

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

# **Burden of Diabetes**



- 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<sup>1,2</sup>
- Medical Nutrition Therapy effective in improving body weight, and hyperglycaemia<sup>3, 4</sup>
- Travelling distances, time constraint and costs detract the effectiveness of lifestyle intervention<sup>5</sup>
- Drop-out rates ranges from 30 60%<sup>5,6</sup>

- 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 smartphone<sup>1</sup>
- > 50% smartphone owners use their phone to search for health information<sup>2</sup>
- Increasingly part of essential healthcare<sup>3</sup>



- 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



# **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

| 1 |          | 1495<br>calories remaining kcal<br>Consumed:0 Max:1495<br>Burnt:3                                |        |              |
|---|----------|--|--------|--------------|
|   | P        | Message from Nutritionist<br>Hi,<br>Your goals for this week are:                                |        |              |
| 1 | - 00     | STEPS 0<br>TAKEN 3 kcal  | 10000  | L            |
|   | Q        | Daily Tip<br>Too much alcohol will sabotage your v<br>loss goal. It can also lead to liver failu | weight | $\mathbf{P}$ |
| l | <u>.</u> | Daily Meal Report<br>Please log in your meal daily   | >      | $\mathbf{F}$ |
|   | -@       | Weight Log<br>Please remember to log your weight   | >      |              |
|   |          |  |        |              |
|   |          | ^  |        |              |

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

Log or plan a meal



# **Results: Weight Loss**



# **Glycemic Control**

n = 352

DIABETES

PREDIABETES



# **Significant improvement in Diabetes control**

In patients with poor Diabetes Control (HbA1c ≥ 8%)



# **Reduction in DM Medications**

Changes in Dosage of DM Medications n = 139

**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

| JMIR MHEALTH AND UHEALTH  | 2020   vol. 8   iss. 4   e14802   p. 1  | Lim et al               |                              |  |  |  |  |  |
|---|---|-------------------------|------------------------------|--|--|--|--|--|
| <u>Original Paper</u>   |   |                         |                              |  |  |  |  |  |
| •   | nabled by Mobile Technology on<br>onalcoholic Fatty Liver Disease:<br>Trial   | •                       |                              |  |  |  |  |  |
| Su Lin Lim <sup>1</sup> , BSc, PhD; Jolyn Johal <sup>1</sup> , BSc; Kai Wen Ong <sup>1</sup> , BSc; Chad Yixian Han <sup>1</sup> , BSc; Yiong Huak Chan <sup>2</sup> , PhD;<br>Yin Mei Lee <sup>3</sup> , MBChB, MRCP, SAB; Wai Mun Loo <sup>3</sup> , MBBS, MRCP<br><sup>1</sup> Dietetics Department, National University Hospital, National University Health System. Singapore. Singapore |   |                         |                              |  |  |  |  |  |
| <sup>2</sup> Biostatistics Unit, Yong Loo Lin School of Medicine,<br><sup>3</sup> Department of Medicine, Gastroenterology and Hepat  | JOURNAL OF MEDICAL INTERNET RESEARCH <u>Review</u>  | 2021   vol. 23   iss. 1 | 11   e28185   p. 1 Ang et al |  |  |  |  |  |
|   | 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 <sup>1*</sup> , BSc, MND, APD; Juliana Chen <sup>2*</sup> , BSc, MND, APD, PhD; Jia Huan Liew <sup>3</sup> , PhD; Jolyn Johal <sup>4</sup> , BSc, APD; Yock Young Dan <sup>5</sup> , ProfDr; Margaret Allman-Farinelli <sup>2</sup> , PhD, FDAA; Su Lin Lim <sup>1</sup> , PhD |                         |                              |  |  |  |  |  |

## In the news

19 health

### Online tool aims to help overweight and diabetic Singaporeans

**EVELINE GAN** 

and Google Play. SINGAPORE - Eating clean is a daily

even the 47-year-old, who heads the available on the Google Play Store, dietetics department at National Uni- and will be on the Apple App Store versity Hospital (NUH), will occasion- next week. ally forgo a wholesome meal for du-

content es. Thankfully, for me, they are avail- to reduce portion sizes if the selected able only during certain seasons,"

said Dr Lim, who conceptualised this year.

to give up one's favourite foods.

up its database. It is currently available for free on the Apple App Store A similar version for those with affair for dietitian Lim Su Lin. But prediabetes or Type 2 diabetes is now

Tailored to Singaporeans, the rian. The king of fruit has a relatively nBuddy app allows users to plan their high calorie, sugar and carbohydrate meals and evaluates their food choices in real-time. Features include provid-"Durians are my guilty indulgenc- ing a healthier food option or a choice

food item is not the best choice. For example, the app might prompt Nutritionist Buddy (nBuddy), a diet a person who intends to consume a app for Singaporeans launched early regular cup of milk coffee to go for a Dr Lim Su

Having counselled patients who sion. It also tells users whether their were struggling to lose weight, Dr Lim food choice is a "red thumbs-down" understands the challenges of having (unhealthy) or a "green thumbs-up" (healthier choice) item. "Other diet apps typically do not

"siu dai" (less sweet) or zero-sugar ver-

So, healthier food recommendaons to replace poorer food choices is provide an immediate guide on food TODAY . WEDNESDAY 10 MAY 2017

19/32



The app also provides science-Diet is the key to the prevention and based daily tips on healthy living and management of many lifestyle diseastracks the user's physical activity. es, and Dr Lim hopes the app will help And for a fee of S\$300 for three people struggling with their weight to months, premium members can get start sustainable habits. access to nutritionist support from "It saddens me when I see patients Dr Lim and another NUH dietitian, with diabetes who could have avoidotal nutritional analysis workshops ed complications like kidney disease

## 国大医院使用手机软件 帮脂肪肝患者减肥效果显著

Lin (left)

conceptualised

Buddy (nBuddy)

Singaporeans.

similar version for

Nutritionist

a diet app for

国大医院的试验显示,第二组试验者与第一组相比,减 掉至少5%的体重的可能性高出四倍。同时,第二组人员 的体重、腰围也比第一组减少更多,心脏收缩压和舒张 压等指标也有极大改善。

软件

### 郑雯婕 报道 zwenjie@sph.com.sg

国立大学医院使用手机软 件,帮助患有非酒精性脂肪性肝 病的成年患者减肥,临床试验结 果证明使用软件的患者减肥成功

率比未使用者高出四倍 本月13日,国大医院一组医 生与营养师团队,在国际学术期 刊 "JMIR mHealth and wHealth" 上发表了临床研究成果。这项试 验由国大医院首席营养师林淑玲

领导,从2017年7月到去年11月,

### Nutritionist Buddy(nBuddy)的手机

该软件可追踪使用者的饮食 和运动量,引导使用者改变生活 习惯,以达到最佳减肥效果 为期六个月的试验结束后, 第二组试验者与第一组相比,减

掉至少5%的体重的可能性高出四 倍。同时, 第二组人员的体重 腰围也比第一组减少更多,心脏 收缩压和舒张压等指标也有极大 改善

患高血压和非酒精性脂肪肝 研究团队耗时两年四个月,对比 约10年的叶清华(48岁,物流运 当返 理) 昭立ら犯ら始小に計



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在六年前,才林安佑兰要市辅助

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ANALY, CRIMINAL

## Before: 76 kg After:60 kg After: 75 kg Before: 91 kg GERS YOU? BE DIFFERENT TAL ST A 9

Lost 16 kg in 6 months BP normalized & NAFLD reversed Weight loss sustained at 2 years 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

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