



UNIVERSITI PUTRA MALAYSIA

***EFFECTIVENESS OF AN INTEGRATED-WEIGHT MANAGEMENT
PROGRAMME IN REDUCING BODY WEIGHT AMONG
NONCOMMUNICABLE DISEASE PATIENTS IN MALAYSIAN
GOVERNMENT PRIMARY CARE CLINICS***

TAN SIEW TIN

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By

TAN SIEW TIN

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfilment of the Requirements for the Degree of
Doctor of Philosophy**

May 2021

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DEDICATION

To

My beloved late father, Mr Tan Leong Beng and
lovely mother, Madam Ng Yok Yau
My great siblings: Tan Swee Lay, Tan Chin Seng, and Tan Siew Leng
My supportive husband, Low Kin Hein
My adorable boy, Low Zi Hong
Who blessed and supported me throughout my PhD research journey.



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

EFFECTIVENESS OF AN INTEGRATED-WEIGHT MANAGEMENT PROGRAMME IN REDUCING BODY WEIGHT AMONG NONCOMMUNICABLE DISEASE PATIENTS IN MALAYSIAN GOVERNMENT PRIMARY CARE CLINICS

By

TAN SIEW TIN

May 2021

Chairman : Professor Datin Sherina Mohd Sidik, PhD
Faculty : Medicine and Health Sciences

Worldwide, there were 1.3 billion (26%) adults aged 18 years old and above were overweight in 2016. More than 650 million (13%) adults were obese. In Malaysia, it was reported that the prevalence of overweight was 30.4% whilst the prevalence of obesity was 19.7% in 2019. Obesity could lead to noncommunicable diseases (NCDs) and other complications. This study aimed to develop, implement, and evaluate a new integrated-Weight Management Programme (i-WMP) in reducing body weight (BW) as the primary outcome among NCD patients in Malaysian government primary care clinics.

A randomised, single-blind, parallel-group trial study was carried out in two Malaysian government primary care clinics (Hulu Langat District, Selangor). Two hundred forty-four eligible patients were invited, consented, recruited, and randomised into intervention ($n = 122$) or wait-list control group ($n = 122$).

Behaviour change wheel (BCW) was used as the theoretical framework to develop the i-WMP. This i-WMP consisted of three sessions. Session 1 and 2 were implemented at week 0 and Session 3 was implemented at week 4. The baseline data were collected using validated, pre-tested, and self-administered questionnaires. These questionnaires included information on socio-demographic profile; smoking and vaping; anthropometric measurements such as BW, body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHtR), body fat percentage (BF%); knowledge, attitude, and practice (KAP) towards dietary and physical activity; total physical activity metabolic equivalent of task (MET)-minutes/week and sitting time (International Physical Activity Questionnaire short form, IPAQ-SF); depression (Patient Health Questionnaire, PHQ-9); anxiety (The Generalised Anxiety Disorder Scale, GAD-7).

Data collected were analysed using the application of IBM SPSS (version 23). The generalised linear mixed model was performed for programme evaluation. The confidence interval was set at 95% and a level of significance of 0.05. Once randomised, all participants were included in the analysis, intent-to-treat principle was applied for lost follow-up.

The retention rate was 74.2%. Results exhibited that the i-WMP was effective in reducing BW ($F(2, 499) = 16.020, p < 0.001$), BMI ($F(2, 499) = 16.711, p < 0.001$), WC ($F(2, 499) = 16.767, p < 0.001$), WHtR ($F(2, 499) = 16.918, p < 0.001$), and total sitting time ($F(2, 499) = 3.774, p = 0.024$). This programme also was effective in improving diet knowledge ($F(2, 499) = 6.134, p = 0.002$), diet attitude ($F(2, 499) = 10.201, p < 0.001$), diet practice ($F(2, 499) = 43.080, p < 0.001$), physical activity knowledge ($F(2, 499) = 34.527, p < 0.001$), physical activity attitude ($F(2, 499) = 19.252, p < 0.001$), and physical activity practice ($F(2, 499) = 12.455, p < 0.001$). Nonetheless, the changes in BF% and total physical activity MET-minutes/week did not reach statistical significance.

i-WMP is effective in reducing BW, BMI, WC, WHtR, and total sitting time; while improving KAP towards dietary and physical activity in these patients with NCD. This i-WMP could be recommended and implemented in the primary care setting.

Keywords: integrated-Weight Management Programme, body weight, noncommunicable disease, randomised controlled trial

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**KEBERKESANAN SATU PROGRAM PENGURUSAN BERAT BADAN
BERINTEGRASI UNTUK MENGURANGKAN BERAT BADAN DALAM
KALANGAN PESAKIT PENYAKIT TIDAK BERJANGKIT DI KLINIK-KLINIK
KESIHATAN KERAJAAN MALAYSIA**

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Di seluruh dunia, terdapat 1.3 bilion (26%) orang dewasa berusia 18 tahun dan ke atas mempunyai berat badan berlebihan pada tahun 2016. Lebih daripada 650 juta (13%) orang dewasa mengalami obesiti. Di Malaysia, dilaporkan bahawa prevalens berat badan berlebihan adalah 30.4% sementara prevalens obesiti adalah 19.7% pada tahun 2019. Obesiti dapat menyebabkan penyakit tidak berjangkit (NCD) dan komplikasi lain. Kajian ini bertujuan untuk membentuk, melaksana dan menilai Program Pengurusan Berat Badan Berintegrasi (i-WMP) yang baharu dalam mengurangkan berat badan (BW) sebagai hasil utama dalam kalangan pesakit NCD di klinik kesihatan kerajaan Malaysia.

Satu kajian percubaan terkawal rawak, rabun sepihak dan selari dijalankan di dua buah klinik kesihatan kerajaan Malaysia (Daerah Hulu Langat, Selangor). Seramai 244 pesakit yang memenuhi syarat masing-masing diundang, dipersetujui, direkrut dan diperuntukkan secara rawak ke dalam kumpulan intervensi ($n = 122$) atau kawalan ($n = 122$).

Roda perubahan tingkah laku (BCW) digunakan sebagai kerangka teori untuk membentuk i-WMP. Program ini terdiri daripada 3 sesi. Sesi 1 dan 2 dilaksanakan pada minggu 0 dan Sesi 3 dilaksanakan pada minggu ke-4. Data pada peringkat awal dikumpul dengan menggunakan borang soal selidik (dikendalikan sendiri) yang telah divalidasi dan diuji kebolehpercayaan sebelum kajian. Maklumat dalam soal selidik ini termasuk profil sosio-demografi; merokok dan penggunaan rokok elektronik; pengukuran antropometri seperti BW, indeks jisim badan (BMI), lilitan pinggang (WC), nisbah pinggang-ke-tinggi (WHtR),

peratusan lemak badan (BF%); pengetahuan, sikap dan amalan (KAP) mengenai diet dan aktiviti fizikal; jumlah aktiviti fizikal metabolik bersamaan tugas (MET)-minit/minggu dan masa duduk (Borang Soal Selidik Aktiviti Fizikal Antarabangsa, IPAQ-SF); kemurungan (Soal Selidik Kesihatan Pesakit, PHQ-9); kegelisahan (Skala Gangguan Kecemasan Umum, GAD-7).

Data yang telah dikumpul dianalisis dengan menggunakan applikasi IBM SPSS (versi 23). *Generalised linear mixed model* telah dilakukan untuk menilai program. Selang keyakinan ditetapkan pada 95% dan tahap signifikan 0.05. Setelah diperuntukkan secara rawak, semua peserta dimasukkan ke dalam analisis, prinsip niat-untuk-rawatan diterapkan untuk kehilangan janji temu susulan.

Kadar retensi ialah 74.2%. Hasil kajian menunjukkan i-WMP ini berkesan dalam mengurangkan BW ($F(2, 499) = 16.020, p < 0.001$), BMI ($F(2, 499) = 16.711, p < 0.001$), WC ($F(2, 499) = 16.767, p < 0.001$), WHtR ($F(2, 499) = 16.918, p < 0.001$) dan jumlah masa duduk ($F(2, 499) = 3.774, p = 0.024$). Program ini juga berkesan dalam meningkatkan pengetahuan diet ($F(2, 499) = 6.134, p = 0.002$), sikap terhadap diet ($F(2, 499) = 10.201, p < 0.001$), amalan diet ($F(2, 499) = 43.080, p < 0.001$), pengetahuan aktiviti fizikal ($F(2, 499) = 34.527, p < 0.001$), sikap terhadap aktiviti fizikal ($F(2, 499) = 19.252, p < 0.001$) dan amalan aktiviti fizikal ($F(2, 499) = 12.455, p < 0.001$). Namun, perubahan pada BF% dan jumlah aktiviti fizikal MET-minit/minggu tidak mencapai keputusan statistik yang signifikan.

i-WMP ini berkesan dalam mengurangkan BW, BMI, WC, WHtR dan jumlah masa duduk. Pada masa yang sama, program ini juga efektif dalam meningkatkan KAP mengenai diet dan aktiviti fizikal dalam kalangan pesakit NCD ini. i-WMP ini boleh dicadangkan dan dilaksanakan di klinik kesihatan.

Kata kunci: Program Pengurangan Berat Badan, berat badan, penyakit tidak berjangkit, percubaan rawak terkawal

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

<	Less than
>	More than
≤	Less than or equals to
≥	Greater than or equals to
Adult	Aged 18 years old and above
App	Application
BCW	Behaviour change wheel
BCT	Behaviour change technique
BF%	Body fat percentage
BMI	Body mass index
BW	Body weight
CI	Confidence interval
CALO-RE	Coventry, Aberdeen & London – Refined
COM-B	Behaviour system, capability, opportunity, and motivation
CONSORT	Consolidated Standards of Reporting Trials
CPG	Clinical Practice Guidelines
CT	Control theory
CVD	Cardiovascular disease
DBP	Diastolic blood pressure
DV	Dependent variable
FGD	Focus group discussion
FMS	Family medicine specialist
FPG	Fasting plasma glucose

GAD	Generalised Anxiety Disorder
GLMM	Generalised linear mixed model
HDL-C	High density lipoprotein-cholesterol
Ht	Height
i-WMP	integrated-Weight Management Programme
ICC	Intraclass correlation coefficient
IMB	Information-motivation-behavioural skills model
IPAQ-SF	International Physical Activity Questionnaire short form
IPH	Institute for Public Health
IOR	Interquartile range
IV	Independent variable
JKEUPM	Ethics Committee for Research Involving Human Subjects (<i>Jawatankuasa Etika Universiti untuk Penyelidikan Melibatkan Manusia</i>)
KAP	Knowledge, attitude, and practice
KEMAS	Community Development Department (<i>Jabatan Kemajuan Masyarakat</i>)
KOSPEN	<i>Komuniti Sihat Perkasa Negara</i>
LDL-C	Low density lipoprotein-cholesterol
MANS	Malaysian Adult Nutrition Survey
MDG	Malaysian Dietary Guidelines
MET	Metabolic equivalent of task
MO	Medical officer
MOH	Ministry of Health
MREC	Medical Research and Ethics Committee
NCD	Noncommunicable disease

NHMS	National Health and Morbidity Survey
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
NPANM	National Plan of Action for Nutrition of Malaysia
OC	Operant conditioning
PHQ	Patient Health Questionnaire
RA	Research assistant
RCT	Randomised controlled trial
SBP	Systolic blood pressure
ScogT	Socio-cognitive theory
SD	Standard deviation
SE	Standard error
SMS	Short message service
SOP	Standard operating procedure
TC	Total cholesterol
TG	Triglyceride
TPB	Theory of planned behaviour
TRA	Theory of reasoned action
UPM	Universiti Putra Malaysia
WA	WhatsApp
WC	Waist circumference
WHO	World Health Organization
WHtR	Waist-to-height ratio

CHAPTER 1

INTRODUCTION

Chapter 1 explains the problem of interest in this study. It essentially provides a background information on overweight and obesity globally and in Malaysia. The chapter also highlights what brings overweight and obesity become a public health issue and what possible solutions to tackle the issue. The problem statement, significance of the study, research questions, and its objectives and the hypotheses to be tested are presented in this chapter. At the end of this chapter also describes the conceptual framework of the current study.

1.1 Background

According to the World Health Organization (WHO), the definition of overweight and obesity is “abnormal or excessive fat accumulation that presents a risk to health”. Generally, an imbalance of energy intake (calories consumed) and energy output (calories expended) cause overweight and obesity. Based on the global burden of disease in 2017, more than four million of overweight or obese people die annually (World Health Organization [WHO], 2020b). Overweight and obesity are global epidemic - “globesity”, which affect many counties worldwide (WHO, 2020a).

The most common measure for obesity is the body weight (BW). An individual with higher BW generally will have more body fat. The changes of body water, body fat and/or muscle could change an individual’s BW. As the individual aged, the BW could change due to the accumulation of their body fat. In the other hand, the BW is corresponding to the individual’s height (Ht). Therefore, body mass index (BMI) is used to overcome this limitation (Duren et al., 2008).

Body mass index is the most common measure for BW status. It is also a crude population measure of overweight and obesity (regardless of gender), it is applying to all ages of adults. The formulation of BMI has been shown as below (WHO, 2015a):

$$\text{Body Mass Index (BMI)} = \frac{\text{Body weight (in kilograms)}}{[\text{Height (in metres)}]^2}$$

The BW status is classified based on BMI. A person with a BMI of equal or more than 25 kg/m² is classified as overweight, while 30 kg/m² or more is classified as an obese person, as shown in Table 1.1. The risk of co-morbidities is getting higher as the BMI (or BW) increases (WHO Consultation on Obesity, 1998).

Table 1.1 : The body weight classification in adults based on body mass index

Body weight classification	BMI (kg/m²)	Risk of co-morbidities
Underweight	<18.5	Low
Normal range	18.5 – 24.9	Average
Overweight	≥ 25.0	
Pre-obese	25.0 – 29.9	Increased
Obese class I	30.0 – 34.9	Moderate
Obese class II	35.0 – 39.9	Severe
Obese class III	≥ 40.0	Very severe

(Adapted from WHO Consultation on Obesity, 1998)

As the BMI increases, the risk of getting noncommunicable diseases (NCDs), such as cardiovascular diseases (CVDs), type II diabetes mellitus, musculoskeletal disorders, and certain types of cancers increases. Cardiovascular diseases mainly are heart disease and stroke, one of the leading causes of death. Osteoarthritis (musculoskeletal disorders) are joints' highly disabling degenerative disease. Overweight and obesity are some of the major risk factors for certain types of cancers, such as breast cancer, colon cancer, endometrial cancer, gallbladder cancer, kidney cancer, liver cancer, ovarian cancer, and prostate cancer (WHO, 2020c). Besides these co-morbidities (numerous of diseases), overweight and obesity have many adverse psychological and social costs (Webber, 2001).

Worldwide, more than 1.9 billion adults aged 18 years old and above were overweight (39%) in 2016. Out of these, more than 650 million were obese (13%). There are 15% of obese women and 11% of obese men worldwide. Thirty-nine percent of overweight adults consisted of 40% of women and 39% of men. Between 1980 and 2014, the prevalence of obesity increased more than double worldwide. By 2020, obesity approximately tripled since 1975 globally (WHO, 2015b, 2020c).

Prevalence of obesity and overweight increased in low- and middle- income countries (in the urban area). Economies emerging in developing countries caused the increment of childhood obesity and overweight rate of more than 30% as compared to developed countries. Childhood obesity is more prone to obesity in adulthood. Obesity and overweight lead to higher mortality than underweight (WHO, 2015b).

Overweight and obesity are the talk of the town and the focus of public health and primary care in Malaysia. Malaysian adults have the highest prevalence of obesity (14.0%) and overweight (44.2%) as compared to the population of Southeast Asia. In other words, Malaysia is the fattest country in Southeast Asia (WHO, 2014). The prevalence of overweight and obesity is shown an increasing trend among Malaysian adults, which also leads to the increasing prevalence of NCDs, such as type II diabetes mellitus, hypertension, and cancer (Institute for Public Health [IPH], 2011b; Prospective Studies Collaboration, 2009). Consequently, Malaysia may face the issue of reduction in human resources' productivity and the increment of health care costs in the long run (Norliza, 2017).

Many of overweight and obesity's root causes are preventable and reversible (WHO, 2020a). Therefore, the development of an effective weight management programme by changing the behaviour of Malaysian adults to reduce their calories consumption but to increase their calories expenditure is vital. Thus, the integrated-Weight Management Programme (i-WMP), version 1.0 is developed and aims to reduce the NCD patients' BW healthily (as primary outcome) while improve other outcome variables (as secondary outcomes). This i-WMP integrated three key ingredients: dietary advice, physical activity, and behavioural intervention.

1.2 Statement of the problem

Ministry of Health (MOH) Malaysia has been promoting the healthy eating and an active lifestyle in the community for the past many years. Programmes such as "10,000 steps a day campaign, 2009", "My Weight My Health, 2012", "MySihat, 2013", "Komuniti Sihat Perkasa Negara (KOSPEN), 2013", and "Nutrition Month Malaysia, 2016 - 2019" were launched in the community setting (Malaysian Pharmaceutical Society [MPS], 2012; Mansor & Harun, 2014; Ministry of Health [MOH] Malaysia, 2013; Nutrition Society of Malaysia [NSM], 2020; Verma et al., 2013). Ideally, Malaysian adults should be equipped with nutrition knowledge and capable of maintaining healthy BW by eating healthily and living actively.

However, economic growth, globalization, industrialization, urbanization, and westernization have contributed to the increasing trend of overweight and obesity in Malaysia. Besides more fast food consumption, Malaysians are lacking physical activity and more prone to a sedentary lifestyle (Khambalia & Seen, 2010; WHO, 2015b). In Malaysia, there are plenty of delicious, energy dense, and well-advertised food. Food can be easily accessed in many places and even at midnight. At the same time, labour-saving technologies and devices contributed hugely to Malaysian's sedentary lifestyle (National Coordinating Committee on Food and Nutrition [NCCFN], 2010).

According to National Health and Morbidity Survey (NHMS) 1996, the prevalence of overweight was 16.6% among Malaysian adults, it continued to increase to 29.1%, 29.4%, 30.0%, and 30.4% for the year of 2006, 2011, 2015, and 2019 respectively (IPH, 1997, 2008b, 2011b, 2015, 2020). The prevalence of obesity exhibited a similar trend as the prevalence of overweight. The Malaysian adults' prevalence of obesity was 4.4% in 1996, it continued to increase to 14.0% (2006), 15.1% (2011), 17.7% (2015), and 19.7% (2019) (IPH, 1997, 2008b, 2011b, 2015, 2020).

The increasing prevalence of overweight and obesity among Malaysian adults are threatening the public health and primary care as this will also lead to the increasing prevalence of NCDs such as CVDs, type II diabetes mellitus, and cancers (IPH, 2011b; Prospective Studies Collaboration, 2009). Among Malaysian adults aged 18 years old and above, the prevalence of diabetes has increased from 11.6% (2006) to 17.5% (2015). The prevalence of hypertension is approximately 30%. Furthermore, there are over 50% of hypertension or diabetes undiagnosed cases (WHO, 2019). Obese people also reported being associated with psychological distress such as depression and anxiety, which are significant predictors of suicidal behaviour risk (Barry & Petry, 2009; Sherina et al., 2012a, 2012b; Tan et al., 2015).

Besides that, the increasing prevalence of Malaysian adults' overweight and obesity imposed the greatest cost and time burden on existing healthcare systems, as well as human resources. Direct healthcare cost was referred to as the services of preventive, diagnostic, and treatment. The indirect healthcare cost was including the value of salary lost (lost the job opportunity due to disability or illnesses) or future earnings lost (premature death) (MOH Malaysia, 2004).

If Malaysian overweight and obese NCD patients are continuing with their unhealthy eating habits and sedentary lifestyle, this will harm their health status physically, physiologically and psychologically. The prevalence of NCDs may continue to rise.

On the other hand, a review found that only a few weight management programmes have been conducted in Malaysia from 2005 until 2015, including "dietary and physical activity programmes" and "dietary, physical activity, and behaviour modification programmes" (Tan et al., 2017). Also, there is a lack of randomised controlled trials (RCTs) in Malaysia to tackle this issue based on the finding of the same review searched from 2005 to 2015 (Tan et al., 2017).

Weight loss is proven to reduce the health risk among obese people. A 100 kg person who loses 10 kg can reduce 10 mmHg and 20 mmHg of their systolic and diastolic blood pressure, respectively. A hypertensive patient can reduce the

need for medication through weight loss. By reducing 10% of initial BW, they can benefit 10%, 15%, and 30% of reduction in total cholesterol (TC), low density lipoprotein-cholesterol (LDL-C), and triglyceride (TG), respectively. Besides that, it reduces more than 50% risk of getting type II diabetes mellitus. All-cause mortality reduces 20 - 25% when a person loses 10% of their initial BW (NCCFN, 2010).

Since the overweight and obesity issues are critical and reversible, something needs to be done before it is too late. Most of the existing weight management programmes focus on knowledge and awareness improvement (“know what” and “know why”) of healthy living and active living. Thus, a programme that focuses on scientifically proven behaviour change techniques (BCT), which can enhance the skill of Malaysian adults in changing their existing unhealthy behaviours (“know how”) is needed. A systematic review and meta-analysis showed that the majority of behavioural weight management programme were effective (Hartmann-Boyce et al., 2014). Meta-analysis shows evidence that programmes which incorporate multi-components such as behavioural techniques, besides diet and physical activity are more effective in reducing BW (Hartmann-Boyce et al., 2014). No adverse event or risk was found for a similar weight management programme (Madigan, Jolly, et al., 2014). The behaviour change wheel (BCW) with the centre hub, ‘behaviour system’: capability, opportunity, and motivation (COM-B) was used as a theoretical framework to develop this intervention programme for this study. It has been used reliably by the National Institute of Health and Clinical Excellence’s guidance on overweight and obesity reduction (Michie, van Stralen, et al., 2011).

Therefore, there is a need to develop an integration weight management programme that consists of dietary advice, physical activity, and behavioural intervention (Hartmann-Boyce et al., 2014; Lewis et al., 2013; Madigan et al., 2013; Madigan, Daley, et al., 2014). Subsequently, the programme can be implemented and evaluated by conducting a RCT among the NCD patients in the Malaysian government primary care clinics.

The overweight or obese patients with NCD especially will have appointment with the primary care clinic for follow-up and progress monitoring on their health status. Based on the *Prosedur Operasi Standard Pengurusan Pemakanan Berlebihan Berat Badan dan Obes* (Overweight and Obesity Management Standard Operating Procedures) 2016, overweight or obese patients will be referred to the nutritionists by the family medicine specialists (FMSs) or medical officers (MOs). Patients who lose weight unsuccessfully with serious co-morbidity will then refer to the hospital (MOH Malaysia, 2016). The elaboration is detailed out in Chapter Two (See Section 2.5.3). Therefore, the primary care setting is ideally to be the ‘first port of call’ to intervene overweight or obese patients with NCD as compared to the community or hospital setting (Beeken et al., 2017).

Weight loss is linked with the tremendous benefits of health outcomes; it is identified as the main target for overweight and obesity management worldwide (Jensen et al., 2014). Every kilogram of BW reduction is contributed to 16% of diabetes risk reduction (Hamman et al., 2006). Besides the improvement of biomarker indicator, quality of life, mental health, mobility, and health status are known graded improvement in conjunction with BW reduction (Ryan & Yockey, 2017). Thus, BW is set as the primary outcome in this study.

1.3 Significance of the study

To the researcher's knowledge, this is a new i-WMP that to be developed, implemented, and evaluated through the study design of RCT among NCD patients in Malaysian government primary care clinics. The findings of this study can contribute to the body of knowledge in public health, specifically to the primary care setting in weight management among NCD patients.

If the programme is proven to be effective, this rationalises the opportunity to use the primary care setting to screen and intervene the overweight and obesity NCD patients. This is especially relevant for NCD patients with chronic diseases such as CVDs, type II diabetes mellitus, hypertension, and hyperlipidaemia. Many NCD patients who attend primary care clinics are obese, especially those with the chronic diseases as mentioned above. The primary care setting is an ideal setting to monitor the progress of these patients through each follow-up for as long as needed. Furthermore, the impact of diet and physical activity assessment and management has been proven among high risk patients in primary care. Facilities such as health risk assessment instruments and health checks in primary health care are useful to improve and support behavioural change and preventive care. Structured primary healthcare system serves as a good setting and opportunity for integrated approaches in managing lifestyle modification among patients from different services and funding such as government, private, at district, state, and national level (Harris, 2008).

If the programme is proven to be effective, eventually it could help to reduce the burdens and health care costs in the primary care setting. The reason behind this is that the module of this programme could be used as a standardised reference in this setting. All the experts needed for this i-WMP can be trained in the primary care setting, mainly the FMSs, nutritionists, dietitians, medical and health officers, nurses, and medical assistants. No additional resource needs to be added. The gap filled by this i-WMP is it is a group-based weight management programme as compared to an individual based approach, which is usually applied in primary care. Thus, it can reduce the time and cost burden in primary care, yet increase the efficiency of existing health care systems.

Furthermore, if the i-WMP is proven effective, the impact on society, economy and nation may include:

- i. reduction in the prevalence of overweight and obesity among the NCD patients in Malaysian government primary care.
- ii. a successful i-WMP will ultimately result in a healthy and wealthy nation.

1.4 Research questions

1. Is the i-WMP effective in:
 - a) reducing BW?
 - b) reducing BMI?
 - c) reducing waist circumference (WC)?
 - d) reducing waist-to-height ratio (WHtR)?
 - e) reducing body fat percentage (BF%)?
2. Is the i-WMP effective in:
 - a) improving the scores of knowledge, attitude, and practice (KAP) towards dietary?
 - b) improving the scores of KAP towards physical activity?
3. Is the i-WMP effective in:
 - a) improving total physical activity metabolic equivalent of task (MET)-minutes/week?
 - b) reducing total sitting time?

1.5 Research objectives

1.5.1 General objective

To develop, implement, and evaluate the effectiveness of i-WMP among NCD patients in government primary care clinics in Hulu Langat District, Selangor, Malaysia.

1.5.2 Specific objectives

1. To develop and implement i-WMP among NCD patients in government primary care clinics in Hulu Langat District, Selangor, Malaysia.
2. To determine the socio-demographic profile (age, gender, ethnicity, religion, marital status, education level, working status, and total monthly household income); smoking and vaping; and mental health

status (depression and anxiety) of the participants from the intervention and wait-list control groups at baseline (week 0).

3. To determine the anthropometric measurements (BW, BMI, WC, WHtR, BF%, and Ht) of the participants from the intervention and wait-list control groups at baseline (week 0).
4. To determine the KAP towards dietary and physical activity of the participants from the intervention and wait-list control groups at baseline (week 0).
5. To determine the total physical activity MET-minutes/week and sitting time of the participants from the intervention and wait-list control groups at baseline (week 0).
6. To compare the socio-demographic profile, smoking and vaping, mental health status, and baseline characteristics of study outcomes between the participants from the intervention and wait-list control groups, at baseline (week 0).
7. To evaluate the effectiveness of i-WMP among the participants from the intervention group as compared to the participants from the wait-list control group at baseline (week 0), immediate post-intervention (week 4), and two months post-intervention (week 12), in terms of;
 - a) mean change in anthropometric measurements (BW, BMI, WC, WHtR, and BF%).
 - b) mean change in scores of KAP towards dietary and physical activity.
 - c) mean change in total physical activity MET-minutes/week and sitting time.

1.6 Research hypotheses

1. The i-WMP is effective in:
 - a) reducing BW.
 - b) reducing BMI.
 - c) reducing WC.
 - d) reducing WHtR.
 - e) reducing BF%.
2. The i-WMP is effective in:
 - a) improving the scores of KAP towards dietary.
 - b) improving the scores of KAP towards physical activity.
3. The i-WMP is effective in:
 - a) improving total physical activity MET-minutes/week.
 - b) reducing total sitting time.

1.7 Conceptual framework

Based on the literature search in Chapter 2, the study variables associated with NCD patients with BMI equal to or more than 25 kg/m² were divided into modifiable risk factors and non-modifiable risk factors. The modifiable risk factors were included poor diet; low level of physical activity; mental health status (depression and anxiety); KAP towards dietary and physical activity; smoking and vaping; and medical history (biochemical). Non-modifiable risk factors were included socio-demographic profile (age, gender, ethnicity, religion, marital status, education level, working status, and total monthly household income) and genetics.

Therefore, the conceptual framework was drawn and shown in Figure 1.1. The general objective of this study is to develop, implement, and evaluate the i-WMP among NCD patients in Malaysian government primary care clinics. The primary outcome in this study was the BW, secondary outcomes were including other anthropometric measurements (BMI, WC, WHtR, and BF%), KAP towards dietary and physical activity, total physical activity MET-minutes/week, and total sitting time. The patients' respective baseline outcome variable, gender, ethnicity, age, and total monthly household income were adjusted in the analysis.

The i-WMP was consisted of dietary advice, physical activity, and behavioural intervention. The BCW was used as a theoretical framework to develop the intervention programme for this study, which drawing on the BCTs (Michie, Ashford, et al., 2011; Michie, van Stralen, et al., 2011).

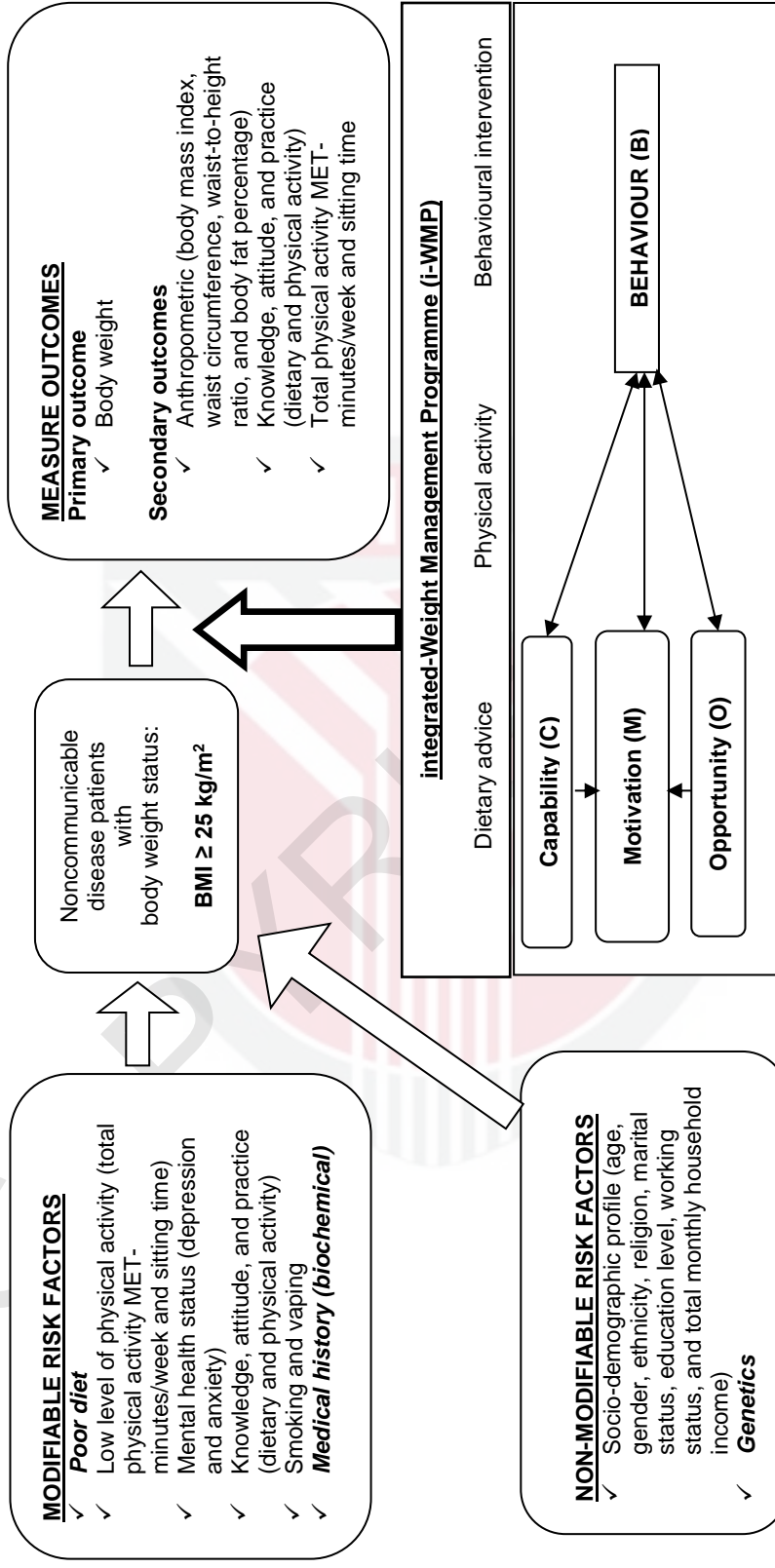


Figure 1.1 : Conceptual framework based on COM-B system theory model

Note : Variables presented in bold and italics were not included in the study

(Source : Michie, van Stralen, et al., 2011)

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