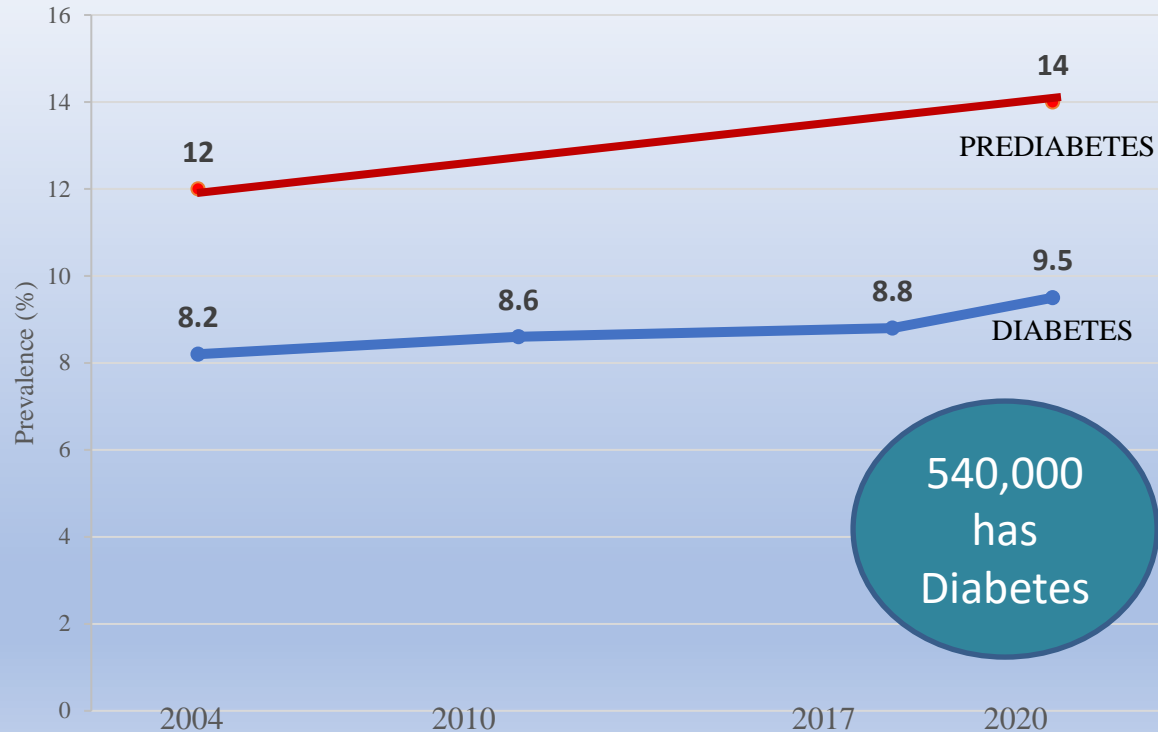
National University
Hospital

Diabetes Lifestyle Intervention using Technology Empowerment (D'LITE)

*Dr Lim Su Lin
Chief Dietitian
Department of Dietetics
National University Hospital*

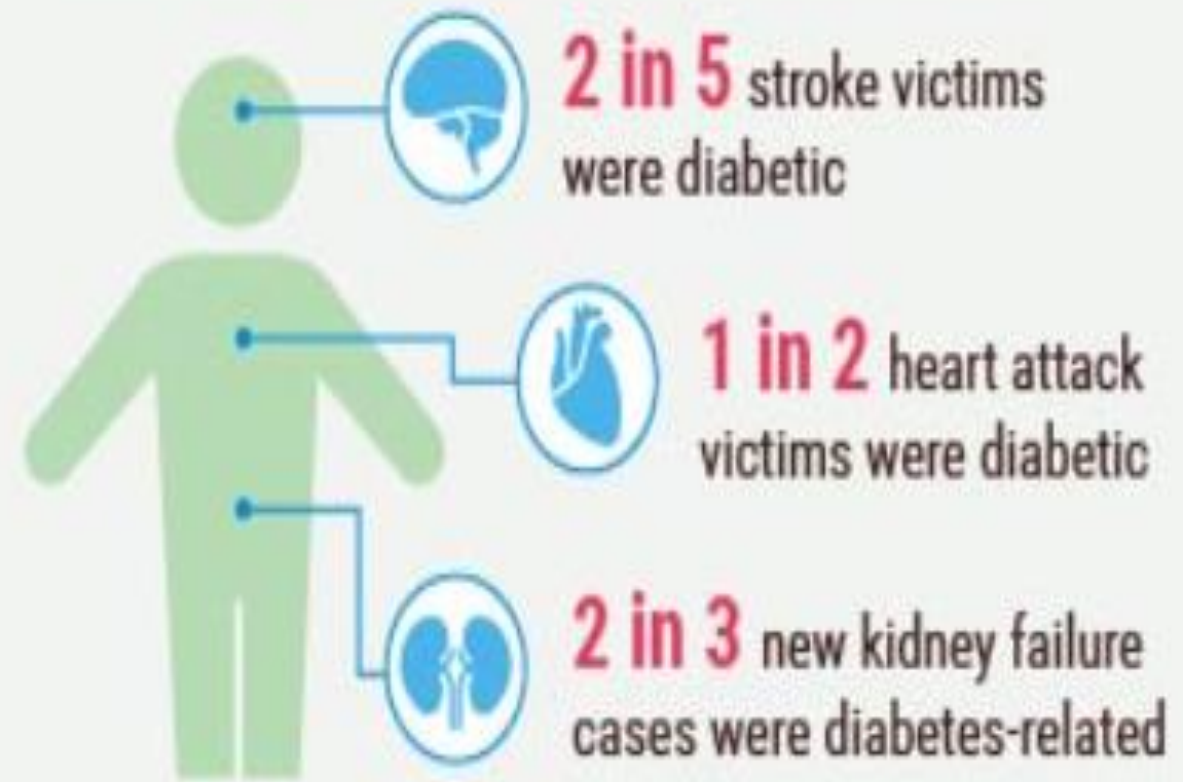
Burden of Diabetes

Prevalence of Diabetes & Prediabetes¹



1 in 3 unable to control **blood sugar levels**²

Poor control of diabetes can lead to serious complications³



1. National Health Survey 2004-2010 & National Population Health Survey 2017- 2020

2. National Health Survey 2010, Ministry of Health, Singapore

3 Singapore National Registry of Diseases Office

What do we know?

- Lifestyle interventions such as medical nutrition therapy and exercise have been considered fundamental as first-line treatment^{1,2}
- Medical Nutrition Therapy - effective in improving body weight, and hyperglycaemia^{3, 4}
- Travelling distances, time constraint and costs - detract the effectiveness of lifestyle intervention⁵
- Drop-out rates ranges from 30 - 60%^{5,6}

1. American Diabetes Association. Diabetes Care. 2019; 42 Suppl 1:S46–S60.

2. Li R, et al..Ann Intern Med. 2015;163(6):452-60.

3. Mitchell LJ, et al. J Acad Nutr Diet. 2017;117(12):1941-62.

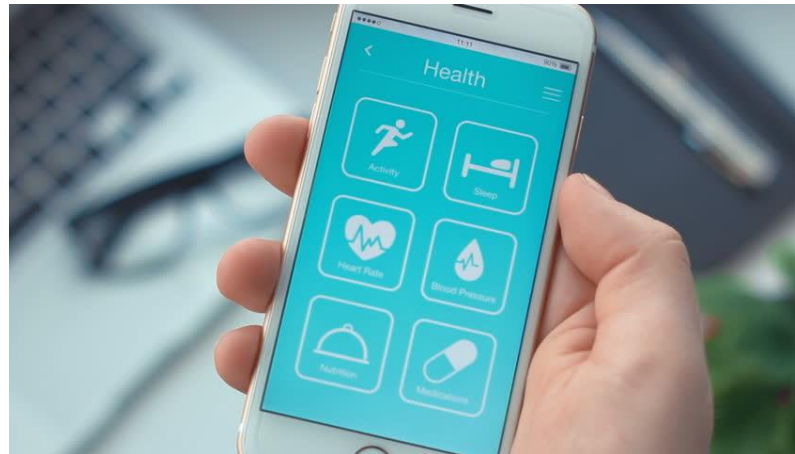
4. Raynor HA, et al. J Acad Nutr Diet. 2017;117(10):1578-611.

5. Moroshko I, et al. Obes Rev. 2011;12(11):912-34.

6. Middleton, et al., Am J Lifestyle Med. 2013 ; 7(6): 395–404.

Can mobile technology help?

- 90% of Singapore population owns a smartphone¹
- > 50% smartphone owners use their phone to search for health information²
- Increasingly part of essential healthcare³



1. Muller, J. (2020). Smartphone market in Singapore - Statistics and facts. Retrieved from: <https://www.statista.com/topics/5842/smartphones-in-singapore/>
2. Jason WY Lee, et al., (2020) Digital Health 6:1-7
3. Bert F, et al. (2014). Journal of Medical Systems, 38(1):1-11.

Objectives and Research Design of D'LITE Study

To determine whether a smartphone app-based lifestyle intervention programme would lead to weight loss, normoglycemia and improved metabolic indices among individuals with diabetes or prediabetes, as compared to standard care

Multi-centre RCT

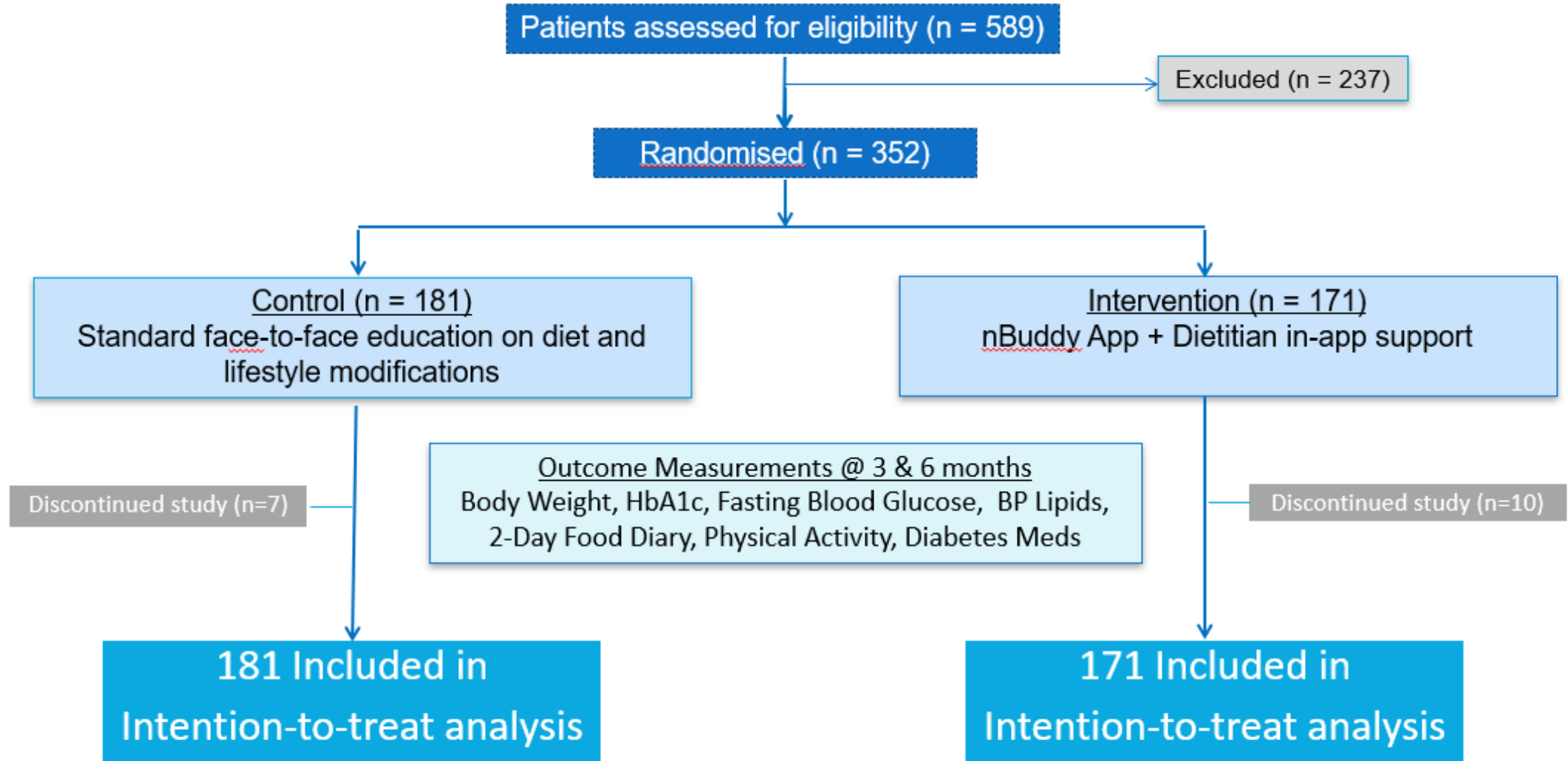


Recruitment Sites

Inclusion Criteria

- ✓ 21-75 years
- ✓ PreDM or DM
- ✓ BMI ≥ 23.0 kg/m²
- ✓ Owns a smartphone
- ✓ Written informed consent

Study Flow



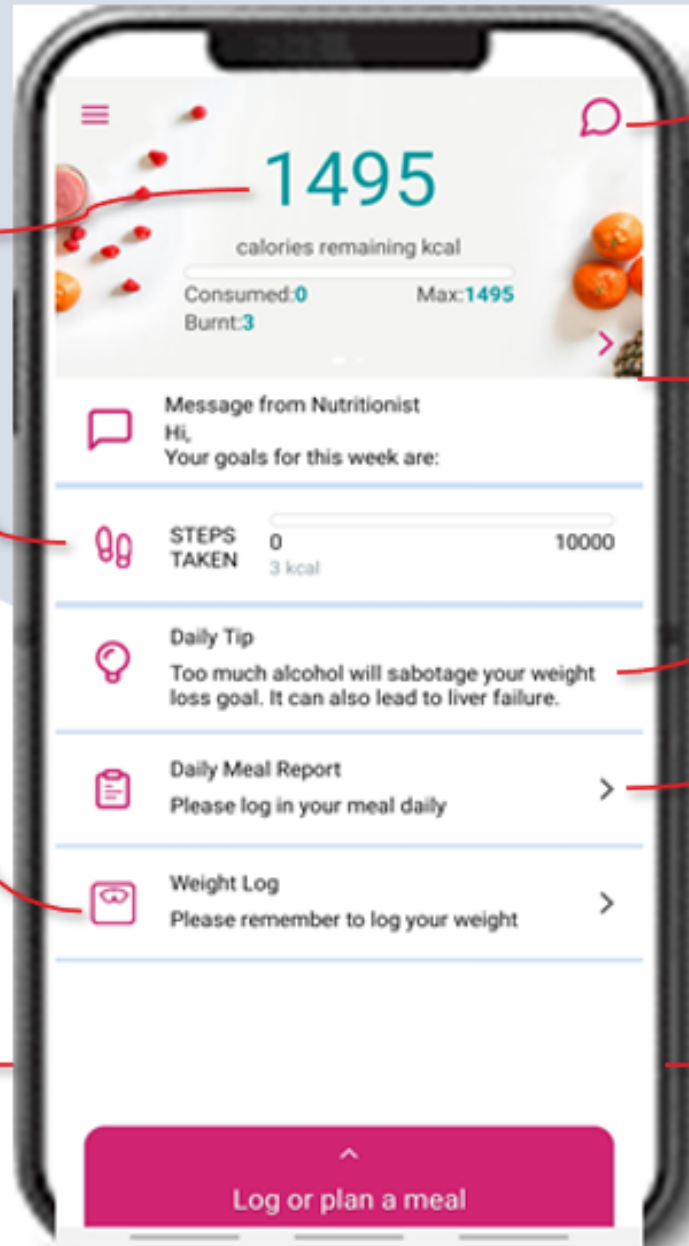
Nutritionist Buddy Diabetes App(Intervention)

Keep within pre-set calorie limit through daily meal logging
(14,000 food types in database)

Incremental step count goal

Weigh minimally twice a week using issued weighing scale

SMBG twice a week with issued glucometer



Dietitian support via chat function

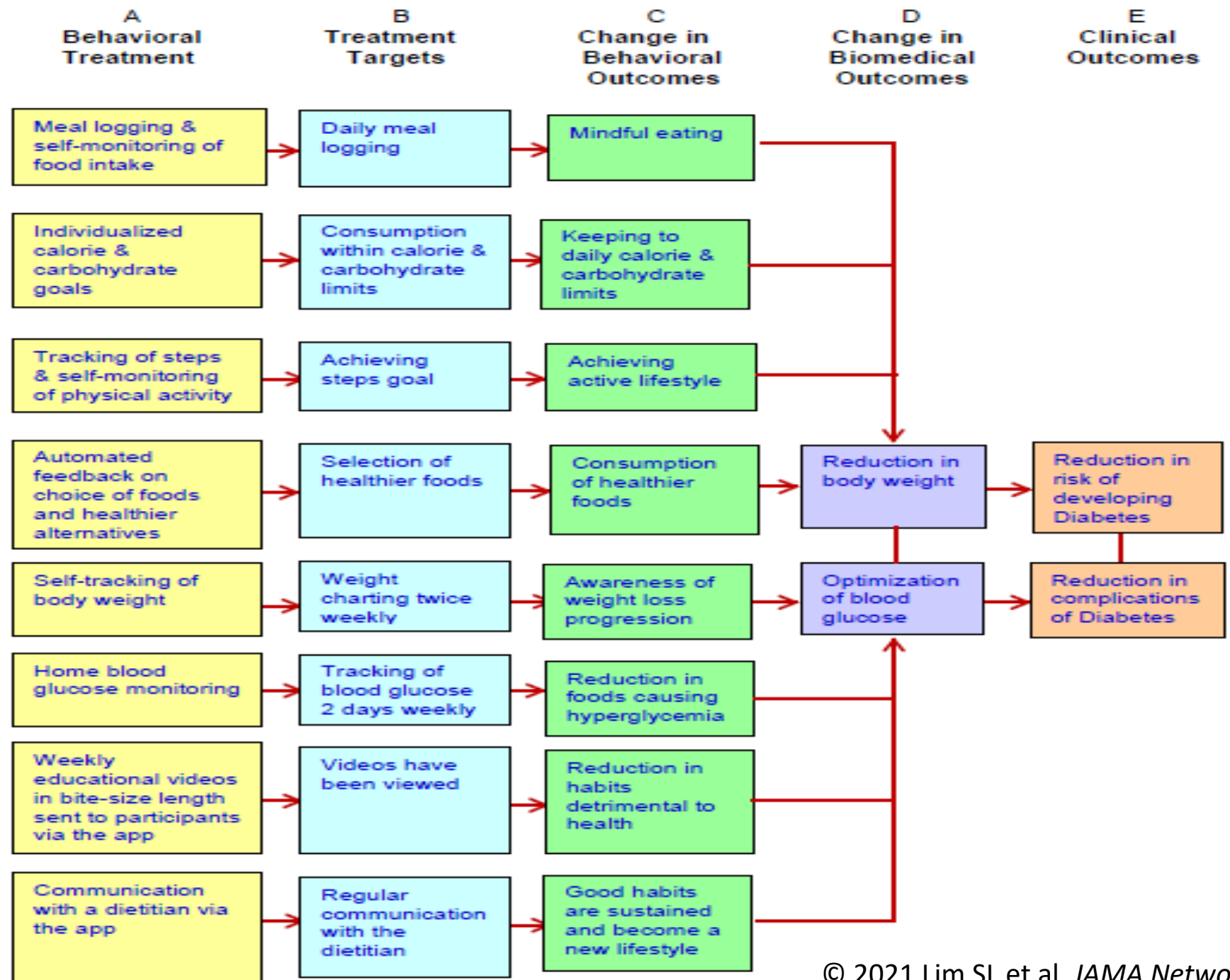
Keep within carbohydrates limit per meal

Daily motivational tips

Choose healthier food alternatives (through real-time automated feedback)

3-min educational videos

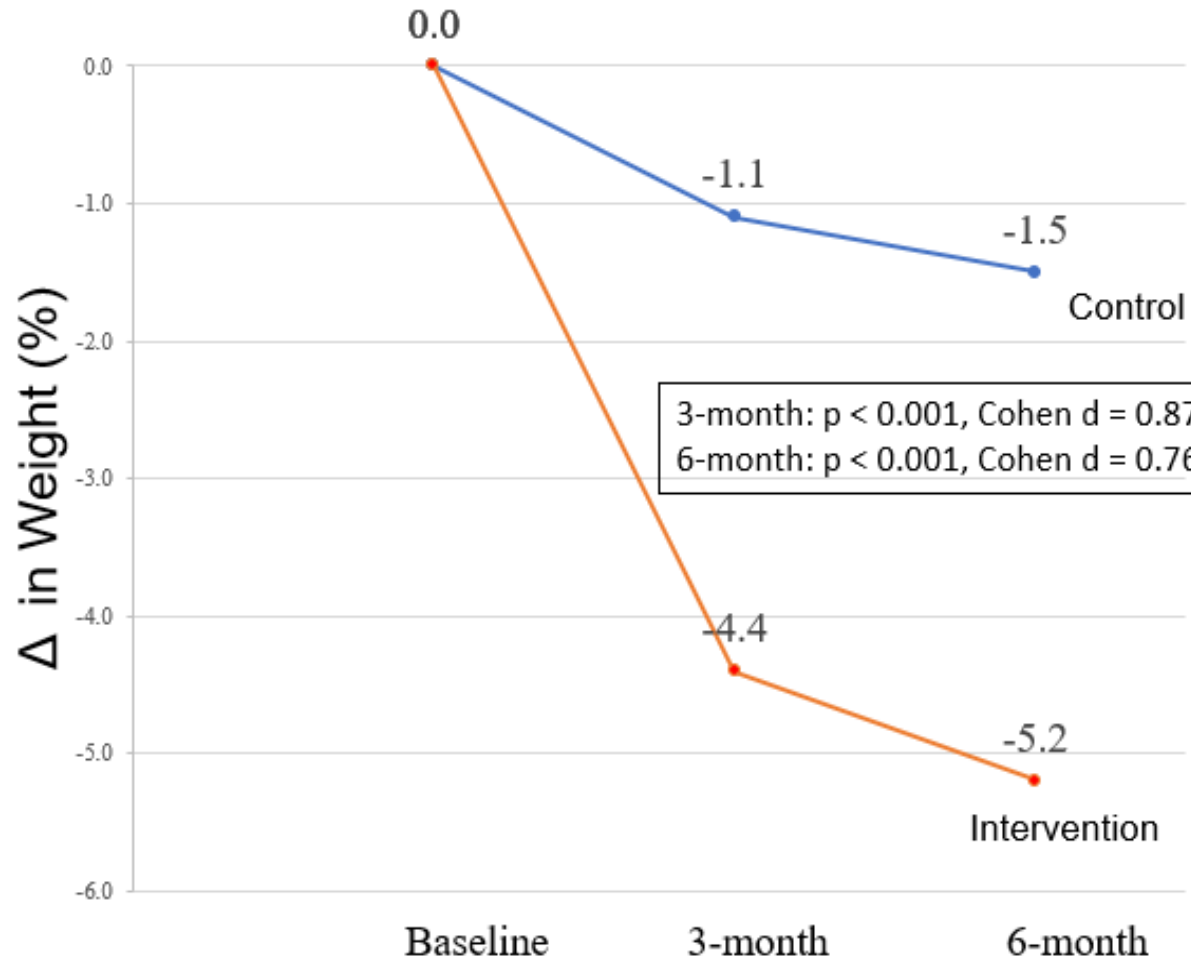
Concept: From app use to behaviour change



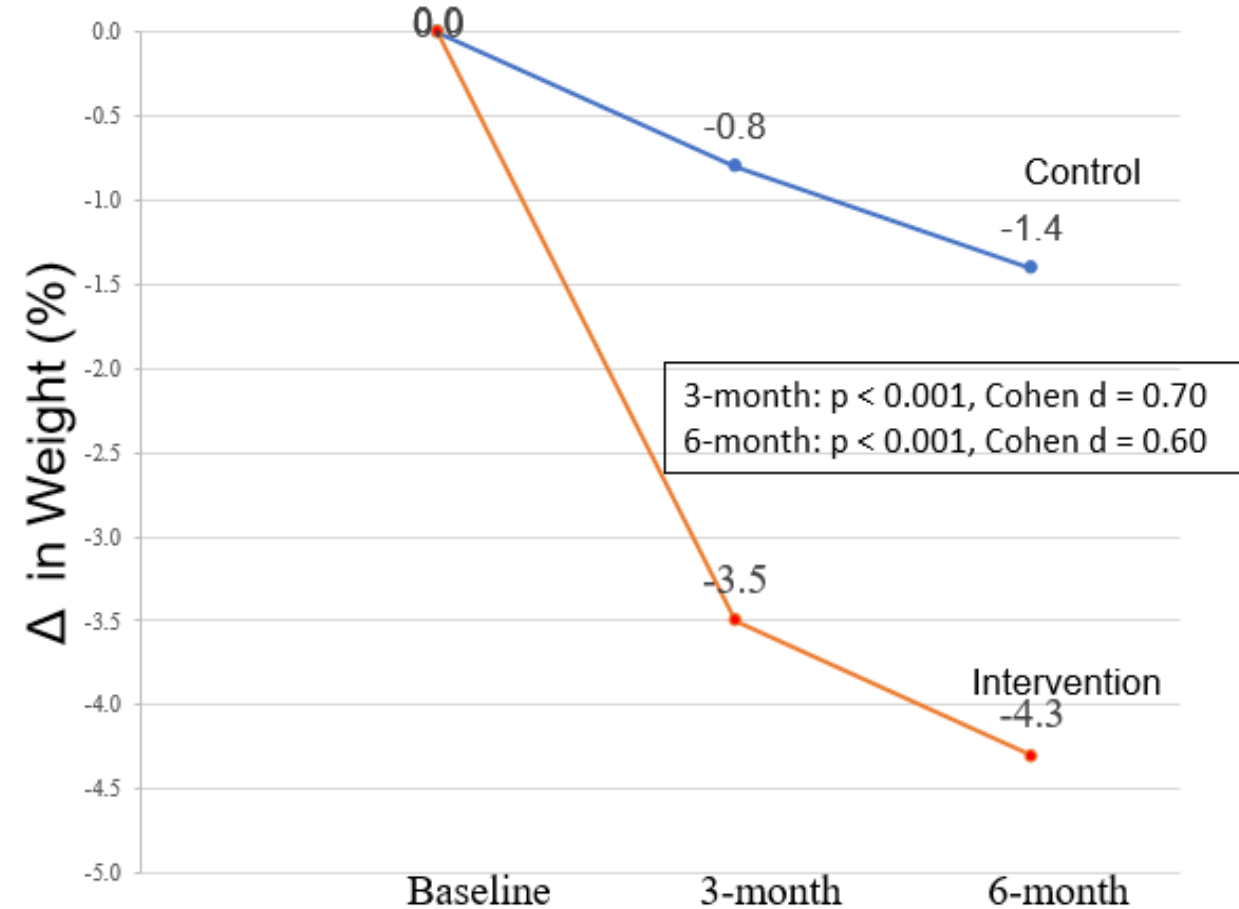
Results: Weight Loss

n = 352

PREDIABETES



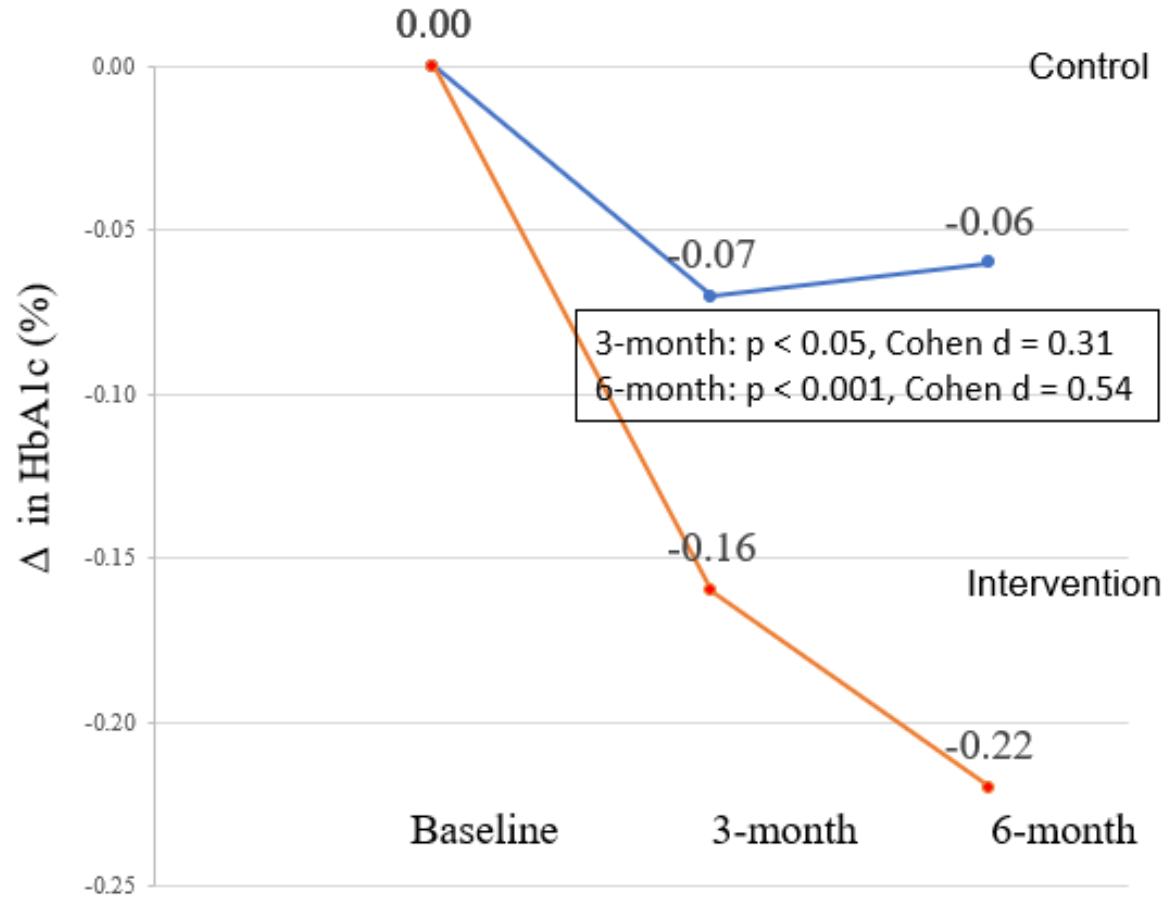
DIABETES



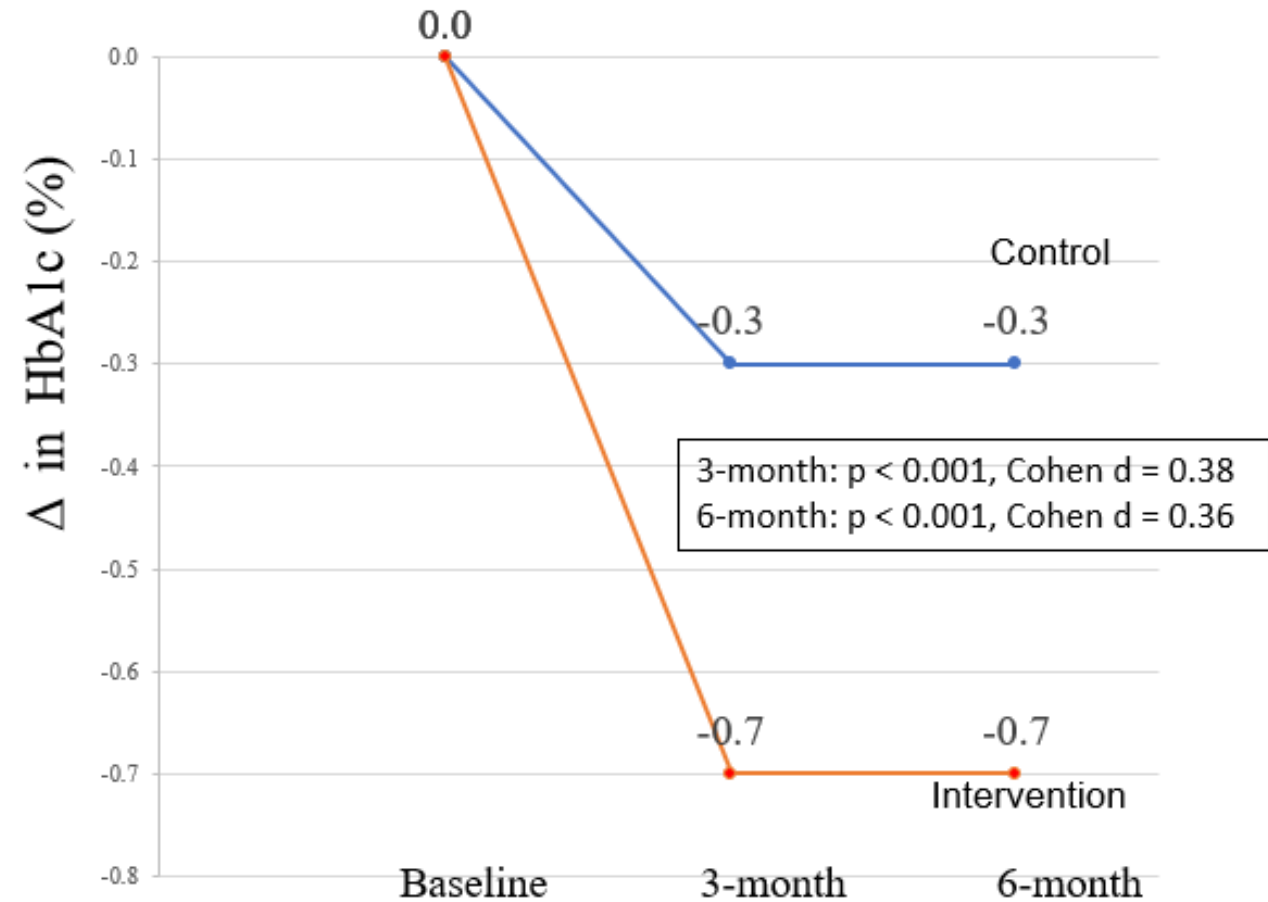
Glycemic Control

n = 352

PREDIABETES

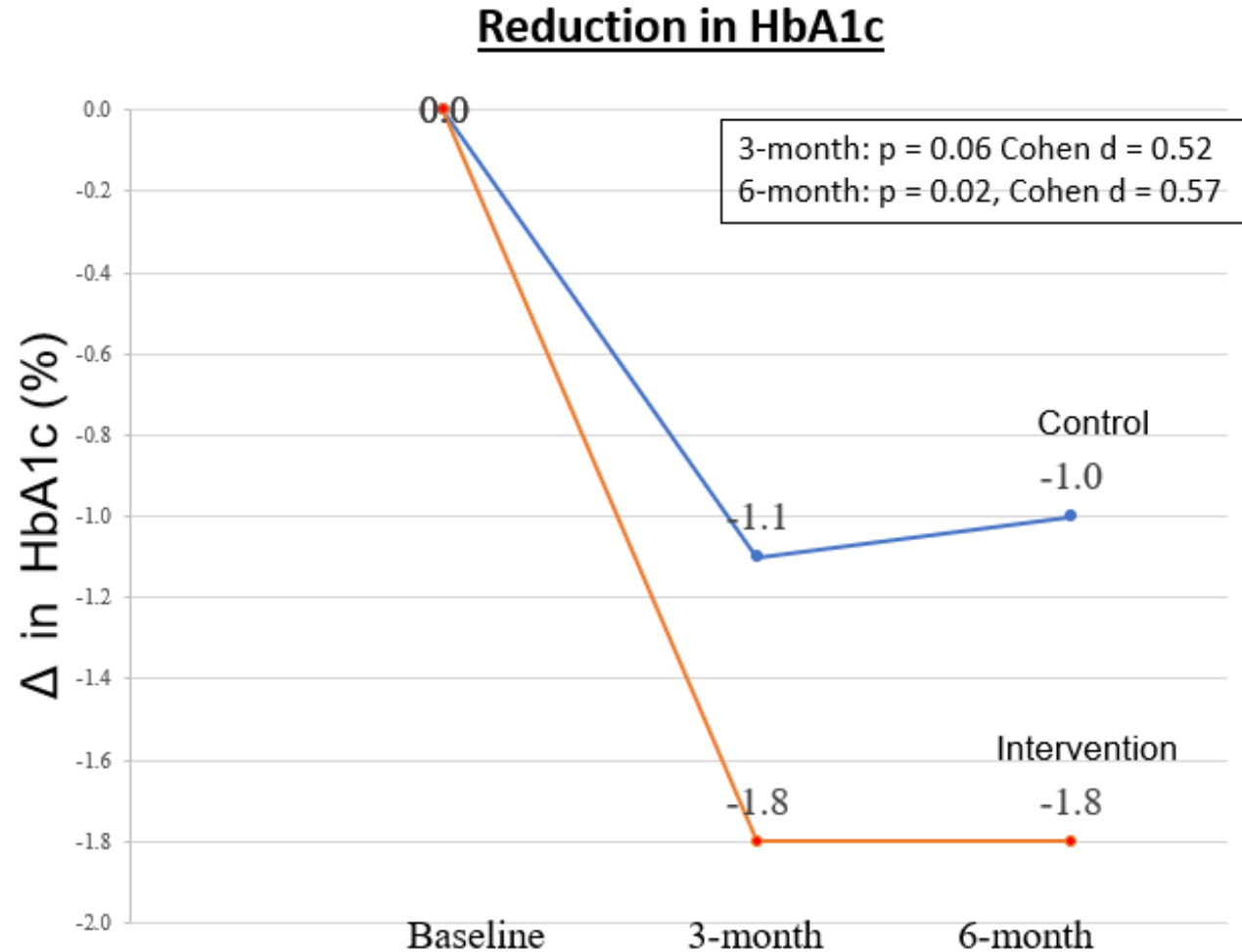


DIABETES



Significant improvement in Diabetes control

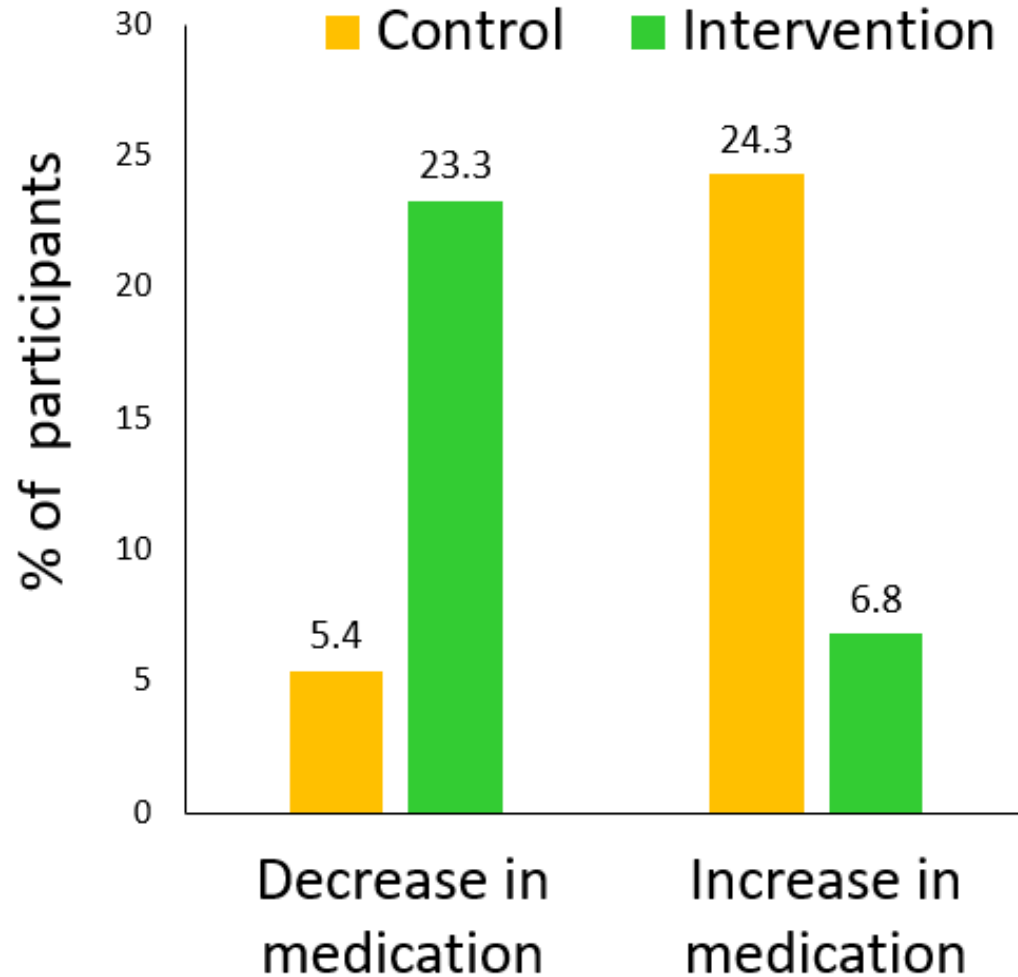
In patients with poor Diabetes Control ($\text{HbA1c} \geq 8\%$)



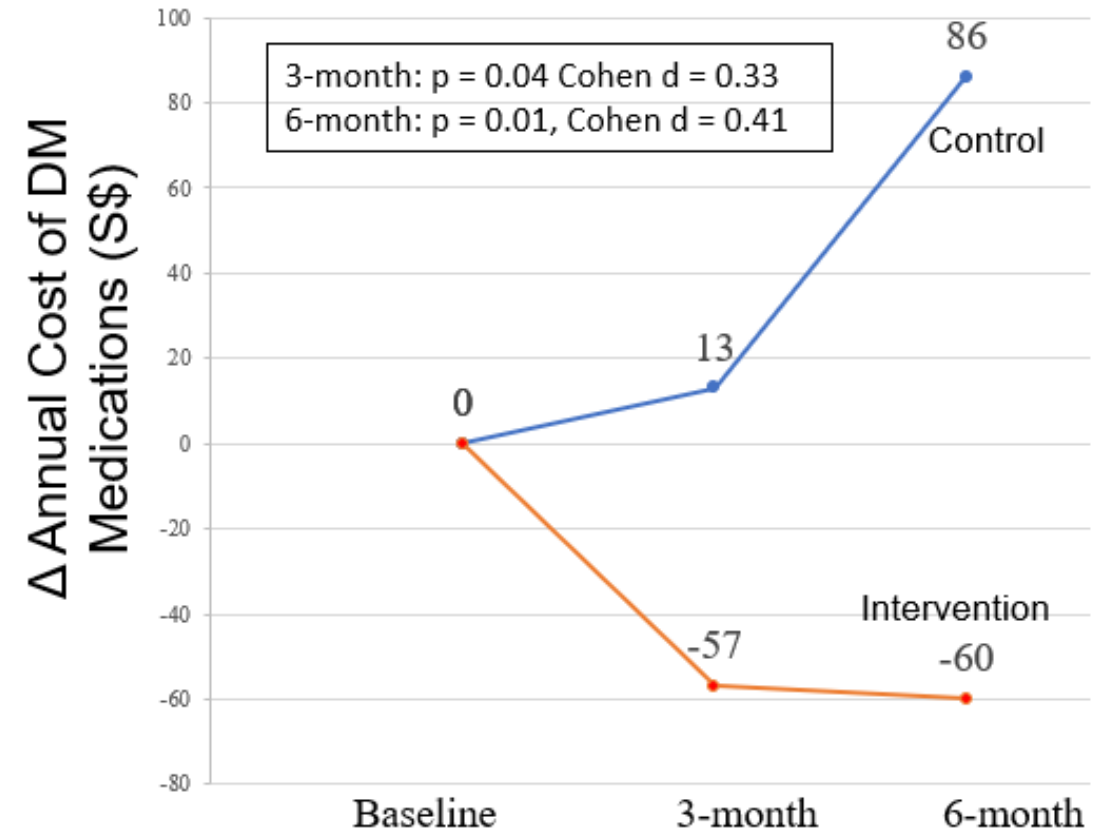
Reduction in DM Medications

n = 139

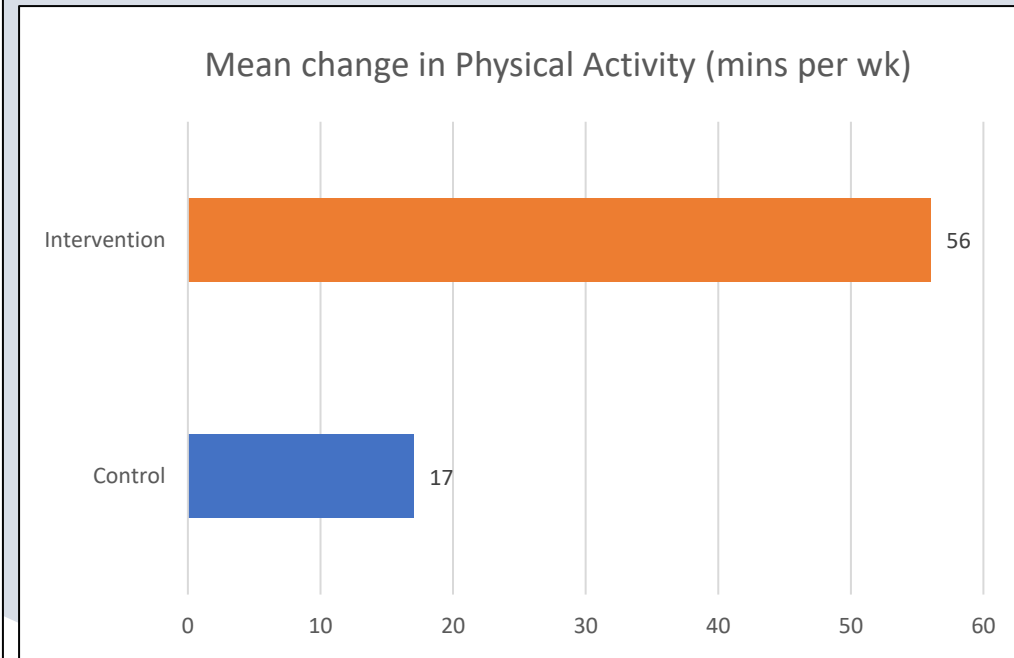
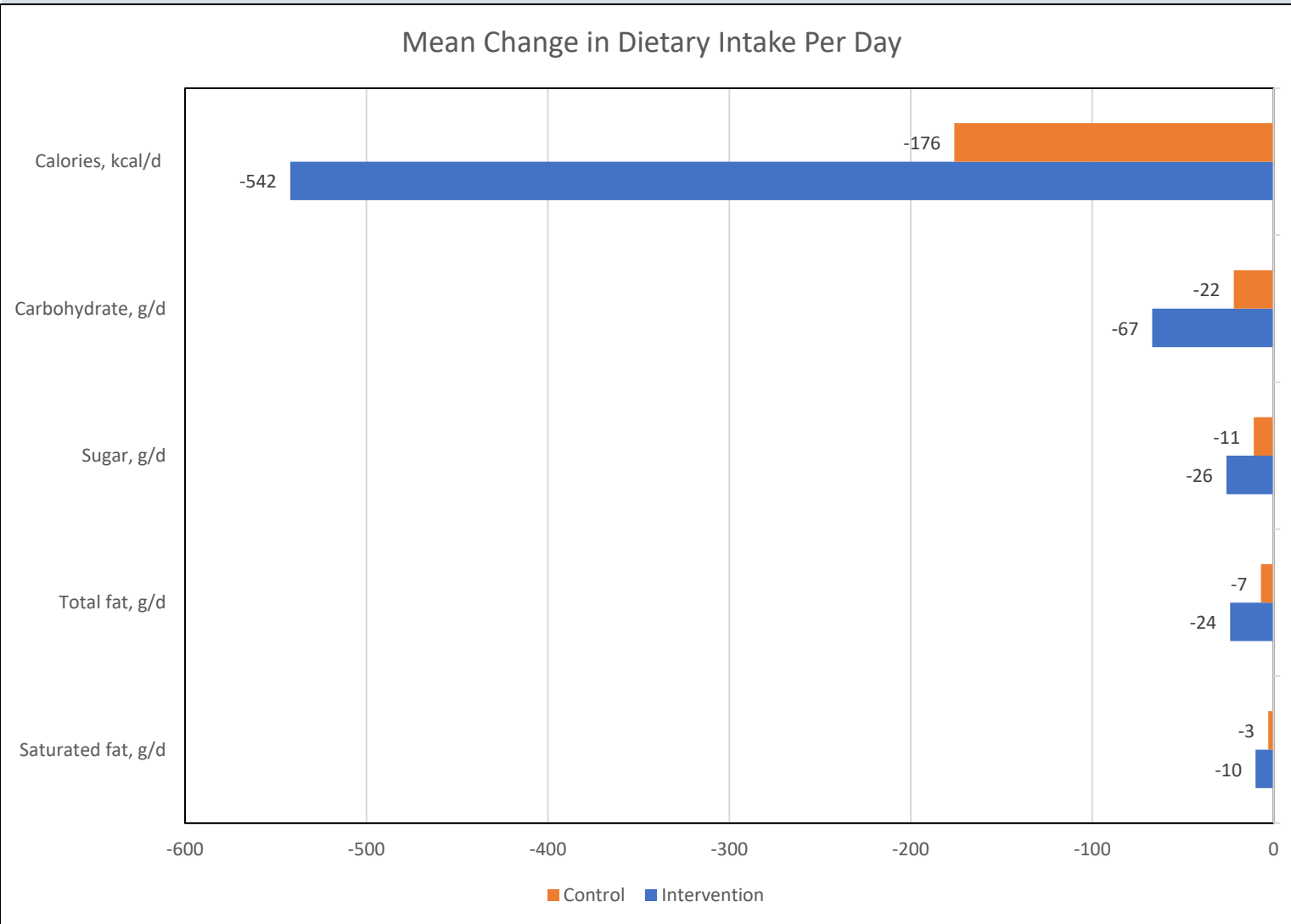
Changes in Dosage of DM Medications



Changes in Annual Costs of DM Medications

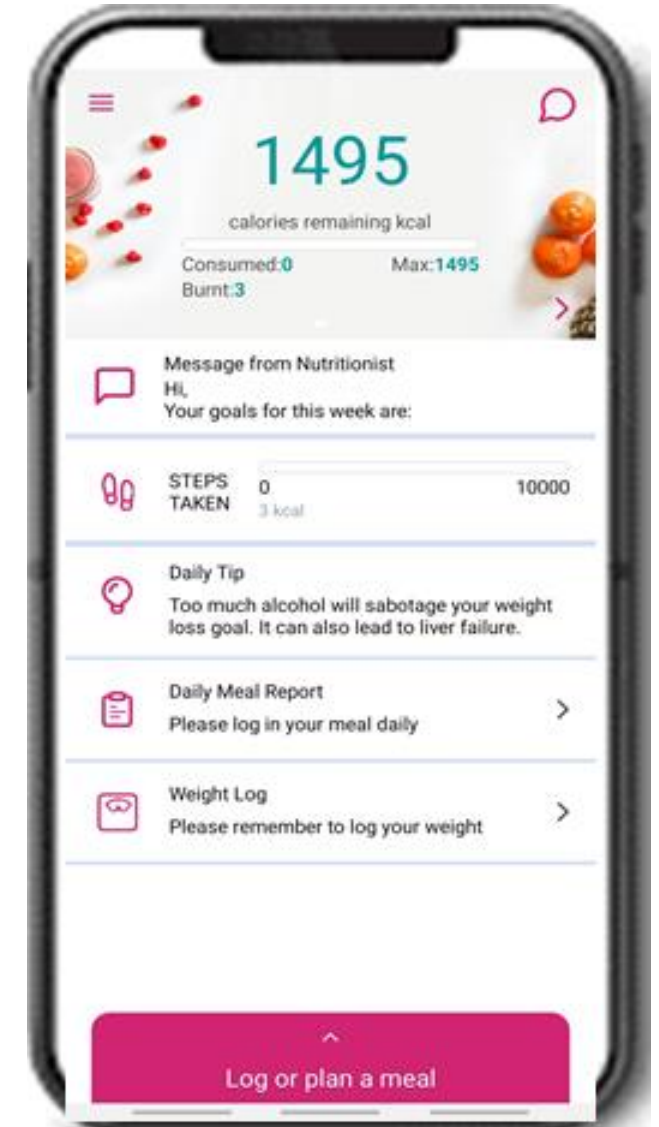


Sustained Changes in Dietary Intake & Physical Activity



Does app engagement make a difference?

- **476,300** data points of participants assigned to the app
- Daily app engagement tracked via the backend dashboard
- Associations between the **app engagements** with:
 - Weight loss
 - HbA1c reduction





Original Investigation | Nutrition, Obesity, and Exercise

Effect of a Smartphone App on Weight Change and Metabolic Outcomes in Asian Adults With Type 2 Diabetes

A Randomized Clinical Trial

Su Lin Lim, PhD; Kai Wen Ong, BSc; Jolyn Johal, BSc; Chad Yixian Han, BSc; Qai Ven Yap, BSc; Yiong Huak Chan, PhD; Yu Chung Chooi, MSc; Zhi Peng Zhang, MMed; Cheryl Christine Chandra, MBBS; Anandan Gerard Thiagarajah, MMed; Chin Meng Khoo, PhD

Original Paper

Lifestyle Intervention Enabled by Mobile Technology on Weight Loss in Patients With Nonalcoholic Fatty Liver Disease: Randomized Controlled Trial

Su Lin Lim¹, BSc, PhD; Jolyn Johal¹, BSc; Kai Wen Ong¹, BSc; Chad Yixian Han¹, BSc; Yiong Huak Chan², PhD; Yin Mei Lee³, MBChB, MRCP, SAB; Wai Mun Loo³, MBBS, MRCP

¹Dietetics Department, National University Hospital, National University Health System, Singapore, Singapore

²Biostatistics Unit, Yong Loo Lin School of Medicine,

³Department of Medicine, Gastroenterology and Hepat

Review

Efficacy of Interventions That Incorporate Mobile Apps in Facilitating Weight Loss and Health Behavior Change in the Asian Population: Systematic Review and Meta-analysis

Siew Min Ang^{1*}, BSc, MND, APD; Juliana Chen^{2*}, BSc, MND, APD, PhD; Jia Huan Liew³, PhD; Jolyn Johal⁴, BSc, APD; Yock Young Dan⁵, ProfDr; Margaret Allman-Farinelli², PhD, FDAA; Su Lin Lim¹, PhD

19/32

Diet is the key to the prevention and management of many lifestyle diseases, and Dr Lim hopes the app will help people struggling with their weight to start sustainable habits.

"It saddens me when I see patients with diabetes who could have avoided complications like kidney disease if

[illegible]

Before: 76 kg

After: 60 kg



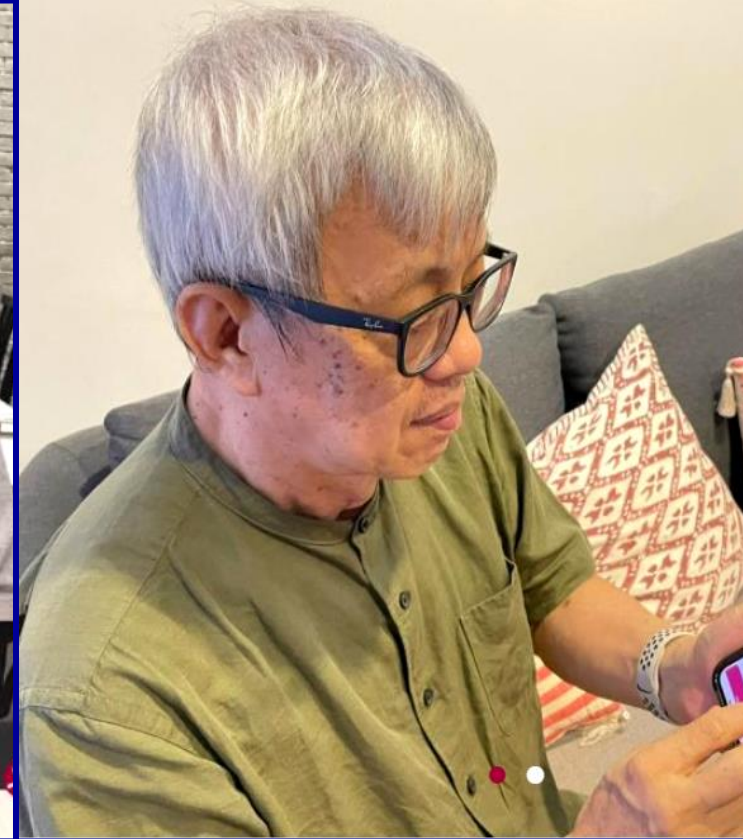
Lost 16 kg in 6 months

BP normalized & NAFLD reversed

Weight loss sustained at 2 years

Before: 91 kg

After: 75 kg



Lost 8 kg in 6 months

HbA1c reduced from 10% to 6% in 6 mths

Weight loss at 2 years: 16 kg

What have we learnt

- Lifestyle interventions enabled by a well-designed mobile application effective in:
 - ❖ weight loss
 - ❖ diabetes control
 - ❖ prediabetes reversal
 - ❖ positive dietary changes
 - ❖ improved physical activities
- Effect greater in those with poor diabetes control
- Reduction in diabetes medications
- Potentially scalable to the larger population

Translation into clinical practice

- Diabetes App Programme
- Weight Loss App Programme
- Liver (NAFLD) App Programme
- Gestational DM App Programme

Acknowledgments

Special thanks to:

National Medical Research Council (NMRC)

Dr Khoo Chin Meng

Dr Chan Yiong Huak

Ms Ong Kai Wen

Ms Yap Qai Ven

Ms Jolyn Johal

Ms Genevieve Yeo

Mr Chad Han

Dr Anandan Gerald

Dr Zhang Zhi Peng

Dr Richard Hui

Dr Cheryl Christine Chandra

Dr Steven Chong