



Effectiveness of a Structured Group-Based Intervention “Know Your Medicine –
Take It For Health” (KYM-TIFH) in Improving Medication Adherence among
Malay Patients with Underlying Type 2 Diabetes Mellitus in the Sarawak State of
Malaysia: A Randomized Controlled Trial

(MedAdh-RCT)

Protocol ID: 35875 (NMRR ID: NMRR-17-925-35875)

(Study Protocol Version 4, Submitted on 7th July 2017)

RESEARCH TEAM MEMBERS

Corresponding Person/Principal Investigator:

*Ting Chuo Yew¹

Principal Investigators at site:

**Abu Hassan Alshaari Bin Abd Jabar², Benodict Apok Anak Talin¹

¹Sarawak Pharmacy Enforcement Division, Sarawak State Health Department

²Sarawak Pharmaceutical Service Division, Sarawak State Health Department

*Corresponding person: Ting Chuo Yew (tingchuoyew@gmail.com)

**Sponsor: Jalan Diplomatik, Off Jalan Bako, 93050 Petra Jaya, Kuching. Sarawak
Pharmaceutical Service Division, Sarawak State Health Department

CHAPTER 1: INTRODUCTION

Overview

This chapter provides important information on the background of this study so that the readers could visualize the potential impact of this study to the extant body of knowledge and practices in improving medication adherence among T2DM patients.

1.1 Medication Adherence

Medication adherence (MA) is defined as the level of patients in complying with the medications prescribed by healthcare providers (Jimmy & Jose 2011; Vrijens et al 2012). There are different interchangeable terms to describe adherence including “poor adherence, inadequate adherence, lack of adherence and nonadherence” (World Health Organization 2003). MA is the most direct and influential factor on the treatment outcome of any patients. A famous quote “Drugs don’t work in patients who don’t take them” had explicitly explained the problem (Brondi et al., 2013). This is particularly true for certain infectious diseases such as Tuberculosis and Human Immunodeficiency Virus, where the outcome of the treatment is highly related to the adherence of patients to the medications prescribed. In other words, MA indicates how much a patient would obtain the benefits from the medications prescribed (Nieuwlaat et al., 2014) when they adhere and how much they would endanger their life when they don’t adhere (DiMatteo et al. 2002; Schiff et al. 2003).

In 2013, World Health Organization (WHO) disclosed a worrying fact that approximately half of patients with chronic diseases do not adhere to their medications prescribed (Sabate 2003) and

the fact was supported by several past studies (Peterson et al. 2003; Bosworth 2012; Haynes et al. 2008). It is estimated more than half of them stop taking medications within a year of their treatment (DiMatteo et al., 2002; Schiff et al., 2003; Vanelli et al., 2009). As such, estimated \$100 billion per year of wastage of healthcare expenditures on medication and treatment of complications due to nonadherence to medications (Osterberg & Blaschke 2005; McDonnell & Jacobs 2002). Hence, an effective intervention that could curb the MA problems, would have a great impact on the overall healthcare system through improving diseases management and reducing the economic burden.

1.2 Problems with MA among T2DM patients

MA problems among T2DM patients had found to be gnarly and devastating (Krass et al 2015). It was estimated that more than half of the patients failed to achieve recommended glycaemic goals due to nonadherence (García-Pérez 2013; WHO 2003). A recent systematic review (Capoccia 2016) summarized factors that contribute to the poor adherence among T2DM patients were age, ethnicity, health beliefs, medication cost, insulin use, health literacy, medication cost, co-pays, medical insurance coverage and primary non-adherence. Furthermore, greater adherence rate was significantly associated with better glycaemic control, less hospital visits and admissions, and lower medical costs. On the other hand, lower adherence rate was significantly associated with poor medication tolerance, frequency of medication intake (> 2 times a day), having concomitant depression and negative belief about the medications. Consequently, patients who poorly adhere to medications would take more medications due to the poor glycaemic control and development of micro- and macrovascular complications (American Diabetes Association 2013b). Such condition would

further worsen their adherence due to more complex medications and greater chance of experiencing drug-related side effects (García-Pérez 2013). This inevitably increase the economic burden and wastage to healthcare services (Meng et al 2017). Hence breaking the vicious cycle is an urgent call to all stakeholders.

1.3 Interventions to improve MA among T2DM patients in Malaysia

Ministry of Health Malaysia (MOH) had initiated several interventions in curbing the MA problems at national level. Two of those which had been perpetuated and led by pharmacists are Medicine Therapy Adherence Clinic (MTAC) in year 2004 and “Know Your Medicine” (KYM) Campaign in year 2007. From the perspective of patient engagement, MTAC is employing one-to-one approach while KYM is using mass communication approach and group based approach or one-to-more approach.

1.3.1 Diabetic MTAC

In Malaysia, MOH had taken an important step in enhancing the diabetic care services provided by governmental healthcare institutes through the launching of Diabetes Resource Centers. Nevertheless, the Pharmaceutical Services Division (PSD) of MOH had launched Medicine Therapy Adherence Clinic (MTAC) in year 2004 to improve the quality, safety and cost-effectiveness of patient care in MOH hospitals and clinics (PSD 2013). The MTAC covers all aspects of medication management such as dosage, adherence, adverse drug events and other drug related problems. To date, up to thirteen (13) MTACs had been formed to target different types of diseases management such as diabetes, anticoagulant, retroviral disease, respiratory, heart failure, stroke, psoriasis, nephrology, rheumatology, hepatitis,

geriatrics, hemophilia and psychiatry (Alrasheedy et al 2017). Furthermore, plenty of studies had been carried out to evaluate the impact of the pharmacist-managed clinic on medication management among patients and the results were encouraging (Alrasheedy et al 2017).

1.3.2 KYM campaign

Apart from the pharmacist-led one-to-one approach with the patients on their medication management, PSD of MOH also launched a national campaign to promote the quality use of medicines through mass communication and group based approach which is called “Know Your Medicine” (KYM) Campaign in year 2007. The campaign utilizes the mass media, social media, exhibitions as well as group based approach to deliver the message to public in Malaysia. The messages conveyed include information on their medication management such as why, how and when to take medicines, reporting adverse drug events, awareness on rational use of medicines and medications that need special precautions. In specific, assuring and improving medication adherence among patients is one of the important component of the campaign (PSD 2008).

In term of improving medication adherence among Malay T2DM patients, a structured group-based intervention (SGBI) called “Know Your Medicine - Take It For Health” with abbreviation KYM-TIGF, was created by the researchers of this study who work at Sarawak Pharmaceutical Services Division in year 2016 under the national “Know Your Medicine” campaign. The KYM-TIGF is a theoretical based, patient empowerment and combination of psychosocial, educational and behavioral intervention. It is a one-off SGBI that aims to improve the medication adherence through the message specially designed to target

psychosocial variables as theorized by Theory of Planned Behaviour (Ajzen 1991) and Information-Motivation-Behavioural Skill Model (Fisher et al. 2006). The psychosocial variables mentioned include attitude to medication adhere, subjective norm to medication adherence, perceived behavioural control towards medication adherence, adherence information, adherence skill and intention to adhere. Moreover, the message design of the intervention is based on a cross-theoretical framework adapted from Slater (1999). The details on the intervention design and contents will be further elaborated in the Chapter three under Research Methodology.

1.4 Problem statements

A current systematic review by Odgers-Jewell et al (2017) revealed that little had been done to investigate the effectiveness of group based education in improving medication adherence among T2DM patients. This concur with the comprehensive review on interventions to improve medication adherence by Conn & Ruppap (2017), as the researchers conclude that there is an urgent need in evaluating the interventions to improve medication adherence that employ group-based approach.

While MTAC had been proven to be effective in improving the MA among T2DM patients (PSD 2013; Conn & Ruppap 2017), the evidence on the effectiveness of the group based educational approach (KYM-TIFH in specific) in promoting medication adherence among T2DM patients remain lacking. Furthermore, the current measurement on the effectiveness of the campaign is the increment of the awareness level of public towards proper use of medicines (NSUM 2008, NSUM 2012) without measuring the impact of the campaign on actual behaviour.

Besides aforementioned, Malay ethnic was found to be the main contributor to the prevalence of poor MA (PSD 2013) due to forgetfulness (75.3%) and reluctant to take prescribed medications (43.8%). Facing the high prevalence of poor MA among Malay patients, an effective and efficient approach which could engage more patients within shorter period of times to improve the medication adherence problems is highly preferred (Odgers-Jewell 2017). Hence, all the problem statements addressed above lead to the necessity of conducting this study, which aims to investigate the effectiveness of the SGBI “KYM-TIFH” in improving MA among Malay patients with T2DM.

CHAPTER 2: LITERATURE REVIEW

Overview

The researchers of this study intend to further address the problem statements mentioned above and to justify the necessity of conducting this study based on two main research questions: (1) Is measuring the effectiveness of the SGBI KYM-TIFH among Malay T2DM patients a necessity? (2) What is the gap on the effectiveness of group-based intervention in improving medication adherence among T2DM patients?

2.1 First research question: Is measuring the effectiveness of the SGBI-TIFH among Malay T2DM patients a necessity?

The researchers aim to justify the necessity and urgency of this study based on three real world evidences: (1) The ever-increasing trend of T2DM patients globally, regionally and locally; (2) The complications of the T2DM and its economic burden; (3) High prevalence of T2DM yet poor MA among Malay patients in Malaysia as well as in Sarawak.

2.1.1 The ever-increasing trend of T2DM patients

Diabetes, an epidemic chronic disease caused either by the failure of the pancreas in producing sufficient insulin (pathology of Type 1 Diabetes Mellitus) or by the failure of the body cells in utilizing the insulin produced by pancreas effectively (pathology of Type 2 Diabetes Mellitus) (WHO, 1999). It remains as a gnarly health issue since the global prevalence of diabetes among adults had increased from 108 million in 1980 to 422 million in 2014 (WHO 2016). While Type 1 Diabetes Mellitus (T1DM) is unpreventable due to

irreversible damage on the pancreas, Type 2 Diabetes Mellitus (T2DM) is preventable and its complications could be minimized through various lifestyle modifications and medication management (NICE 2014). Notably, majority of the diabetes mellitus patients are T2DM patients (95%) and are more prevailing among adults as compared to children (Kanapathy 2015; WHO 2016). Besides aforementioned, there are another two types of diabetes that occupy less of the affected population, namely secondary diabetes and gestational diabetes (NICE 2014).

Zooming into the Asian region, it was revealed that the increment rate of diabetes among low and middle income countries (LMIC) is quicker than the high-income countries. Over the years, LMIC such as China, India, Indonesia, Korea and Thailand, had three to five-fold increase in diabetes patients whereby the HIC like United States of America (USA) had only doubled (Yoon et al 2006; Chen et al 2012). The emerging of Asia as diabetes epicenter has been associated with its rapid urbanization and nutrition transition in the past decades (Chan et al 2009). Among the Asian countries, five countries comprised of China, India, Pakistan, Indonesia and Bangladesh are ranked among top 10 countries that are predicted to have biggest population of diabetes in 2030 (Shaw et al. 2010). In contrast to HIC, LMIC is reported to have higher proportion of young to middle-aged people affected by T2DM (Shaw et al. 2010). Nonetheless, the difference of population with T2DM between rural and urban has been diminishing due to the rapid urbanization, rural to urban migration and change of lifestyle (Chen et al 2012; Chan 2009; Ramachandran 2008).

In Malaysia, there were 3.3 million cases of diabetes in 2015 reported by International Diabetes Federation (2015). On the other hand, a national health and morbidity survey

(NHMS) carried out by Ministry of Health Malaysia (MOH) in year 2015 (IPH 2015), provides contemporary and localized facts on the disease. The survey was conducted on respondents who were above 18 years old by questionnaire and their fasting blood glucose were obtained using CardioChek portable blood test kit. Among 19,935 respondents of the survey, 17.5% (95% CI: 16.6, 18.3) of them were found to have diabetes. In comparison to the results of the first NHMS and second NHMS conducted in year 1986 and 1996 respectively, the recent finding again showed that there is a steady increase in prevalence of diabetes among Malaysian (Samiei et al. 2016). Furthermore, WHO estimates the trending epidemic of the disease would lead to a total of 2.48 million with 164% increment from year 2000 to year 2030. Focusing on the differences of prevalence according to the demographic characteristics, the prevalence of the diabetes according to age group increase from 5.5% (95% CI: 3.9, 7.7) among 18-19 years age group, to a peak of 39.1% (95% CI:33.6, 44.9) among the 70-74 years age group. However, there isn't significant difference between prevalence of diabetes in urban areas (17.7%) with prevalence of diabetes in rural areas (16.7%). In terms of variation between states in Malaysia, Kedah was found to have the highest prevalence of diabetes (25.4% with 95% CI: 21.0, 30.3), followed by Perlis at 20.6% (95% CI: 18.0, 23.5) and Johor at 19.8% (95% CI: 16.8, 23.3). Sarawak was reported to has 14.8% (95% CI: 16.8, 23.3) of diabetic cases and was similar to Sabah (14.2 % with 95% CI: 12.2, 16.4). With regard to the difference of prevalence of diabetes between genders, females were found to be higher (18.3% with 95% CI: 17.2, 19.4) as compared to males (16.7% with 95% CI: 15.7, 17.8) without statistical significance. However, there is significant differences between different ethnic groups. The Indians were found to have the highest prevalence of diabetes (22.1% with 95% CI:19.2, 25.3), followed by the Malays (14.6% with 95% CI:

13.8, 15.5), the Chinese (12.0% with 95% CI:10.7, 13.5) and last with other indigenous groups (10.7% with 95% CI:8.8, 13.0). Even though Indian ethnic was found to have greater percentage of T2DM (22.1% with 95% CI:19.2, 25.3) as compared to Malay ethnic (14.6% with 95% CI: 13.8, 15.5), Malay ethnic still has a higher total number of T2DM patients due to its biggest population size in Malaysia as compared to Indian ethnic which is the third largest ethnic group in Malaysia (Department of Information 2015). Furthermore, Sarawak has less Indian population as compared to other States of Malaysia (Department of Information 2015). The facts above justify the focus of the current study, which Malay T2DM patients in Sarawak are targeted population.

2.1.2 Poor disease management leads to complications and economic burden

T2DM patients who have poor disease management are highly susceptible to complications that could significantly increase their morbidity and mortality. It was estimated that more than 50% patients who failed to achieve recommended glyceic goals were due to non-adherence to the diabetic medications (García-Pérez 2013; WHO 2003). As a result, they would take more medications due to the poor glyceic control and development of micro- and macrovascular complications (American Diabetes Association 2013b).

Nevertheless, patients with T2DM who reside in resources-deprived countries are often suffered from late diagnosis, insidious onset (Azevedo and Alla 2008) and life-threatening complications. Complications that affect T2DM include cardiovascular diseases such as heart disease and stroke (Fox 2010; Hu et al 2012; Goldfine and Fonseca 2014), diabetic retinopathy (Tatti et al 2010; Yau et al. 2012), end stage renal failure (Middleton et al 2004; Brancati et al. 1997), depression (Anderson et al 2001; Egede et al 2002; Ali et al. 2006) and

also significant reduction in patients' life expectancy (Narayan et al 2003; Jonker et al 2006). Among all the complications, cardiovascular diseases are the most prevailing cause of death, accounting for 52% of deaths in T2DM. End stage renal failure accounts for 11% of deaths in T2DM. Whereas in Malaysia, neuropathy was the most common complication (30.1%), followed by retinopathy (23.5%), albuminuria (22.9%) and microalbuminuria (20.4%) (Mafauzy 2006).

The high disease burden of diabetes and its complications has caused immense financial and workforce lost. American Diabetes Association (2013) revealed that a total of 176 billion USD had been spent for the medical cost of diabetes and a total of 69 billion USD lost due to reduced productivity caused by diabetes. Similarly, United Kingdom recorded a total of 23.7 billion pounds spent on the direct and indirect cost of diabetes from 2010 to 2011 (Hex 2012). Whereas in Malaysia, Malaysia government had spent approximately RM 2684.24 for the treatment of every diabetic patients and extra RM 1400 to RM 3200 for diabetic patients who must undergo hemodialysis due to end stage renal failure (The Star Online 2016). In terms of workforce lost, there were 1.5 million of deaths caused by diabetes in 2012 globally (WHO 2016). The healthcare expenditure of Malaysia on diabetic treatment and management was further projected to reach between 1,073,139,000 USD and 1,828,693,000 USD by 2030 (Li et al 2010). Hence, reducing the disease burden of diabetes would significantly reduce the financial and workforce loss.

2.1.3 High prevalence of T2DM yet poor MA among Malay patients

Notwithstanding the fact that Malay ethnic has greatest number of T2DM patients, Malay ethnic was also found to be the main contributor to the prevalence of medication non-adherence (PSD 2013) due to forgetfulness (75.3%) and reluctant to take prescribed medications (43.8%). Hence, all these facts justify the focus of the current study to examine the effectiveness of KYM-TIFH among Malay patients with T2DM who reside in Sarawak. Such investigation would enable the policy makers and authorities to improvise the current strategy in curbing the poor MA among Malay T2DM patients.

2.1.4 Factors contribute to the medication adherence among T2DM patients in Malaysia

Past studies to investigate the factors that influence the MA among Malaysian T2DM patients had revealed several appealing common factors as in Table 1 (Omar & San 2008; Al-Qazaz et al. 2011; Manan et al. 2014). Such findings shed light on the development of intervention that could possibly improve the MA among T2DM patients in Malaysia through addressing the contributing factors. The most commonly found contributing factors were (1) forgetfulness; (2) patient-provider communication and relationship; (3) complex dose regimen and (4) self-medication. These findings concur with what had been reported by Nguyen et al. (2017) and should be proactively addressed by authorities in designing any intervention to improve MA. In term of financial barriers as reported by Al-Qazaz et al. (2011), has less relevant to this study as it focusses on the patients who obtain the supply of medications from public health clinics with subsidization by government.

Table 1: Contributing factors of MA among T2DM patients in Malaysia

Author	Year	Factors hindering medication adherence
Omar & San	2008	<ol style="list-style-type: none"> 1. Patients forget to take medications 2. Careless when taking medications and take wrong dose 3. Elderly patients have significant lower medication adherence 4. Complex dose regimen
Al- Qazaz et al.	2011	<ol style="list-style-type: none"> 1. Financial barriers 2. Forgetfulness 3. Self-medication 4. Relationships with doctor and family members
Manan et al.	2014	<ol style="list-style-type: none"> 1. Patients fear of long-term medication side effects 2. Patients think that doctors over prescribe the medicine and over confidence on the medicines. 3. Lack of communication to achieve concordance state between patients and health care providers led to dissatisfactions among them.

2.2 Second research question: What is the extant gap on the effectiveness of group-based intervention in improving MA?

The gap on the effectiveness of group-based intervention in improving MA are mitigated through literature review on two propositions: (1) the past literatures found the evidence on the effectiveness of group-based intervention remain lacking or contradicting; and (2) the theoretical grounding for the measurement of the KYM-TIFH should be extended for greater predictive and explanatory power.

2.2.1 First proposition: Evidence on the effectiveness of group-based intervention remain lacking or contradicting

A current systematic review by Odgers-Jewell et al (2017) revealed that little had been done on investigating the effectiveness of group based education in improving medication adherence among T2DM patients. This concur with the comprehensive review on interventions to improve medication adherence by Conn & Ruppap (2017), as the researchers conclude that there is an urgent need in evaluating the interventions to improve medication adherence that employ group-based approach.

Notably, the group based educational intervention in promoting self-management among T2DM patients had proven to be effective (Trento 2004; Deakin et al. 2005; Davies et al 2008) and even found to have better results as compared to individual education approach in improving HbA1c, fasting blood glucose, weight, body mass index, waist circumference, blood pressure, blood lipid profiles, diabetes knowledge and self-efficacy (Trento et al 2004; Odgers-Jewell et al 2017). In contrary, a group based education using motivating interview

technique in improving medication adherence among rheumatoid arthritis patients through changing their medication beliefs, had found to be discouraging as no significant difference between intervention group with control group (Zwicker et al 2014). Hence, the effectiveness of the current group based education to improve medication adherence among T2DM patients remain inconclusive and it warrant the necessity of this study.

Zooming into the context of this study, the current evidence on the effectiveness of KYM Campaign rely on the awareness level of proper use of medicines. According to the national survey on use of medicines (NSUM) conducted in year 2008 and 2012 consecutively, results had shown that the baseline awareness level of respondents towards proper use of medicines had increased from 44.4% to 56.6%. Although the increment of awareness level could imply the effectiveness of the KYM Campaign, little evidence had shown its impact on the actual behaviour. Such gap could be supported by the fact that 73.1% of Malaysians forgot to take their medicines and 42.3% of them chose not to take medicines (PSD 2013). Moreover, the gap between awareness level and actual behaviour change was also supported by past study, which found that increment in awareness alone don't lead to actual behaviour change (Hillsdon et al 2001). Thus, a more comprehensive measurement on the effectiveness of KYM-TIFH should be considered. This lead to the next proposition, which researchers propose the use of theories to measure the impact of the SGBI and extend the existing theories to establish theoretical contribution.

2.2.2 Second proposition: Theoretical grounding for the measurement of the SGBI should be extended for greater predictive and explanatory power

The use of behavioural theories in the development and evaluation of health interventions had been widely supported by scholars and health practitioners as they found theory based health interventions have superior effects over non-theory based interventions (Wu et al. 2012; Glanz and Bishop 2010; Painter et al. 2008).

Several theories had been employed in the studies pertinent to medication adherence behavior.

Based on a recent systematic review on theories commonly employed in the study of medication-taking behaviors (Davis et al. 2015), there were four theories namely (1) Information-Motivation-Behavioural Skill Model (Figure 1; Amico et al. 2005; Fisher et al. 2006; Mayberry & Osborn 2014); (2) Trans-theoretical Model (Figure 2; Prochaska and Velicer 1997; Liang and Berger 2006); (3) Social Cognitive Theory (Figure 3; Bandura 2011; Shegog et al. 2012) and (4) Theory of Planned Behaviour (Figure 4; Ajzen 1991; Edwards et al. 2007).

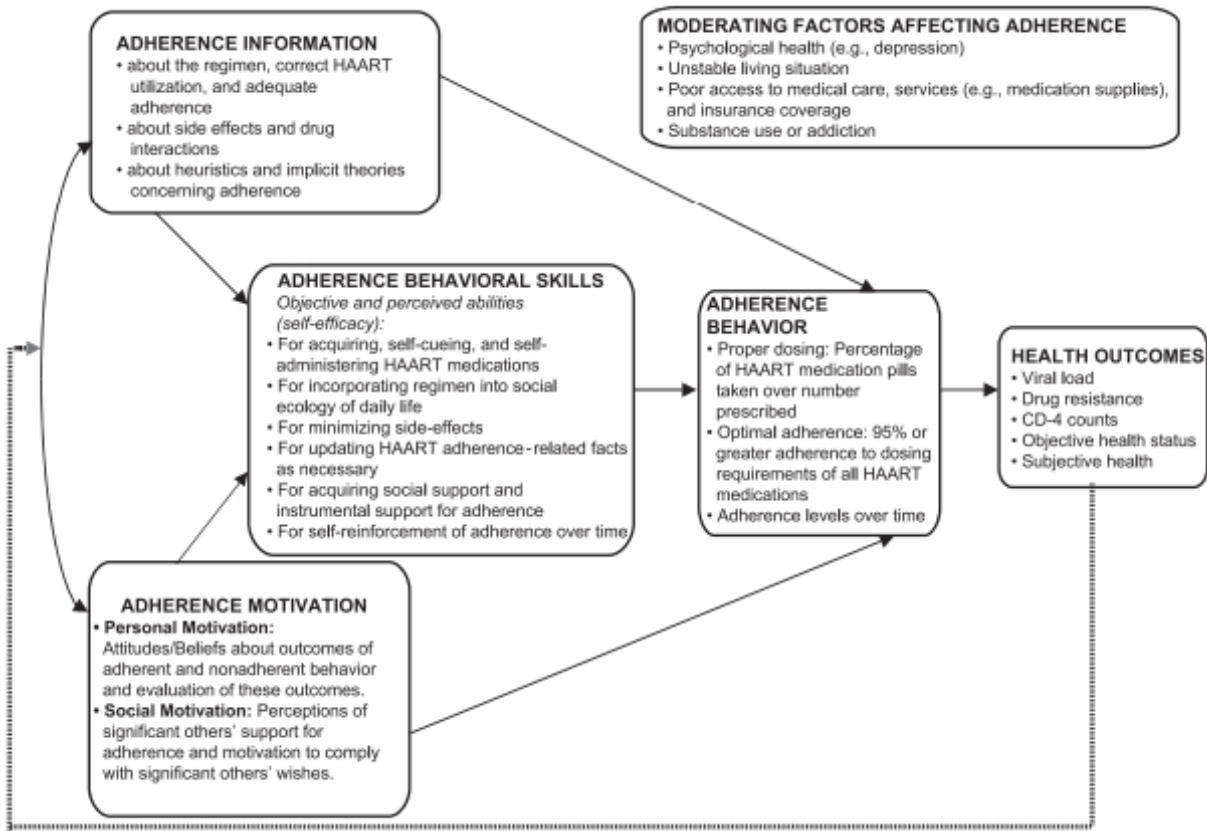


Figure 1: Information-Motivation-Behavioral Skills Model (Amico et al. 2005; Fisher et al. 2006)

Stages of Change in Which Change Processes Are Most Emphasized

	Stages of Change				
	Precontem- plation	Contemplation	Preparation	Action	Maintenance
Processes	Consciousness raising Dramatic relief Environmental reevaluation	Self-reevaluation	Self-liberation	Contingency management Helping relationship Counterconditioning Stimulus control	

Figure 2: Transtheoretical Model of Change (Prochaska and Velicer 1997)

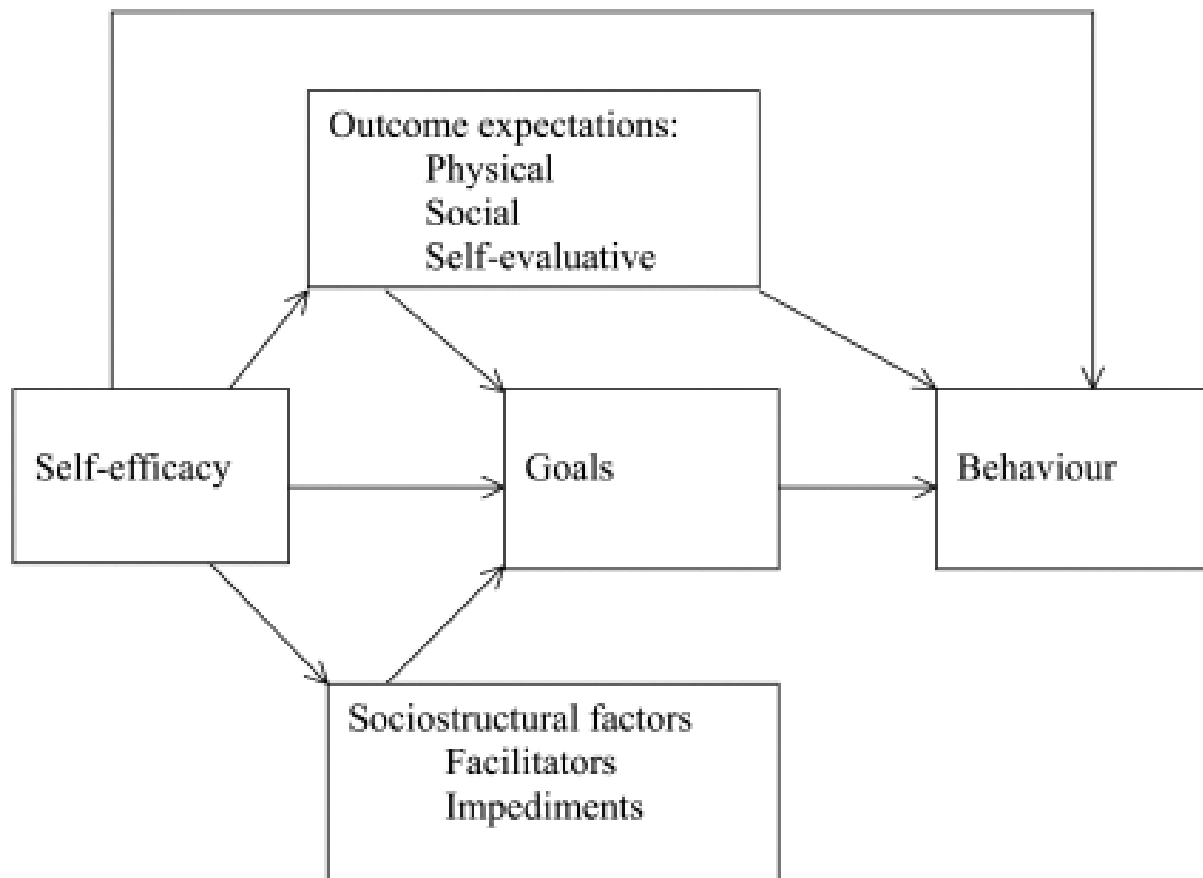


Figure 3: Social Cognitive Theory (Adopted from Luszczynska and Schwarzer 2005; Bandura 1977; Bandura 2011)

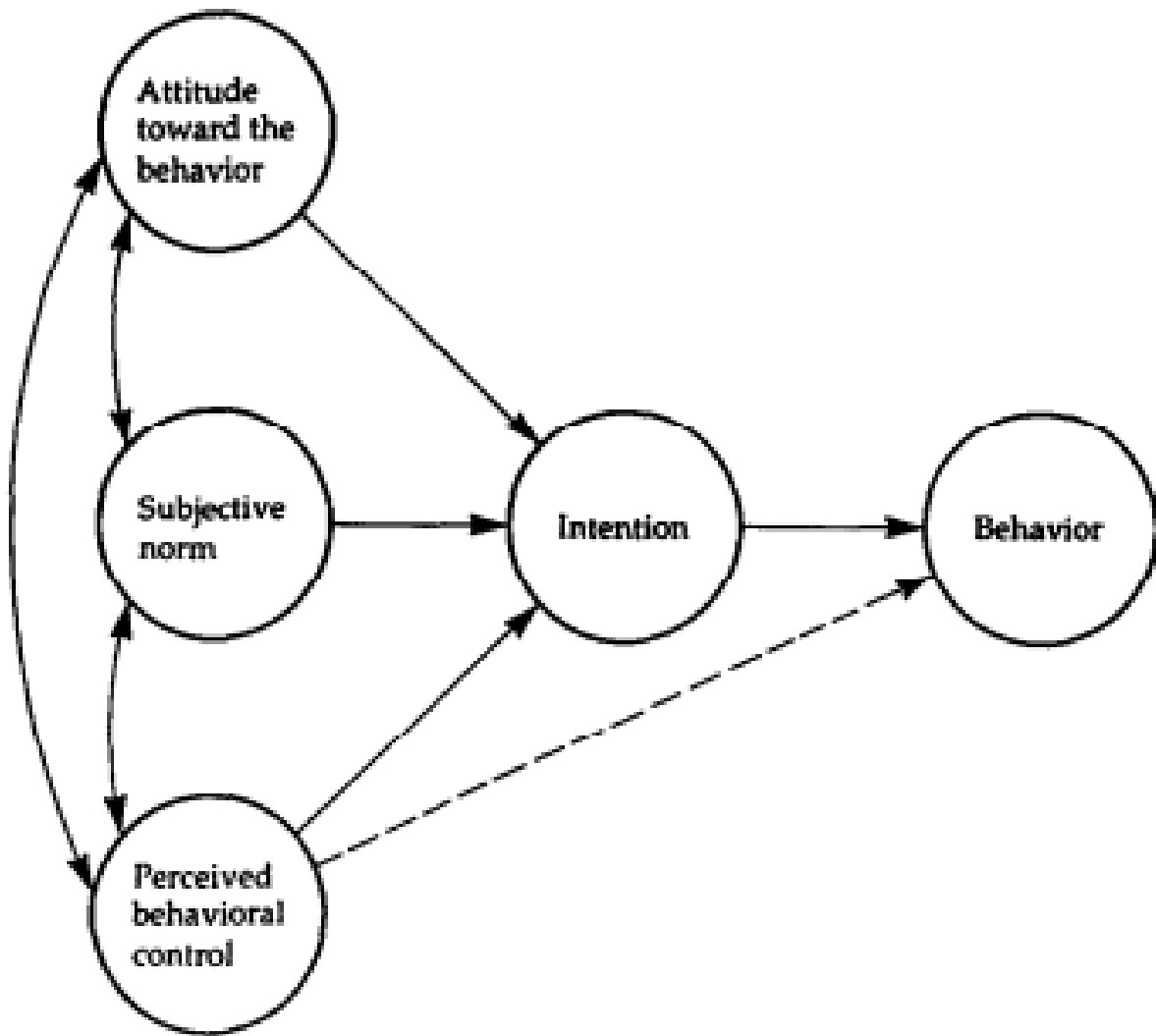


Figure 4: Theory of Planned Behavior (Ajzen 1991)

Among the theories mentioned above, Theory of Planned Behaviour (TPB), Information-Motivation-Behavioral Skill Model (IMB) and Social Cognitive Theory (SCT) employ the cognitive perspective while Transtheoretical Model (TTM) employ stage of change perspective (Munro et al. 2007). Moreover, TPB and TMM had been widely employed in the study of adherence behaviour as compared to IMB, MAM and SCT (DiMatteo et al 2012). In specific, Theory of Planned Behavior (TPB) is chosen as the underlying theory in evaluating the effectiveness of the KYM-TIFH on psychosocial variables because of its established evidence in predicting medication-taking behavior through meta-analysis (DiMatteo 2014). On the other hand, IMB is chosen as supporting theory to extend the TPB as it has been empirically tested on the medication adherence among T2DM patients (Mayberry and Osborn 2014). The integration of both theories in predicting the medication taking behavior is indeed a latest attempt and it aims to extend the extant body of knowledge.

2.2.2.1 Theory of Planned Behavior as underlying theory

TPB is a theory founded in the field of social psychology and is best suited to describe volitional behaviours especially health-related behaviours (Ajzen 1991; Godin and Kok 1996). TPB posits that a behaviour is influenced by attitude towards the behaviour, perceived subjective social norm towards the behaviour and perceived behavioural control towards the behaviour and is mediated by the intention to act. Attitude towards the behaviour is how one evaluate the advantages or disadvantages of performing a behaviour. Subjective social norm is the social expectations of a behaviour perceived by individual. Perceived behavioural control is personal perception about the difficulty and capability to perform a behaviour. Ajzen (1991) further revealed that perceived behavioural control has a direct effect to the behaviour when the a given behaviour having less

volitional control. Perceived behaviour control could reflect both external (such as time and money) and internal factors (such as skill and information), and this is similar to the self-efficacy construct conceptualized by Bandura (1977). Thus, the level of perceived behavioural control of an individual will determine the persistence of a given behaviour over time in the face of obstacles and setbacks. For better illustration of the value of TPB in explaining the behaviour of this study, medication-taking behaviour is influenced by attitude, perceived social norm and perceived behavioural control over the MA and all three factors are mediated by the intention towards MA while perceived behavioural control has also direct effect towards the behaviour. A recent systematic review and meta-analysis on the use of TPB in the studies about adherence will the treatment of chronic illness, further approve the feasibility of the TPB in the current study (Rich et al 2015). The TPB was found to account for 32.92% of the variance in intention and 9.18% of the variance in behaviour and all the relationship between variables were found to be consistent with the original hypotheses of the TPB.

2.2.2.2 Information-Motivation-Behavioral Skill Model as supporting theory

The IMB had been studied extensively among patients affected with Tuberculosis (Munro et al 2007) and HIV (Fisher et al 2006) who acquired to adhere to long-term medication to achieve clinical outcome. It had also been used to study the medication-taking behaviour and self-care behaviour among T2DM patients (Mayberry and Osborn 2014; Meunier et al. 2016).

IMB is a simple and latest behavioural model which have high predictive value on long-term medication adherence (Munro et al. 2007). The IMB posits that to achieve behavioural change, one should have adequate information, motivation and behavioural skills. In the context of MA, firstly a patient should have sufficient knowledge about his/her medical condition and medication.

Secondly, patient needs to be motivated to adhere, which include personal and social motivation. Lastly, one should have appropriate skills to carry out the task. Hence the researchers intend to adapt it as supporting theory for this study by putting adherence information as moderating factor between intention to adhere and actual medication adhering behaviour. Such hypothesis is supported by the fact that adherence information has direct effect on MA as posits by IMB.

2.2 Objectives of the study

This study aims to investigate the effectiveness of the SGBI “KYM-TIFH” in improving MA among Malay patients with underlying T2DM in the Sarawak State of Malaysia. Based on the two main research questions, three specific objectives of this study are:

- 1) to measure the effectiveness of the KYM-TIFH in improving medication adherence among Malay patients with underlying T2DM.
- 2) to test the predictive capacity of the integrated model in explaining the MA among Malay patients with underlying T2DM.
- 3) to measure the impact of the KYM-TIFH on the psychosocial variables of MA.

The conceptual framework that integrates TPB and IMB constructs to measure the effectiveness of the KYM-TIFH is illustrated in Figure 5.

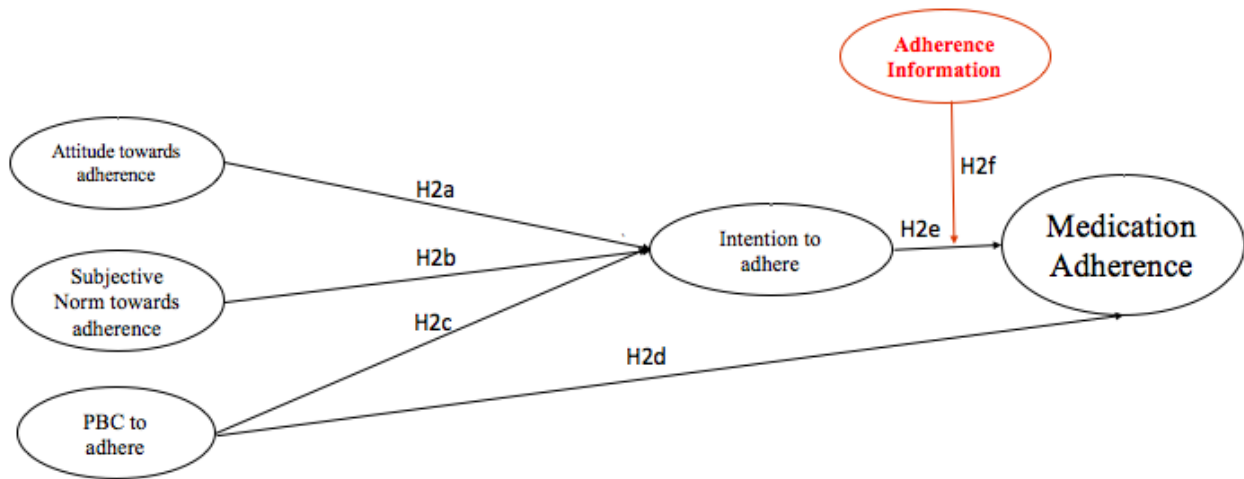


Figure 5: Conceptual framework of the study (TPB constructs are in black colour while IMB construct is in red colour)

2.3 Hypotheses

Based on the first specific objective, two hypotheses to be tested are:

H1a: There is significant difference of medication adherence level among participants before and after the intervention.

H1b: There is significant difference of medication adherence level after the intervention between participants from intervention group and control group.

Based on the second specific objective, six hypotheses to be tested are:

H2a: There is a significant relationship between attitude to adherence and intention to adhere.

H2b: There is a significant relationship between subjective norm to adherence and intention to adhere.

H2c: There is a significant relationship between perceived behavior control to adherence and intention to adhere.

H2d: There is a significant relationship between perceived behavior control to adherence and medication adherence.

H2e: There is a significant relationship between intention to adherence and medication adherence.

H2f: There is a moderating effect by adherence information between intention to adhere and medication adherence.

Based on the third specific objective, five hypotheses to be tested are:

H3a: There is significant difference of attitude to adhere after the intervention between participants from intervention group and control group.

H3b: There is significant difference of subjective norm to adhere after the intervention between participants from intervention group and control group.

H3c: There is significant difference of perceived behavioural control to adhere after the intervention between participants from intervention group and control group.

H3d: There is significant difference of intention to adhere after the intervention between participants from intervention group and control group.

H3e: There is significant difference of adherence information after the intervention between participants from intervention group and control group.

2.4 Operational definitions

(1) Medication adherence: Medication adherence is defined as the level of patients in complying with the medications prescribed by healthcare providers. Such level of compliance is measured through a self-reported scale MALMAS (Chung et al. 2015) which had been validated among T2DM patients in Malaysia.

(2) T2DM Malay patients: Type 2 Diabetes Mellitus Malay patients of this study refers to all the patients who are prescribed with oral anti-hyperglycaemic agents (OHA) and obtain their medications supply from the pharmacy department of KS-HC and PJ-HC during the study period. Such T2DM patients whose identity card show their religion as Islam, will be considered as Malay T2DM patients for this study.

(3) Cluster Randomized Controlled Trial: Cluster Randomized Controlled Trial refers to the study design employed by this study with accordance to the Recommendations for Intervention Trials “SPIRIT” (Chan et al. 2013) and will be reported in accordance to the Consolidated Standards of Reporting Trials (CONSORT) Statements with extension to cluster randomized trials (Campbell et al. 2012).

(4) Structured group based intervention: The structured group based intervention of this study refers to the program “Know Your Medicine – Take it for Health” which was formulated and employed by the Pharmaceutical Services Division of Sarawak State Health Department in late 2016 under the national campaign “Know Your Medicine” to promote medication adherence among T2DM Malay patients. The official name of the intervention is “Kenali Ubat Anda –

Ambillah untuk Kesehatan” in Malay language or “Know Your Medicine – Take it for Health” in English with abbreviation KYM-TIFH.

(5) Effectiveness: The effectiveness of this study refers to the improvement of medication adherence level among T2DM Malay patients before and after the SGBI with such improvement having significant difference as compared to the results in control group. Furthermore, the effectiveness of the SGBI will be complemented by the qualitative data through focus group discussion and semi-structured interview.

(6) Complications: The complications in this study refers to the diabetes-related complications including retinopathy, nephropathy, diabetic foot problems, ischemic heart disease and stroke that had been diagnosed by doctors and were documented in patients’ medical records during the period of study.

Chapter 3: Research Methodology

Overview

This chapter depicts the research paradigm and methodology employed to achieve the three specific objectives of this study. For the first research objective, which is to measure the effectiveness of the KYM-TIFH, positivist approach with experimental study design is best suited. In specific, experimental study with randomized controlled trial (RCT) design is employed as RCT is positioned at higher level of evidence-based medicine pyramid after case studies, case-control and cohort studies (Murad et al. 2016). Nevertheless, the findings from the RCT on the effectiveness of the KYM-TIFH will be triangulated by the findings from subsequent focus group discussion (FGD) and semi-structured interview (SSI) which employ interpretivist or qualitative approach. The aim of the interpretivist approach is to obtain the experience and attitudes of respondents about the KYM-TIFH in a flexible and iterative manner (Berg and Lune 2004; Smith 2002).

For the second objective, which is to test the predictive capacity of the integrated model on medication adherence, positivist approach with cross-sectional analysis is best suited. The point of assessment will be at the end of the trial. For the third objective, which is to test the impact of KYM-TIFH on the psychosocial variables that lead to medication adherence, the positivist approach with prospective analysis to examine how the psychosocial variables change before and after the intervention and cross-sectional analysis to examine whether there is significant difference of the change in psychosocial variables between participants from intervention group and control group.

3.1 Study Design

This study aims to assess the effectiveness of a structured group based intervention specifically KYM-TIFH in improving medication adherence among Malay patients with T2DM. To achieve the objectives, positivist approach with experimental study design will be employed. In specific, it is a non-clinical, multicentre, randomized controlled trial (RCT) with a parallel design and two treatment group.

3.2 Study Population

The studied population will be the entire Malay patients with underlying T2DM. Whereas the targeted population will be the entire Malay patients with underlying T2DM who reside at Petra Jaya, Kuching Division of Sarawak State and Kota Samarahan, Samarahan Division of Sarawak State. Location map of both area is showed in Figure 6.

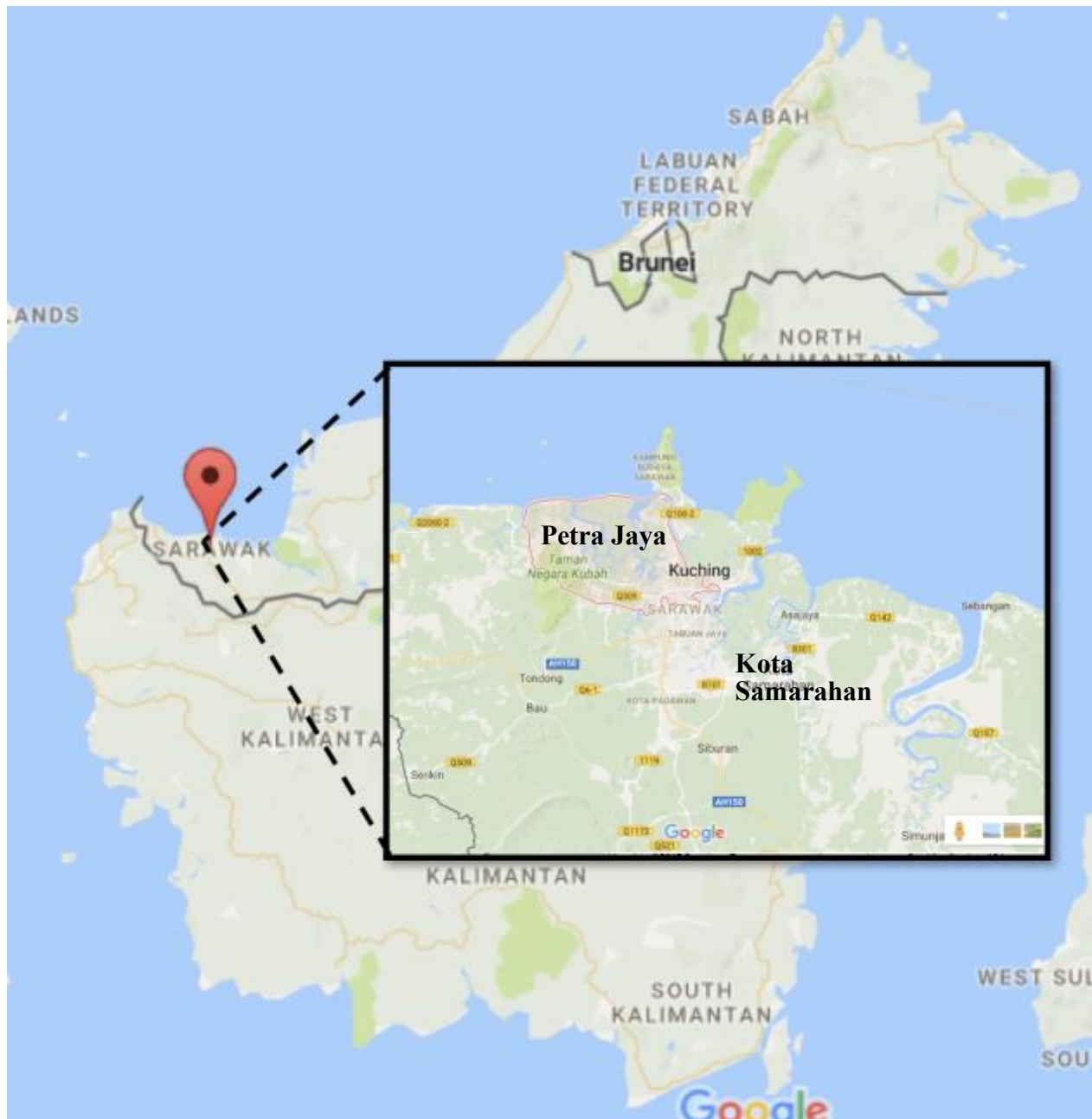


Figure 6: Location map of Petra Jaya and Kota Samarahan

Both divisions are chosen due to their largest proportion of Malay population who reside in the State (DOSM 2011).

3.3 Study setting- the study sites or clusters

The selected study sites that would enable the researchers of this study to engage with the targeted population are Petra Jaya Health Clinic (PJ-HC) and Kota Samarahan Health Clinic (KS-HC) that are funded by Malaysian government. Residents who reside at Petra Jaya and Kota Samarahan are able to access to quality healthcare services at the Health Clinic Petra Jaya (PJ-HC) and Health Clinic Kota Samarahan (KS-HC) respectively. Both clinics have medical specialist, medical officers, pharmacists, nurses and other allied health professionals to run the services such as emergency unit, out-patient unit, maternal & child clinic, pathology unit, X-Ray unit, disabled children development unit, counselling service unit and diabetes unit (Borneo Post Online 2014; Chew et al. 2017). Patients who suffered from T2DM can be diagnosed and get continuous consultations, medications and monitoring of the disease at the clinics. Nevertheless, both clinics will be run by a pharmacist who is specifically trained to run a diabetic MTAC (i.e. DMTAC) who shall also be referred to as a pharmacist in-charge of the DMTAC. He/she shall address any medication-related problems encountered by the patients in order to ensure that they will become adherent towards their complex multiple-medication treatment regimens. Only patients who deemed to have problems with adhering their medications will be referred by doctors to attend DMTAC. However, due to constraint in manpower, each diabetic pharmacist would only able to cater certain number of patients referred. Thus, the KYM-TIFH was designed with an aim to complement rather than competing the existing efforts.

With the aim to recruit suitable participants that could yield highly generalizable data to the studied population, PJ-HC and KS-HC are chosen as the study sites to recruit respondents and collect data. Moreover, the KS-HC had been included as one of the KYM-TIFH campaign site on 17-21 July 2017 while PJ-HC will be on 24-28 July 2017. Thus, the researchers incorporate this

study during the period of KYM-TIFH campaign by obtaining prior approval and financial support from Head of Department of the Sarawak Pharmaceutical Services Division.

3.4 Participants

All the Malay patients with underlying T2DM who get the supply of medications from KS-HC and PJ-HC will be screened for eligibility as participants of this study using a structured screening form (APPENDIX A). The inclusion and exclusion criteria to screen for eligible participants are depicted as below:

3.4.1 Inclusion Criteria

- i. 8 items MALMAS score < 6 (patients with middle and low adherence)
- ii. Malay patients > 18 years old

3.4.2 Exclusion Criteria

- i. Pregnant Women
- ii. Patients less than 18 years old
- iii. Patients who had severe and enduring mental health problems
- iv. Patients who can't listen or read due to inherited disabilities or malfunction
- v. Patients who unable to communicate in Malay language
- vi. Patients who are participating in other study
- vii. Patients who decline the consent to participate
- viii. Hospitalized

3.4.3 Extraneous Variable/ Confounding Variables

Several extraneous variables that would affect the outcome of this study based on literature. A review classified the contributing factors of adhering diabetic medications into five dimensions (Sabaté 2003), namely (1) patient-related, (2) condition-related, (3) socioeconomic, (4) health system-related and (5) therapy-related. Furthermore, a more recent review (Kirkman et al. 2015) on the factors associated with diabetes medication adherence are categorized into (1) patient factors, (2) prescription factors and (3) prescriber factors.

Hence, extraneous variables included in this study will be (1) route of administration, oral only or oral and insulin injection; (2) numbers of medications, one or more than one (Dailey et al 2001); (3) frequency of the medications, a once-daily dose or more frequent (Paes et al 1997); (4) age; (5) gender; (6) highest education level; (7) monthly household income; (8) employment status; (9) having complications; (10) taking traditional complementary and alternative medicines; (11) residential area, urban or rural; (12) living condition, having social support or stay individually; (13) undergone diabetic education by diabetic nurse; (14) enrolled with diabetic MTAC.

3.5 Recruitment

A sampling frame that include all T2DM Malay patients who obtained the supply of the medications from the two study sites (HCKS and HCPJ) for more than three months, is obtained prior to the study. The method of obtaining sampling frame is done through screening all the prescriptions prescribed by the medical specialists, medical officers or health officers from both study sites within the period of 1st February 2017 to 30th April 2017. Information that could be obtained through prescription screening include the diagnosis and medications of the patients, name and age. Malay patients could be identified based on their name, with male having the word

“bin” or “b” and female having the word “binti” or ‘bt’ among their name characters. However, the exact ethnicity of the respondents will be confirmed in subsequent screening. As such, all potential respondents who are Malay T2DM patients will be approached during the screening phase.

After that, approximately one month prior to the actual study which is during 1st – 30th June 2017 (T0 screening), will be the screening phase to identify potential respondents for this study with structured screening form as in Appendix A. An 8-items MALMAS medication adherence scale that had been validated among Malaysian with T2DM (Chung et al. 2015), will be administered to obtain the adherence score which enable the researchers to evaluate the eligibility of the prospective respondents. Patients who are having middle and low medication adherence level (MALMAS score < 6) and fulfill all the inclusion and exclusion criteria will be provided with informed consent and study information sheet (APPENDIX B). Those who agree to participate will be informed about the KYM-TIFH and they will be asked to choose a date during the campaign to attend the program. After they choose the date they prefer, their name will be recorded in the “List of Participants” (APPENDIX C) with a specific code assigned. Notably, patients are not informed of their group assignment and thus are not aware of the differences between intervention group and control group. Besides, none of the recruiters who are the pharmacist staff at both health clinics, are aware of subsequent treatment allocation throughout the recruitment stage, to ensure allocation concealment. All research materials that contain patients’ information will be coded and kept by principal investigator to maintain confidentiality of respondents.

3.6 Randomization and Blinding

The Sarawak Research Society who is independent from this study team will be appointed to carry out the simple randomization. The “List of Participants” will be handed over to the chairman of the Society to carry out the randomization. The randomization will be conducted using online randomization program available at <http://www.graphpad.com/quickcalcs/index.cfm> as recommended by Suresh (2011). After that the participants’ list with their code and group assignment will be kept by the chairman of the Society without informing any of the researchers, facilitators and respondents to assure the blinding of three parties about the treatment allocation. On the day of the intervention, the chairman and the authorized committee member of the Society will register the attendance of respondents and inform them about the actual venue of the program. Each HCKS and HCKS will have two venues prepared and available during the period of the study with one venue allocated for intervention group and the other one allocated for control group. None of the participants will be aware of the difference between the venues assigned while facilitators do. However, participants will be able to know whether they are assigned to control group as there will not be any form of information provided to the participants in control group. Hence, the blinding of participants and facilitators end at the stage of the intervention.

For the blinding of researchers, it will be continued towards the stage of publication. During the post-intervention follow up, the researchers still are blinded on the allocation of participants, as the participant list with group allocation is kept by the chairman of the Society. None of the instruments distributed to the participants will disclose their name and their group assignment to assure the blinding among researchers who do the data analyses. Only after the results of this

study is published, the blinding or the codes will be broken through the return of the participants' list to the principal investigator. The randomization codes will be maintained by the chairman of the Society throughout the study without disclosing it to the researchers or the participants.

No procedure of breaking code is necessary for this study as the intervention of this study is educational and does not involve investigation medicinal product (IMP). Thus, the risk of suspected unexpected serious adverse reaction (SUSAR) or serious adverse event (SAE) would be at minimum or none. However, should any SAE or SUSAR happen during the study, the principal investigator will be reported to the MREC and the physicians of the health clinic to rule out the possibility of such condition is due to this study before proceeding to break code.

Figure 7 shows the flow of participants and randomization throughout the study.

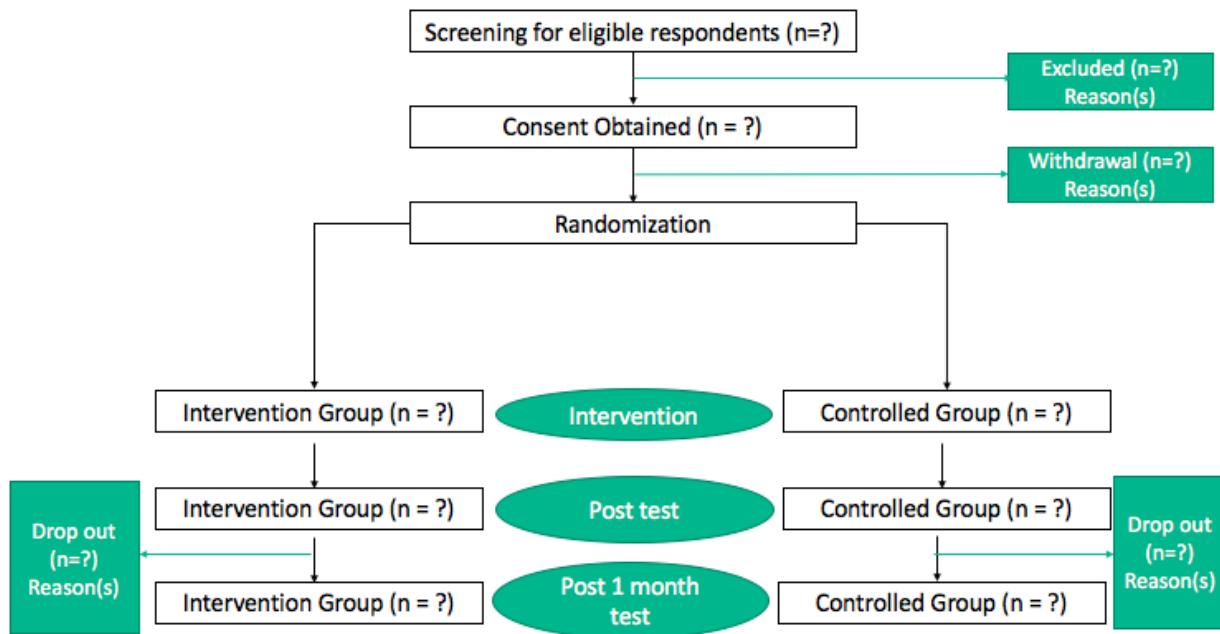


Figure 7: Flow of participants and randomization of this study.

3.7 Sample size

We are planning a study of a continuous response variable from independent control and experimental subjects with 1 control per experimental subject. In a previous study (Butt et al. 2016), the response within each subject group was normally distributed with standard deviation 1.8. If the true difference in the experimental and control means is 1, we will need to study 69 experimental subjects and 69 control subjects to be able to reject the null hypothesis that the population means of the experimental and control groups are equal with probability (power) 0.9 (Dupont and Plummer 1998). By estimating 30% of dropout or incomplete data, a minimum sample size 180 with 90 for both groups are pre-determined for each study sites.

On the other hand, to test the integrated model as mentioned in second objective, with effect size f square equal to 0.15, α error probability equals to 0.05, power equals to 0.95 and total number of predictors equal to 3, total sample size required will be 170 (Faul et al 2009). Assuming 30% of dropout or incomplete data, a minimum sample size 221. As a result, a total minimum sample size of 442 with 221 for both groups are acquired.

3.8 Intervention Design

The KYM-TIFH of this study was formulated and employed by the researchers of this study who work at Pharmaceutical Services Division of Sarawak State Health Department in late 2016 under the national campaign “Know Your Medicine”. It aims to promote medication adherence among T2DM Malay patients due to prevailing nonadherence among them as mentioned earlier. The official name of the intervention is “Kenali Ubat Anda – Ambil demi Kesihatan” in Malay language or “Know Your Medicine – Take it for Health” in English with abbreviation KYM-TIFH. It was specifically designed to complement the individual approach in improving

medication adherence among T2DM Malay patients. This is because group-based intervention can engage more patients at once and serves as building the fundamental capability of patients to adhere with prescribed medications within shorter period as compared to individual approach. Mattson and Hall (2011) advocated that SGBI has numerous irreplaceable benefits that individual approach might not have, including (1) validation; (2) normalization of experience; (3) reduction of isolation; (4) sense of belonging; and (5) enhanced self-esteem. The number of participants for each session of the SGBI is fixed between 20 to 24 participants. The SGBI is only conducted for once with three hours (180 minutes) long and facilitated by one main facilitator and three assistant facilitators. The KYM-TIFH nonetheless had considered the barriers towards medication adherence among T2DM patients (as in Table 1) by incorporating several strategies in designing the program.

3.8.1 Intervention mapping and message design

The KYM-TIFH employed psychosocial, educational and behavioral approach. It was designed based on the application of multiple behavior change theories and persuasion theory as recommended by Slater (1999). The cross-theoretical framework for the message design of intervention as recommended by Slater (1999) involved theories such as Transtheoretical Model (TTM) (Prochaska & Velicer 1997), Theory of Reasoned Action (TRA) (Ajzen & Fishbein 1980), Protection Motivation Theory (PMT) (Rogers 1975), Elaboration-Likelihood Model (ELM) (Petty and Cacioppo 1986) and Social Cognitive Theory (SCT) (Bandura 1992) as in Table 2. Nonetheless, the intervention embrace the philosophy of patients' empowerment, which had found to be effective in engaging patients to produce behavioral change among diabetes patients (Anderson 1995; Anderson et al 1995). Hence, the facilitators are trained to employ non-didactic

approach in facilitating the and eliciting the learning among the group members. The intervention mapping as illustrated in Figure 8, depicts the appropriate outcomes for audiences at each stage of change for use in designing campaign objectives following the recommendations by Slater (1999).



Figure 8: Intervention mapping and the outcomes for audiences at each stage of change

Based on the intervention mapping and message design strategies using cross-theoretical approach, the intervention message delivery strategies are depicted in Table 3. After the completion of the program, participants will be asked to fill in the questionnaire with the assistance of four facilitators (APPENDIX D). A briefing on how to answer the questionnaire will be given by main facilitator and all facilitators are allowed to answer any questions raised by respondents related to the questionnaire. However, they are not allowed to answer on behalf of the respondents. After the completion of the questionnaire, they will be informed about the subsequent follow up measurement after one, three and six month. After that, they will be dismissed and having usual care provided by the health clinic as before without any changes.

Table 2: Message design strategies using cross-theoretical framework approach (adopted from Slater 1999)

Pre-contemplation to contemplation	Contemplation to Preparation	Preparation to action	Action to maintenance
SCT: initiate interpersonal discussion on the issue	TRA: address key beliefs on the issue	SCT: modelling necessary skills to act	TRA: Repeat the behavior
ELM: use credible source to address the issue	SCT: further discussion on the issue	ELM: Use reliable and credible facts to persuade the adoption of behaviour	SCT: See how other people act and set an achievable goal
PMT: increase salience of threat on the issue	ELM: use of anecdote or narrative to address the issue and increase the attitude accessibility	TRA: Reinforce appropriate beliefs and increase the motivation to act	ELM: reinforce the importance of adherence by highly credible sources

SCT: Social Cognitive Theory; ELM: Elaboration-Likelihood Model; PMT: Protection Motivation Theory; TRA: Theory of Reasoned Action.

Table 3: Intervention message delivery strategies

Stage of Change	Message delivery strategies	Times Allocated
Pre-contemplation	<p>Increase the salience of the issues and maximize message exposure by displaying four standing banners throughout the program, with wordings and pictures that illustrate four different important messages targeting attitude, subjective norm, perceived behavior control and intention towards medication adherence. The message for attitude is “I take as scientific evidences show it does help”; the message for subjective norm is “I take as people important to me want me to take for health”; the message for perceived behavior control is “I take as I make sure I take no matter how”; the message for intention to adhere is “From now on, I will take it for health”.</p>	Preset
	Answer the questionnaire before intervention begin	15
	<p>Breaking respondents into 4 groups (5-6 persons/group) and assign group leader of each group before the program begin. Main facilitator welcome the participants and introduce of the other facilitators. Group members introduce themselves to one another by telling their name, their residential area, their</p>	10 minutes

	favorite food and how long they had been diagnosed with T2DM and how many types of medications they are taking.	
	Present a 5 minutes' video clip on the prevalence of T2DM, disease burden, medication adherence problems among T2DM patients and last with an introduction on the KYM-TIFH and its objective by Deputy Director in Pharmacy Program of Sarawak State Health Department.	5 minutes
	Using role play by facilitators with power point slides to illustrate the pathology of T2DM disease and how does medicines help in managing the disease.	10 minutes
Contemplation	Group members share their attitude and belief on taking medications through writing it down on a mahjong paper with assistance of facilitators. Only key words are written.	10 minutes
	Facilitators will go through the answers given by respondents and recognize the attitude and belief on medication taking behaviors that are correct and rectify those that are incorrect.	20 minutes
Preparation	Present a 5 minutes' video clip that shows an interview of four T2DM Malay patients on their experience in taking medications especially the reasons that they are not adhering the medications as prescribed and how they overcome it.	5 minutes

Group members are asked to write down all their reasons of nonadherence on mahjong paper with 20 minutes assistance of facilitators and think of a way to tackle it through group discussion. Facilitator will present the suggestions given by respondents and share with all participants.

5 minutes' break for participants. At the same time facilitators will distribute the medications belonged to the participants that had been dispensed by outpatient pharmacy department of HCPJ/HCKS.

Action Explain each types of medications for T2DM, how to differentiate the proprietary name and generic name of medicines, storage of medicines and how to read the label using Power Point slides with active engagement with audiences through asking simple questions. 15 minutes

Main facilitator will brief participants on the use of the medication chart (Appendix E) and they will be asked to write down all the medications they have on the chart with the dosage regimen. Subsequently, they need to identify the types of medications which have problem to adhere and discuss with the group on the method they want to take to improve it. 15 minutes

Simulation of taking medications according to the medication chart using their own medications one by one with observation by facilitators to ensure the correctness. The simulation only acquires the participants to show the medicines they are going to take and tell the quantity and timing they need to 20 minutes

	take the medicines to the group facilitator. Facilitators will be able to evaluate the actual understanding and skill in taking medications of participants and rectify right away. Repeat testing the skill of participants until they can demonstrate correct medication taking skill on all their medications.	
Maintenance	Present a 5 minutes' video clip that show the message delivered by (1) Director of Sarawak State Health Department, (2) Deputy Director in Pharmacy Program of Sarawak State Health Department and (3) Dr in charge of Sarawak Traditional and Complementary Medicine Division about the importance of taking medication as prescribed.	5 minutes
	All participants will be taught on how to set goal using SMART strategy (Langford et al 2007) pertaining to their medication adherence and share with their group members.	15 minutes
	Answer the questionnaire after intervention	15
	Total Time	180 minutes

3.8.2 Content of Control Group

Participants who are assigned to control group, they will be asked to fill in the questionnaire with the assistance of four facilitators (APPENDIX D) right away without any intended input given to participants. A briefing on how to answer the questionnaire will be given by main facilitator and all facilitators are allowed to answer any questions raised by respondents related to the questionnaire. However, they are not allowed to answer on behalf of the respondents. After the completion of the questionnaire, they will be informed about the subsequent follow up measurement after one, three and six month. After that, they will be dismissed and having usual care provided by the health clinic as before without any changes.

3.8.3 Facilitators and training

To conduct the KYM-TIFH, each session will require one (1) main facilitators and three (3) assistant facilitators to facilitate the program. A total of four (4) main facilitators and twelve (2) assistant facilitators to cater two study sites will be involved in the study. Besides, four qualified and trained facilitators are available for backup. As the number of participants for each sessions of the structured group based intervention is fixed between 20 to 24 participants, each facilitator will assist an average of 5-6 participants.

All the facilitators are the pharmacists who serve under the Pharmaceutical Services Division of Sarawak State Health Department. Facilitators who have experience of conducting at least two times of the intervention will be eligible as the facilitators for this study.

To ensure the consistency and correctness of facilitators in conducting the intervention according to the intervention content, three sessions of the interventions prior to the actual study will be

observed and assessed by the researchers on their performance in terms of coverage of all learning topics, consistency in conducting the intervention, communication with participants and responsiveness to participants' concerns using a structured report namely "Facilitator Competency and Inter-Coder Reliability Assessment Report" (APPENDIX F). All the aspects mentioned above are required to achieve 90%-100% in order to qualified as facilitators for this study. Moreover, among the qualified facilitators, facilitators who were trained to conduct Diabetic MTAC will be appointed as main supervisor. This is because the main facilitators need to have sufficient and up-to-date knowledge in addressing any medication-related-problems raised by participants during the KYM-TIFH. Nonetheless, to ensure the consistency and appropriateness in answering the questions related to the negative perceptions on medication, a booklet of frequently asked questions with answers will be provided to each facilitator and also to participants for their future reference (APPENDIX G).

Apart from training the facilitators to be familiar and consistent in conducting the intervention, the training of the facilitators also includes:

(1) learning how to eliminate concerns and questions the patients come across pertinent to medication adherence with mnemonic tool "ADHERE" adopted from Soto (2004).

- **Acknowledgement:** Acknowledge the concerns of patients.
- **Discuss:** Discuss with patients on their concerns.
- **Handle:** Handle concerns of patients promptly.
- **Evaluate:** Assess patients health literacy and identify possible barriers to adherence.
- **Recommend:** Suggest appropriate and feasible solution to the patient.

- Empower: Elicit patients' willingness to adhere with medications for long-term.

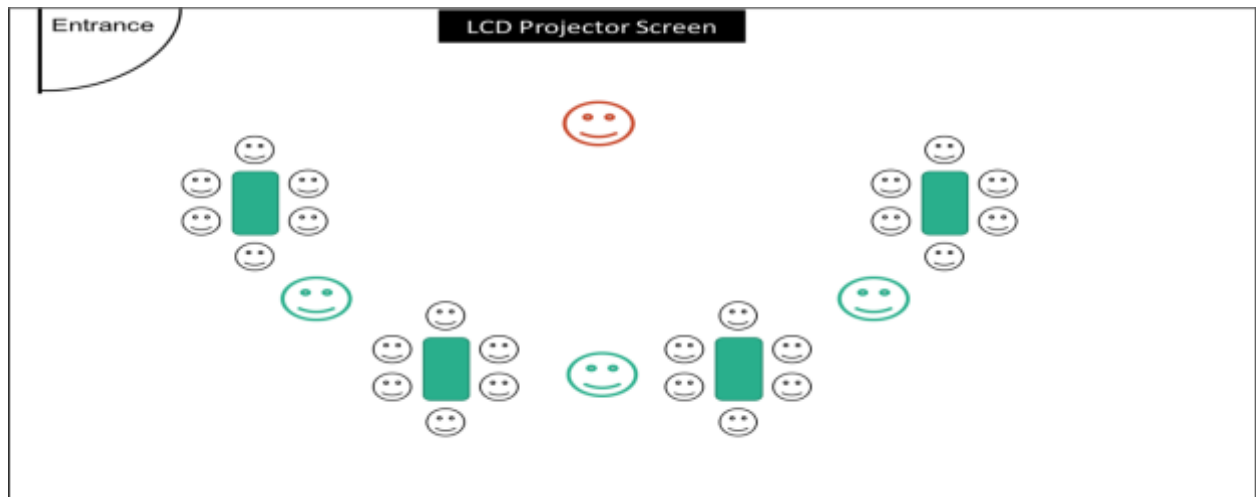
(2) learning what are the Dos and Don'ts when communicating with participants with guidelines provided by Gottlieb (2000):

- Adopt friendly attitude and not business-like attitude
- Avoid medical jargon
- Use short sentences
- Give clear instruction and repeat the instructions
- Give specific and detailed information
- Ensure the patients understand by asking them to repeat what had been said

(3) learning patient-centred communication as advocated by Jones (2004). It encourages the facilitators to be active listener and learn how to encourage the participants to think, understand about the problems about medication adherence they face and decide to act. It also involves nonverbal communication skills such as nodding and making eye contact to show genuine interest and concern on the issues raised by participants.

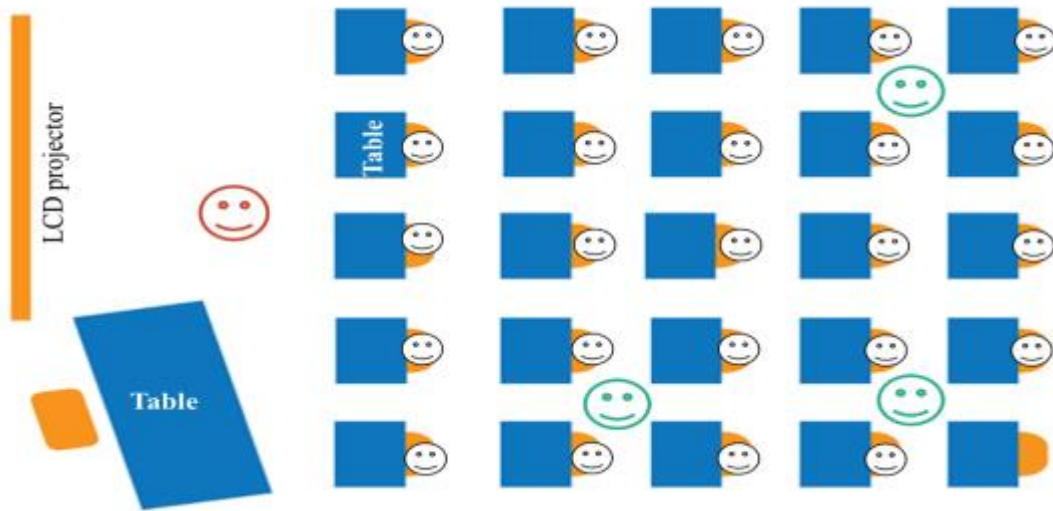
3.8.4 Setting of the venue

The setting of the venue for intervention group will be in 4 mini groups. The participants will be asked to count off from one to four in order to break them into the 4 mini groups, only then the intervention will begin. Besides, the four standing banners that aim to enhance the psychosocial variables towards medication adherence will be displayed. The setting of the venue for intervention group is illustrated in Figure 9 while for control group is illustrated in Figure 10.



☺ = Participant; ☹ = main facilitator; 😊 = assistant facilitator; Green rectangle = table

Figure 9: Setting of the venue for intervention group.



☺ = Participant; ☹ = main facilitator; 😊 = assistant facilitator

Figure 10: Setting of the venue for control group

3.8.5 Study Timeline

The researchers of this study will begin to screen and recruit respondents between 12nd to 23th June 2017. Besides, pre-test on the measurement scales will be conducted prior to actual data collection. The actual intervention will be on 17th to 21st July 2017 for HCKS and on 24th to 28th July 2017 for HCPJ. The post 1 month measurement of actual medication adherence will be carried out on 21st to 25th August 2017 for HCKS respondents and on 28th to 31st August 2017 for HCPJ respondents. The study timeline is illustrated as in Figure 11.

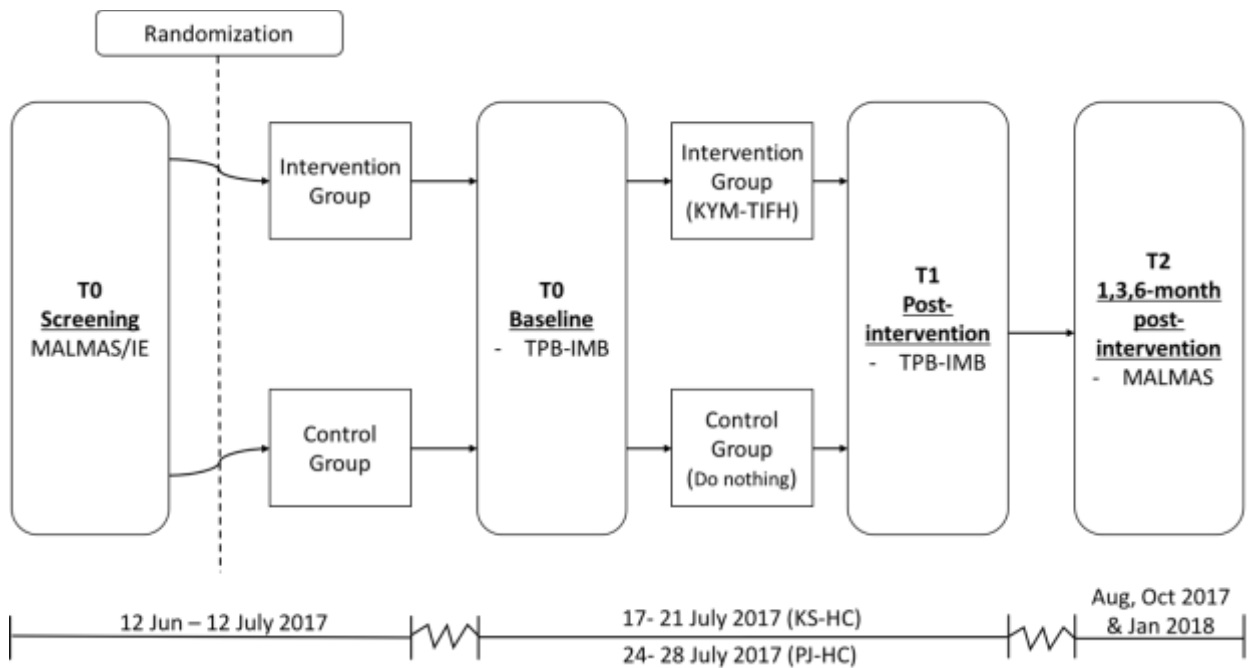


Figure 11: Time of interventions. MALMAS/IE: Medication Adherence Scale plus Inclusion & Exclusion Criteria Screening (Appendix A); TPB-IMB: Scale for Integrated Model of Theory of Planned Behaviour with Information-Motivation-Behavioural Skill Model (Appendix D); KYM-TIFH: “Know Your Medicine- Take if for Health” program; FGD/SI: Focus Group Discussion or Semi-Structured Interview; KS-HC: Kota Samarahan Health Clinic; PJ-HC: Petra Jaya Health Clinic

3.9 Outcome measurement

Primary outcome:

A validated 8-item Malay version of Medication Adherence Scale (MALMAS) will be employed to assess the level of medication adherence among Sarawak patients (Chung et al. 2015). All the items were translated into Bahasa Malaysia and were back translated to English by a group of four experienced language lecturers from University of Malaysia Sarawak.

Secondary outcome:

The psychosocial variables of Theory of Planned Behaviour and adherence information variable from IMB will be employed as secondary outcome of this study. The sources of the items to measure all the variables in conceptual framework are depicted in Table 4.

Paper-based questionnaires will be distributed to the targeted patients by trained enumerators during the group based intervention. Prior to answering the survey, subjects will be briefed about the structure of the questionnaire and how to answer the questions by main facilitator. Any enquiries raised by the respondents will be explained by facilitators.

Table 4: Instrument for the study

Variable	No. of items	Measuring scale	Adopted from
Adherence information	6	5 points Likert scale	McPherson et al. 2008
Attitude to adhere	5	5 points Likert scale	Farmer et al. 2006

Subjective Norm to adhere	6	5 points Likert scale	Farmer et al. 2006
Perceived Behavioural Control to adhere	11	5 points Likert scale	Fernandez et al. 2008
Intention to adhere	3	5 points Likert scale	Vissman et al 2013
Medication adherence	8	1-7 items are measured with binomial answers which are “yes” or “no”; the last item is measured with 5 points Likert scale	Chung et al. 2015
Demographic	15	(1) enrolled with diabetic MTAC; (2) numbers of medications, one or more than one; (3) frequency of the medications, a once-daily dose or more frequent; (4) age; (5) gender; (6) highest education level; (7) monthly household income; (8) employment status; (9) having complications; (10) taking traditional complementary and alternative medicines; (11) residential area, urban or rural; (12) living condition, having social support or stay individually; (13) undergone diabetic education by diabetic nurse; (14) newly diagnosed or established T2DM; (15) concurrent diseases	

3.10 Development of the questionnaire

All the items which are originally in English will be translated into Bahasa Malaysia and were back translated to English by a group of four experienced language lecturers from University of Malaysia Sarawak. Three experts in the field of behavioural studies will be invited to examine the content validity of the BM questionnaire. Furthermore, the translated questionnaire will be pre-tested by three Malay patients with T2DM from Sarawak General Hospital prior to the study. All comments given during pre-test pertinent to the questionnaire design, items and ease of administration will be reported and amendment will be conducted accordingly. The three individuals involved in pre-test would not be included in subsequent pilot and actual study. Subsequently, a pilot study to validate the questionnaire will be conducted by distribute the questionnaire to fifty (50) T2DM Malay patients from Sarawak General Hospital.

3.11 Data Analysis

The data analyses for this study will be comprised of validation of instrument, followed by data analyses to generate results for the three objectives of this study. The software that are essential to carried out the analyses will be IBM SPSS statistics (Version 21, IBM SPSS, Chicago, IL, USA) and SmartPLS 3 (Ringle et al. 2015).

3.11.1 Validation of instrument

Validity of the translated BM version of the instrument will be reported. Content validity will be examined prior to the actual study through three experts' opinion and pre-test. Principle Axis Factor Analysis with Bonferonni test with subsequent Cronbach's Alpha test will be carried out to test the construct validity. Discriminant and convergent validity will be examined using linear discriminant analysis and Pearson correlations respectively.

3.11.2 Data analysis for first objective

The first objective of this study is to measure the effectiveness of the intervention in improving medication adherence. Descriptive statistics will be used to present the results on the level of medication adherence before and after the intervention. Mann-Whitney U test will be used to examine the change of patients between adherent patients (MALMAS > 6) and non-adherent patients (MALMAS < 6) before and after the intervention within same group. In terms of inter-group comparison for the medication adherence level (adherent vs non-adherent) before and after the intervention, Wilcoxon signed-rank will be executed.

3.11.3 Data analysis for second objective

The second objective is to test the predictive capacity of the integrated model. For that, path analysis using Partial Least Square-Structural Equation Model (PLS-SEM) with SmartPLS 3.0 software will be conducted.

3.11.4 Data analysis for third objective

The third objective is to measure the impact of the intervention on psychosocial variables among participants. The change of the psychosocial variables before and after the intervention within the groups will be tested using paired t test. While the change of psychosocial variables before and after the intervention between the groups will be tested using independent t test.

3.13 Treatment Fidelity

Treatment fidelity of the SGBI will be evaluated using the concept and strategies developed by the Treatment Fidelity Workgroup of the National Institutes of Health Behavior Change Consortium (Bellg et al 2004). The framework of treatment fidelity strategies for this study is depicted in Table 5.

Table 5: Framework of treatment fidelity strategies

Components	Goal	Strategies
Study design	<p>Ensure same treatment dose within conditions and equivalent dose across conditions.</p>	<p>(1) SGBI is designed to be completed within 3 hours with allowance of 15 minutes' deviation.</p> <p>(2) The use intervention manual will ensure all facilitators conduct the intervention in a consistent manner.</p> <p>(3) Observation on three sessions of intervention conducted by involved facilitators prior to actual study will be done by researchers to assess the consistency and appropriateness in conducting the intervention. Feedback will be given to the facilitators by observers after the observation. The facilitators will also discuss the issues faced during the intervention with researchers.</p> <p>(4) All facilitators are acquired to adhere with the time allocated for each activity throughout the intervention.</p>
	<p>Plan for implementation setbacks.</p>	<p>Have extra four qualified and trained facilitators in case of unavailability of the involved facilitators.</p>

Provider training	Standardize training.	All the qualified and involved facilitators together with four backup facilitators will be trained together to ensure the consistency in conducting the intervention. Observation on three sessions of intervention conducted by involved facilitators prior to actual study will be able to ensure the actual performance of the involved facilitators.
	Ensure provider skill acquisition.	A scoring scale to assess the qualification and consistency of facilitators in conducting the intervention will be practiced.
	Minimize “drift” in provider skills.	During the actual study, researchers will still observe the intervention conducted by facilitators and will be video recorded to ensure the consistency of intervention. Should researcher observe less than 90% of consistency as compared to training sessions, the reasons that cause the inconsistency will be investigated and reported.
	Accommodate provider differences.	All the facilitators are pharmacists who work in Pharmaceutical Services Division, Sarawak State Health Department. Hence, the facilitators are having similar pattern of knowledge background and are considered expert related to the study.
Treatment delivery	Control for provider differences.	Facilitators having similar background and having same training at the same time

	Reduce differences within treatment.	Scripted intervention protocol is available and used by facilitators
	Ensure adherence to treatment protocol.	During the actual study, researchers will still observe the intervention conducted by facilitators and will be video recorded to ensure the consistency of intervention. Should researcher observe less than 90% of consistency as compared to training sessions, the reasons that cause the inconsistency will be investigated and reported.
	Minimize contamination between conditions	This is a randomization controlled trial with double blinding
Treatment receipt	Ensure participant comprehension.	<p>(1) The participant understanding on the message will be evaluated with the scales developed to measure the impact of the intervention on psychosocial variables of participants. Comparison between the intervention group and control group will show whether the improvement in the psychosocial variables is due to chance or is because of the intervention.</p> <p>(2) Qualitative interview after the intervention will enable the researchers to know how the intervention impact their medication taking behaviour.</p>

	Ensure participant ability to use cognitive skills.	<p>(1) Conduct structured interviews with participants;</p> <p>(2) Facilitators work with participants until they can demonstrate correct medication taking skills.</p> <p>(3) Hypothetical situations that participants may face in real life will be addressed during group discussion and sharing on their reasons of nonadherence and the method that they will adopt to overcome the problem.</p>
	Ensure participant ability to perform behavioural skills.	Facilitators work with participants until they can demonstrate correct medication taking skills.
Enactment of treatment skills	Ensure participant use of cognitive skills.	The use of medication chart prepared by the participants will show how well they comprehend the medication taking skills.
	Ensure participant use of behavioural skills	Medication adherence will be measured after one, three and six months of intervention to ensure the messages conveyed through the intervention are translated into action and such action is maintained.

3.14 Ethical Consideration

All the data are restricted to the principal investigators and solely used for research purposes. Study will be conducted in compliance with ethical principles outlined in the Declaration of Helsinki and Malaysian Good Clinical Practice Guideline. This trial will be registered with Medical Research and Ethics Committee (MREC), National Institutes of Health Malaysia prior to the actual study. Besides, it will be registered with ClinicalTrials.gov following the approval from MREC.

3.15 Informed Consent/Assent Process and Subject Withdrawal

The informed consent forms will be first given and the purpose of the study will be explained to the respondent, in order to obtain the permission to participate in the study. They will be informed that their participation is voluntary and they have full rights to stop or refused to continue the study at any point of the survey. No penalty or benefits would be given once they stopped or completed the study. All the information given is strictly for research purposes and accessible by principle and co-investigators only. Participants will be informed through phone call if there were new information relevant to the consent.

In situation where the researcher found that a participant is no longer eligible or suitable for this study and decide to terminate the participant, or a participant decides to withdraw from this study, the following steps of subject withdrawal will be executed (Education & Magazines 2009).

Firstly, the principal investigator will ask the participant who is withdrawing or terminated, whether the participant intend to provide subsequent follow-up and further data collection after withdrawal or termination from the interventional portion of the study. If the participant agrees to continue with subsequent follow-up and data collection, a new informed consent form for limited participation in this study should be obtained. If the participant doesn't agree to continue with

subsequent follow-up and data collection, no medical records or other confidential records which requiring informed consent will be accessed by any investigator of this study. Meanwhile, only the data collected prior to the participant's withdrawal or termination can be accessed, reviewed and remained as part of the study database. Notably, such data should not be removed and should be included for data analysis to avoid a situation called "informative censoring", which could undermine the validity of this study. Data analysis technique namely intention-to-treat analysis or data imputation will be performed to overcome the withdrawal or termination of the participants. Lastly, the timing and reason of withdrawal or termination of any participant will be reported by the principal investigator.

3.16 Privacy and Confidentiality

The dignity and privacy of the participants is always respected and upheld by the researchers of this study as both are the core elements of research ethics (Guraya 2014; Fisher 2006). Not only the participants will be explained about their rights throughout the study as mentioned above, they also will be informed that they have the right to decide how much information which is required by this study to disclose. Such information includes their physical status, health, social network, thoughts and feelings. Nevertheless, all the participants' names will be kept on a password-protected database and will be linked only with a study identification number for this research. The identification number instead of respondents' identifiers will be used on subject data sheets. All data will be entered into a computer that is password protected. On completion of study, data in the computer will be copied to CDs and the data in the computer will be erased. CDs and any hardcopy data will be stored in a locked office of the investigators and maintained for a minimum of three years after the completion of the study. The CDs and data will be destroyed after that period of storage. Respondents will not be informed about the study's

exaggerated data individually but the findings of this study will be published. Subjects are given access to their personal information and study data.

3.17 Conflict of interest

All the investigators declare that they have no conflict of interest. Notwithstanding, the principal investigator will take the responsibility to report any conflict of interest emerges during the study.

3.18 Publication Policy

No personal information will be disclosed and subjects will not be identified when the findings of the survey are published.

3.19 Gantt Chart

	2017												2018											
Activities/Months	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12			
Literature Search/Review	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Scope/Objective Outlining	X																							
Hypothesis Formulation	X																							
Sampling Design	X																							
Data Collection Protocol Development	X																							
Training of data collectors		X	X																					
Pre-test		X	X																					
Instrument Revise			X	X																				
Main Study Data Collection				X	X	X	X	x	x	x														
Main Study Data Computation					X	X	X	X	X	x														
Main Study Data Analysis								X	X	x	X													
Main Study Data Interpretation								X	X	x	x	X												
First Draft													x	X	X									
Second Draft																X	X	X						
Final Report																			x	x	X			

3.20 Budget

- i. Printing cost = RM 2500
- ii. Standing Banners with colour printing = RM 1500
- iii. Video taking and editing cost = RM 2000

TOTAL = RM 6,000

All expenses will be borne by State Health Department using existing Operating Fund.

References

- Ajzen I. The theory of planned behavior. *Organizational behavior and human decision processes*. 1991 Dec 1;50(2):179-211.
- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood, NJ: Prentice-Hall.
- Al-Qazaz HK, Sulaiman SA, Hassali MA, Shafie AA, Sundram S, Al-Nuri R, Saleem F. Diabetes knowledge, medication adherence and glycemic control among patients with type 2 diabetes. *International journal of clinical pharmacy*. 2011 Dec 1;33(6):1028-35.
- Ali, S., Stone, M. A., Peters, J. L., Davies, M. J., & Khunti, K. (2006). The prevalence of comorbid depression in adults with Type 2 diabetes: a systematic review and meta-analysis. *Diabetic Medicine*, 23(11), 1165-1173.
- Alrasheedy AA, et al. Pharmacist-managed medication therapy adherence clinics: The Malaysian experience, *Research in Social and Administrative Pharmacy* (2017), <http://dx.doi.org/10.1016/j.sapharm.2017.02.011>
- American Diabetes Association. (2013). *The Cost of Diabetes*. Retrieved February 7, 2014 from <http://www.diabetes.org/advocacy/news-events/cost-of-diabetes.html>.
- American Diabetes Association. *Standards of medical care in diabetes: 2013*. *Diabetes Care*. 2013;36(Suppl 1):S11–66.
- Amico KR, Toro-Alfonso J, Fisher JD: An empirical test of the information, motivation and behavioral skills model of antiretroviral therapy adherence. *AIDS care*. 2005, 17:661-673.
- Anderson RM, Funnell MM, Butler PM, Arnold MS, Fitzgerald JT, Feste CC. Patient empowerment. Results of a randomized controlled trial. *Diabetes Care* 1995;18:943-9.

- Anderson RM. Patient empowerment and the traditional medical model. A case of irreconcilable differences? *Diabetes Care* 1995;18:412-5.
- Anderson, R. J., Freedland, K. E., Clouse, R. E., & Lustman, P. J. (2001). The prevalence of comorbid depression in adults with diabetes a meta-analysis. *Diabetes care*, 24(6), 1069-1078.
- Azevedo M, Alla S. Diabetes in sub-saharan Africa: kenya, mali, mozambique, Nigeria, South Africa and zambia. *Int J Diabetes Dev Ctries* 2008 Oct;28(4):101-108.
- Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*. 1977 Mar;84(2):191.
- Bandura A. Social cognitive theory. *Handbook of social psychological theories*. 2011 Aug 31;2012:349-73.
- Bansilal S, Castellano JM, Garrido E, et al. Assessing the impact of medication Adherence on Long- Term Cardiovascular Outcomes. *J Am Coll Cardiol* 2016; 68:789–801.
- Bellg AJ, Borrelli B, Resnick B, Hecht J, Minicucci DS, Ory M, Ogedegbe G, Orwig D, Ernst D, Czajkowski S. Enhancing treatment fidelity in health behavior change studies: best practices and recommendations from the NIH Behavior Change Consortium. *Health Psychology*. 2004 Sep;23(5):443.
- Berg BL, Lune H. *Qualitative research methods for the social sciences*, vol. 5. Boston: Pearson; 2004.
- Bhattacharjee A, Sanford C. Influence processes for information technology acceptance: An elaboration likelihood model. *MIS quarterly*. 2006 Dec 1:805-25.

- Borek, A. J., Abraham, C., Smith, J. R., Greaves, C. J., & Tarrant, M. (2015). A checklist to improve reporting of group-based behaviour-change interventions. *BMC public health*, 15(1), 963.
- Borneo Post Online. Klinik Kesehatan Petra Jaya now operational. April 15, 2014. <http://www.theborneopost.com/2014/04/15/standby-news-13/>. Accessed on 14 April 2017.
- Brancati, F. L., Whelton, P. K., Randall, B. L., Neaton, J. D., Stamler, J., & Klag, M. J. (1997). Risk of end-stage renal disease in diabetes mellitus: a prospective cohort study of men screened for MRFIT. *The Journal of the American Medical Association*, 278(23), 2069-2074.
- Campbell, M. K., Piaggio, G., Elbourne, D. R., & Altman, D. G. (2012). Consort 2010 statement: extension to cluster randomised trials. *Bmj*, 345, e5661.
- Chan, A. W., Tetzlaff, J. M., Gøtzsche, P. C., Altman, D. G., Mann, H., Berlin, J. A., ... & Krleža-Jerić, K. (2013). SPIRIT 2013 explanation and elaboration: guidance for protocols of clinical trials. *Bmj*, 346, e7586.
- Chan, J. C. et al. Diabetes in Asia: epidemiology, risk factors, and pathophysiology. *JAMA* 301, 2129–2140 (2009).
- Chen, B., Zhang, X., Xu, X., Lv, X., Yao, L., Huang, X., Xueying, G., Baozhu, L., Qiang, L., & Cui, C. (2013). Diabetes education improves depressive state in newly diagnosed patients with type 2 diabetes. *Pakistan Journal of Medical Sciences*, 29(5), 1147–1152.
- Chen, L., Magliano, D. J., & Zimmet, P. Z. (2012). The worldwide epidemiology of type 2 diabetes mellitus—present and future perspectives. *Nature Reviews Endocrinology*, 8(4), 228-236.

- Chew BH, Vos RC, Ghazali SS, Shamsuddin NH, Fernandez A, Mukhtar F, Ismail M, Ahad AM, Sundram NN, Ali SZ, Rutten GE. The effectiveness of a value-based EMOTION-cognition-Focused educational programme to reduce diabetes-related distress in Malay adults with Type 2 diabetes (VEMOFIT): study protocol for a cluster randomised controlled trial. *BMC Endocrine Disorders*. 2017 Apr 4;17(1):22.
- Chung WW, Chua SS, Lai PSM, Morisky DE (2015) The Malaysian Medication Adherence Scale (MALMAS): Concurrent Validity Using a Clinical Measure among People with Type 2 Diabetes in Malaysia. *PLoS ONE* 10(4): e0124275. <https://doi.org/10.1371/journal.pone.0124275>.
- Conn VS, Ruppert TM. Medication adherence outcomes of 771 intervention trials: Systematic review and meta-analysis. *Preventive Medicine*. 2017 Mar 16.
- Conn, V.S., Hafdahl, A.R., Cooper, P.S., Ruppert, T.M., Mehr, D.R., Russell, C.L., 2009. Interventions to improve medication adherence among older adults: meta-analysis of adherence outcomes among randomized controlled trials. *Gerontologist* 49:447-62.
- Corcoran, N. (2007) (ed.) *Communicating health. Strategies for health promotion*. London: SAGE Publications.
- Cramer JA. A systematic review of adherence with medications for diabetes. *Diabetes Care* 2004;27:1218–24. doi:10.2337/diacare.27.5.1218
- Currie CJ, Peyrot M, Morgan CL, et al. The impact of treatment noncompliance on mortality in people with type 2 diabetes. *Diabetes Care* 2012;35:1279–84. doi:10.2337/dc11-1277
- Cutrona, S.L., Choudhry, N.K., Stedman, M., Servi, A., Liberman, J.N., Brennan, T., Fischer, M.A., Brookhart, M.A., Shrank, W.H., 2010. Physician effectiveness in interventions to

improve cardiovascular medication adherence: a systematic review. *J. Gen. Intern. Med.* 25:1090-96.

Dailey G, Kim MS, Lian JF. Patient compliance and persistence with antihyperglycemic drug regimens: Evaluation of a Medicaid patient population with type 2 diabetes mellitus. *Clinical Therapeutics*, 2001, 23: 1311 - 1320.

Davies MJ, Heller S, Skinner TC, Campbell MJ, Carey ME, Cradock S, Dallosso HM, Daly H, Doherty Y, Eaton S, Fox C. Effectiveness of the diabetes education and self management for ongoing and newly diagnosed (DESMOND) programme for people with newly diagnosed type 2 diabetes: cluster randomised controlled trial. *Bmj.* 2008 Feb 28;336(7642):491-5.

Davis R, Campbell R, Hildon Z, Hobbs L, Michie S. Theories of behaviour and behaviour change across the social and behavioural sciences: a scoping review. *Health psychology review.* 2015 Aug 7;9(3):323-44.

Deakin TA, McShane CE, Cade JE, Williams R. Group based training for self-management strategies in people with type 2 diabetes mellitus. *Cochrane Database of Systematic Reviews* 2005, Issue 2. Art. No.: CD003417. DOI: 10.1002/14651858.CD003417.pub2.

Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. Part 1: Diagnosis and Classification of Diabetes Mellitus (WHO/NCD/NCS/99.2). Geneva: World Health Organization; 1999

Demonceau, J., Ruppard, T., Kristanto, P., Hughes, D.A., Fargher, E., Kardas, P., De Geest, S., Dobbels, F., Lewek, P., et al., 2013. Identification and assessment of adherence-enhancing interventions in studies assessing medication adherence through electronically compiled drug dosing histories: a systematic literature review and meta-analysis. *Drugs* 73:545-62.

Department of Information, Ministry of Communications and Multimedia. Portal Pusat Maklumat Rakyat. Population by States and Ethnic Group 2015. <http://pmr.penerangan.gov.my/index.php/info-terkini/19463-unjuran-populasi-penduduk-2015.html> (Accessed on 10 May 2017)

Department of Statistics Malaysia. 2010. Population and Housing Census of Malaysia, 2010: Sarawak. https://web.archive.org/web/20141114152728/http://www.statistics.gov.my/portal/download_Population/files/population/04Jadual_PBT_negeri/PBT_Sarawak.pdf (Accessed on 15 April 2017)

DiClemente RJ, Crosby RA, Kegler M, editors. Emerging theories in health promotion practice and research. John Wiley & Sons; 2009 Sep 29.

DiMatteo MR, Haskard-Zolnierok KB, Martin LR. Improving patient adherence: a three-factor model to guide practice. *Health Psychology Review*. 2012 Mar 1;6(1):74-91.

Dubuy V, De Cocker K, De Bourdeaudhuij I, Maes L, Seghers J, Lefevre J, De Martelaer K, Brooke H, Cardon G. Evaluation of a real world intervention using professional football players to promote a healthy diet and physical activity in children and adolescents from a lower socio-economic background: a controlled pretest-posttest design. *BMC Public Health*. 2014 May 16;14(1):457.

Edwards H, Walsh A, Courtney M, et al.: Promoting evidence-based childhood fever management through a peer education programme based on the theory of planned behaviour. *Journal of Clinical Nursing*. 2007, 16:October-1979.

Egede, L. E., Zheng, D., & Simpson, K. (2002). Comorbid depression is associated with increased health care use and expenditures in individuals with diabetes. *Diabetes care*, 25(3), 464-470.

- Eldredge LK, Markham CM, Kok G, Ruiter RA, Parcel GS. Planning health promotion programs: an intervention mapping approach. John Wiley & Sons; 2016 Feb 1.
- Fall, E., Roche, B., Izaute, M., Batisse, M., Tauveron, I., & Chakroun, N. (2013). A brief psychological intervention to improve adherence in type 2 diabetes. *Diabetes & metabolism*, 39(5), 432-438.
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41, 1149-1160.
- Feldman BS, Cohen-Stavi CJ, Leibowitz M, Hoshen MB, Singer SR, Bitterman H, Lieberman N, Balicer RD. Defining the role of medication adherence in poor glycemic control among a general adult population with diabetes. *PloS one*. 2014 Sep 26;9(9):e108145.
- Fisher JF, WA; Amico, KR; Harman, JJ: An Information-Motivation-Behavioral Skills Model of Adherence to Antiretroviral Therapy. *Health Psychology*. 2006, 25:462-473.
- Fox, C. S. (2010). Cardiovascular Disease Risk Factors, Type 2 Diabetes Mellitus, and the Framingham Heart Study. *Trends in Cardiovascular Medicine*, 20(3), 90–95.
- Glanz, K., & Bishop, D. B. (2010). The role of behavioral science theory in development and implementation of public health interventions. *Annual review of public health*, 31, 399-418.
- Glaser BG. The constant comparative method of qualitative analysis. *Social problems*. 1965 Apr 1;12(4):436-45.
- Godin G, Kok G. The theory of planned behavior: a review of its applications to health-related behaviors. *American journal of health promotion*. 1996 Nov;11(2):87-98.

- Goldfine, A. B., & Fonseca, V. (2010). Management of diabetes mellitus in patients with cardiovascular disease in the Bypass Angioplasty Revascularization Investigation 2 Diabetes (BARI 2D) trial. *Circulation*, 121(22), 2447-2449.
- Griffin SJ, Kinmonth A, Veltman MWM, Gillard S, Grant J, Stewart M: Effect on Health-Related Outcomes of Interventions to Alter the Interaction Between Patients and Practitioners: A Systematic Review of Trials. *Ann Fam Med* 2004, 2:595-608.
- Harris R, Noble C, Lowers V. Does information form matter when giving tailored risk information to patients in clinical settings? A review of patients' preferences and responses. *Patient preference and adherence*. 2017;11:389.
- Harvey JN. Psychosocial interventions for the diabetic patient. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*. 2015;8:29-43. doi:10.2147/DMSO.S44352.
- Haynes RB, Ackloo E, Sahota N, McDonald HP, Yao X. Interventions for enhancing medication adherence. *Cochrane database syst Rev*. 2008 Jan 1;2(2).
- Health Development Agency. The effectiveness of Public Health Campaign. www.hda.nhs.uk ISBN 1-84279-283-0. Accessed on April 9, 2017.
- Henseler, J., Ringle, C. M., and Sinkovics, R. R. 2009. The Use of Partial Least Squares Path Modeling in International Marketing. *Advances in International Marketing*, 20: 277-320.
- Hex, N., Bartlett, C., Wright, D., Taylor, M., & Varley, D. (2012). Estimating the current and future costs of Type 1 and Type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs. *Diabetic Medicine*, 29(7), 855-862.
- Hillsdon, M., Cavill, N., Nanchahal, K., Diamond, A. and White, I.R. (2001) National level promotion of physical activity: results from England's ACTIVE for LIFE campaign.

Journal of Epidemiology and Community Health, 55: 755–61.
<http://jech.bmjournals.com/cgi/content/abstract/55/10/755>.

Ho PM, Bryson CL, Rumsfeld JS. Medication adherence: its importance in cardiovascular outcomes. *Circulation* 2009;119:3028–35. doi:10.1161/CIRCULATIONAHA.108.768986

Hu FB, Manson JE, Stampfer MJ, Colditz G, Liu S, Solomon CG, et al. Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. *N Engl J Med* 2001 Sep;345(11):790-797. CDC. Prevalence of overweight and obesity among adults with diagnosed Diabetes United States, 1988-1994 and 1999-2000"Centers for Disease Control and Prevention (CDC) (November 2004) *MMWR. Morbidity and Mortality Weekly Report*; 53(45): 1066-1068.

Hu FB. Globalization of diabetes: the role of diet, lifestyle, and genes. *Diabetes Care* 2011;34:1249–57. doi:10.2337/dc11-0442

Hu, E. A., Pan, A., Malik, V., & Sun, Q. (2012). White rice consumption and risk of type 2 diabetes: meta-analysis and systematic review. *British medical journal*, 344, e1454.

Institute for Public Health (IPH) 2015. National Health and Morbidity Survey 2015 (NHMS 2015). Vol. II: Non-Communicable Diseases, Risk Factors & Other Health Problems; 2015.

International Diabetes Federation. 2015. Malaysia. <http://www.idf.org/membership/wp/malaysia> (Accessed on 18 March 2017)

Jimmy B, Jose J. Patient Medication Adherence: Measures in Daily Practice. *Oman Medical Journal*. 2011;26(3):155-159. doi:10.5001/omj.2011.38.

Johnson MJ. The Medication Adherence Model: a guide for assessing medication taking. *Research and theory for nursing practice*. 2002 Jul 1;16(3):179-92.

- Jones S. Putting the person into person-centered and immediate emotional support emotional change and perceived helper competence as outcomes of comforting in helping situations. *Communication Research*. 2004 Jun 1;31(3):338-60.
- Jonker, J. T., De Laet, C., Franco, O. H., Peeters, A., Mackenbach, J., & Nusselder, W. J. (2006). Physical activity and life expectancy with and without diabetes life table analysis of the Framingham heart study. *Diabetes Care*, 29(1), 38-43.
- Kanapathy, J. (2015). Illness perception of Type 2 Diabetic patients in Malaysia (Doctoral dissertation, City University London).
- Kirkman MS, Rowan-Martin MT, Levin R, et al. Determinants of Adherence to Diabetes Medications: Findings From a Large Pharmacy Claims Database. *Diabetes Care*. 2015;38(4):604-609. doi:10.2337/dc14-2098.
- Kronish IM, Moise N. In Search of a “Magic Pill” for Medication Nonadherence. *JAMA Internal Medicine*. 2017 Feb 27.
- Langford, A. T., Sawyer, D. R., Gioimo, S., Brownson, C. A., & O'Toole, M. L. (2007). Patient-centered goal setting as a tool to improve diabetes self-management. *The Diabetes Educator*, 33(Supplement 6), 139S-144S.
- Lehmann, A., Aslani, P., Ahmed, R., Celio, J., Gauchet, A., Bedouch, P., Bugnon, O., Allenet, B., Schneider, M.P., 2014. Assessing medication adherence: options to consider. *Int. J. Clin. Pharm.-Net* 36:55-69
- Leventhal, H. (1993). Theories of compliance and turning necessities into preferences: Application to adolescent health action. In N. A. Krasnegor, L. Epstein, S. Bennett-Johnson, & S. J. Yaffe (Eds.), *Development aspects of health compliance behavior* (pp. 117-138). Hillsdale, NJ: Lawrence Erlbaum Associates.

- Lewin SA, Skea ZC, Entwistle V, Zwarenstein M, Dick J: Interventions for providers to promote a patient-centred approach in clinical consultations. *Cochrane Database Syst Rev* 2001, 4:CD003267.
- Li CY. Persuasive messages on information system acceptance: A theoretical extension of elaboration likelihood model and social influence theory. *Computers in Human Behavior*. 2013 Jan 31;29(1):264-75.
- Li, R., Zhang, P., Barker, L. E., Chowdhury, F. M., & Zhang, X. (2010). Cost-effectiveness of interventions to prevent and control diabetes mellitus: a systematic review. *Diabetes care*, 33(8), 1872-1894.
- Liang H, Xue Y, Berger BA. Web-based intervention support system for health promotion. *Decision Support Systems*. 2006 Oct 31;42(1):435-49.
- Lowry PB, Moody G, Vance A, Jensen M, Jenkins J, Wells T. Using an elaboration likelihood approach to better understand the persuasiveness of website privacy assurance cues for online consumers. *Journal of the American Society for Information Science and Technology*. 2012 Apr 1;63(4):755-76.
- Luszczynska A, Schwarzer R. Social cognitive theory. *Predicting health behaviour*. 2005;2:127-69.
- Mafauzy M. Diabetes mellitus in Malaysia. *Med J Malaysia*. 2006;61:4.
- Manan MM, Husin AR, Alkhoshaiban AS, Al-Worafi YM, Ming LC. Interplay between oral hypoglycemic medication adherence and quality of life among elderly type 2 diabetes mellitus patients. *Journal of clinical and diagnostic research: JCDR*. 2014 Dec;8(12):JC05.medication adherence. *Cochrane Db. Syst. Rev.* 2008;(2) CD000011.

- Mattson M, Hall JG. Linking Health Communication with social support. *Junker Shutter stock*. 2011;23(4):22-45.
- Mayberry LS, Osborn CY. Empirical validation of the information–motivation–behavioral skills model of diabetes medication adherence: a framework for intervention. *Diabetes Care*. 2014 May 1;37(5):1246-53.
- Meng J, Casciano R, Lee YC, Stern L, Gulyaev D, Tong L, Kitio-Dschassi B. Effect of Diabetes Treatment-Related Attributes on Costs to Type 2 Diabetes Patients in a Real-World Population. *Journal of Managed Care & Specialty Pharmacy*. 2017 Apr;23(4):446-52.
- Meunier S, Coulombe S, Beaulieu MD, Côté J, Lespérance F, Chiasson JL, Bherer L, Lambert J, Houle J. Longitudinal testing of the Information-Motivation-Behavioral Skills model of self-care among adults with type 2 diabetes. *Patient Education and Counseling*. 2016 Nov 30;99(11):1830-6.
- Minet, L., Møller, S., Vach, W., Wagner, L., & Henriksen, J. E. (2010). Mediating the effect of self-care management intervention in type 2 diabetes: a meta-analysis of 47 randomised controlled trials. *Patient education and counseling*, 80(1), 29-41.
- MOH. 2015. Health Expenditure Report 1997-2013. Malaysia National Health Accounts (MNHA) Unit. Malaysia: Ministry of Health.
- Munro S, Lewin S, Swart T, Volmink J. A review of health behaviour theories: how useful are these for developing interventions to promote long-term medication adherence for TB and HIV/AIDS?. *BMC public health*. 2007 Jun 11;7(1):104.
- Murad, M. H., Asi, N., Alsawas, M., & Alahdab, F. (2016). New evidence pyramid. *Evidence Based Medicine*, 21(4), 125-127.

- Narayan, K. M., Boyle, J. P., Thompson, T. J., Sorensen, S. W., Williamson, D. F. (2003). Lifetime risk for diabetes mellitus in the United States. *Journal of the American Medical Association*, 290, 1884-1890.
- National Institute for Health and Care Excellence. (2014). Depression in adults: The treatment and management of depression in adults. Retrieved February 7, 2017 from <http://www.nice.org.uk/guidance/cg90>.
- National Institute for Health and Clinical Excellence. Dapagliflozin in combination therapy for treating type 2 diabetes: NICE technology appraisals [TA288], 2013. <http://www.nice.org.uk/Guidance/ta288>
- National Institute for Health and Clinical Excellence. NICE guidelines [CG87]—Type 2 diabetes: The management of type 2 diabetes, 2009. <https://www.nice.org.uk/guidance/cg87>
- Nguyen T-P-L, Schuiling-Veninga CCM, Nguyen TBY, Vu T-H, Wright EP, Postma MJ (2017) Adherence to hypertension medication: Quantitative and qualitative investigations in a rural Northern Vietnamese community. *PLoS ONE* 12(2): e0171203. doi:10.1371/journal.pone.0171203
- Noar SM, Harrington NG. Tailored Communications for Health-Related Decision-Making and Behavior Change. In *Handbook of Health Decision Science* 2016 (pp. 251-263). Springer New York.
- Odgers-Jewell K, Ball LE, Kelly JT, Isenring EA, Reidlinger DP, Thomas R. Effectiveness of group-based self-management education for individuals with Type 2 diabetes: a systematic review with meta-analyses and meta-regression. *Diabetic Medicine*. 2017 Mar 1.

- Oggioni, C., Lara, J., Wells, J. C. K., Soroka, K., & Siervo, M. (2014). Shifts in population dietary patterns and physical inactivity as determinants of global trends in the prevalence of diabetes: An ecological analysis. *Nutrition, Metabolism and Cardiovascular Diseases*, 24(10), 1105-1111.
- Olokoba, A. B., Obateru, O. A., & Olokoba, L. B. (2012). Type 2 diabetes mellitus: a review of current trends. *Oman Med J*, 27(4), 269-273.
- Omar MS, San KL. Diabetes knowledge and medication adherence among geriatric patient with type 2 diabetes mellitus. *Malay*. 2014;36:53-4.
- Paes AH, Bakker A, Soe-Agnie CJ. Impact of dosage frequency on patient compliance. *Diabetes Care*, 1997, 20: 1512 - 1517.
- Painter, J. E., Borba, C. P., Hynes, M., Mays, D., & Glanz, K. (2008). The use of theory in health behavior research from 2000 to 2005: a systematic review. *Annals of Behavioral Medicine*, 35(3), 358.
- Petty RE, Cacioppo JT. The elaboration likelihood model of persuasion. In *Communication and persuasion 1986* (pp. 1-24). Springer New York.
- Pharmaceutical Services Division, Ministry of Health Malaysia . Know Your Medicine : Quality Use of Medicine, Compliance. 2008. <http://knowyourmedicine.gov.my/en/quality-use-medicine/quality-use-admmedicine/compliance>. Accessed on 20 March 2017.
- Pharmaceutical Services Division, Ministry of Health Malaysia. A National Survey on the Use of Medicines (NSUM) by Malaysian Consumers 2012.
- Pharmaceutical Services Division, Ministry of Health Malaysia. Drug Utilization in the Treatment of Diabetes Mellitus in the Ministry of Health Facilities. Kuala Lumpur 2013.

- Pharmaceutical Services Division, Ministry of Health Malaysia. Perkhidmatan Medication Therapy Adherence Clinic (MTAC); Available from: <http://www.pharmacy.gov.my/v2/ms/entri/perkhidmatan-medication-therapy-adherenceclinic-mtac.html>. Accessed on 20 March 2017
- Prochaska JO, Velicer WF. The transtheoretical model of health behavior change. *American journal of health promotion*. 1997 Sep;12(1):38-48.
- Puffer, S., Torgerson, D. J., & Watson, J. (2005). Cluster randomized controlled trials. *Journal of evaluation in clinical practice*, 11(5), 479-483.
- Raebel MA, Schmittiel J, Karter AJ, Konieczny JL, Steiner JF. Standardizing terminology and definitions of medication adherence and persistence in research employing electronic databases. *Med Care*. 2013 Aug;51(8 Suppl 3):S11-21
- Ramachandran, A., Mary, S., Yamuna, A., Murugesan, N. & Snehalatha, C. High prevalence of diabetes and cardiovascular risk factors associated with urbanization in India. *Diabetes Care* 31, 893–898 (2008).
- Rich A, Brandes K, Mullan B, Hagger MS. Theory of planned behavior and adherence in chronic illness: a meta-analysis. *Journal of behavioral medicine*. 2015 Aug 1;38(4):673-88.
- Ried, L. D., & Christensen, D. B. (1988). A psychosocial perspective in the explanation of patients' drug-taking behavior. *Social Science and Medicine*, 27, 277–285.
- Ringle, Christian M., Wende, Sven, & Becker, Jan-Michael. (2015). *SmartPLS 3*. Bönningstedt: SmartPLS. Retrieved from <http://www.smartpls.com>
- Ripsin CM, Kang H, Urban RJ. Management of blood glucose in type 2 diabetes mellitus. *Am Fam Physician* 2009 Jan;79(1):29-36.

- Risso-Gill, I., Balabanova, D., Majid, F., Ng, K. K., Yusoff, K., Mustapha, F.,... & McKee, M. (2015). Understanding the modifiable health systems barriers to hypertension management in Malaysia: a multi-method health systems appraisal approach. *BMC Health Services Research*, 15(1), 254 (<http://www.biomedcentral.com/1472-6963/15/254>)
- Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *The journal of psychology*, 91(1), 93-114.
- Rosenstock, I. M. (1974a). Historical origins of the health belief model. *Health Education Monographs*, 2(4), 328-335.
- Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education Quarterly*, 15(2), 175-183.
- Ross E, Deverell A: Psychosocial approaches to health, illness and disability: A reader for health care professionals Pretoria: Van Schaik; 2004.
- Samiei, V., Wan Puteh, S. E., Abdul Manaf, M. R., Abdul Latip, K., & Ismail, A. (2016). Are Malaysian Diabetic Patients Ready to Use The New Generation of Health Care Service Delivery? A Telehealth Interest Assessment. *The Malaysian Journal of Medical Sciences : MJMS*, 23(2), 44–52.
- Scholten M. Lost and found: the information-processing model of advertising effectiveness. *Journal of Business Research*. 1996 Oct 1;37(2):97-104.
- Sharma M. Theoretical foundations of health education and health promotion. Jones & Bartlett Publishers; 2016 Mar 1.
- Shaw, J. E., Sicree, R. A. & Zimmet, P. Z. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res. Clin. Pract.* 87, 4–14 (2010).

- Shegog R, Markham C, Leonard A, Bui T, Paul M: +CLICK: pilot of a web-based training program to enhance ART adherence among HIV-positive youth. *AIDS care*. 2012, 24:310-318.
- Slater MD. Integrating application of media effects, persuasion, and behavior change theories to communication campaigns: A stages-of-change framework. *Health Communication*. 1999 Oct 1;11(4):335-54.
- Smith F. *Research methods in pharmacy practice*. London: Pharmaceutical Press; 2002.
- Soto-Greene, M., Salas-Lopez, D., Sanchez, J., and Like, R.C. (2004) Antecedents to Effective Treatment of Hypertension in Hispanic Populations. *Clinical Cornerstone*, 6(3), 30-36.
- Strickland JR, Smock N, Casey C, Poor T, Kreuter MW, Evanoff BA. Development of targeted messages to promote smoking cessation among construction trade workers. *Health education research*. 2015 Feb 1;30(1):107-20.
- Tatti, P., Di Mauro, P., Masselli, L., Longobardi, A., & Barber, A. (2010). Prevention of diabetic eye disease: the commonest cause of blindness in individuals younger than 65 years. *Clinical Ophthalmology*, 4, 1291–1298.
- The Star Online. 2016. Hilmi: Alarming increase in diabetes among Malaysians. 8 April 2016. <http://www.thestar.com.my/news/nation/2016/04/08/hilmi-alarming-increase-in-diabetes-among-malaysians/> (Accessed on 19 March 2016)
- Trento M, Passera P, Borgo E, Tomalino M, Bajardi M, Cavallo F, Porta M. A 5-year randomized controlled study of learning, problem solving ability, and quality of life modifications in people with type 2 diabetes managed by group care. *Diabetes care*. 2004 Mar 1;27(3):670-5.

- Vissman AT, Young AM, Wilkin AM, Rhodes SD. Correlates of HAART adherence among immigrant Latinos in the southeastern United States. *Aids Care*. 2013 Mar 1;25(3):356-63
- Vrijens B, De Geest S, Hughes DA, et al. A new taxonomy for describing and defining adherence to medications. *British Journal of Clinical Pharmacology*. 2012;73(5):691-705. doi:10.1111/j.1365-2125.2012.04167.x.
- Wald DS, Butt S, Bestwick JP. One-way versus two-way text messaging on improving medication adherence: meta-analysis of randomized trials. *The American journal of medicine*. 2015 Oct 31;128(10):1139-e1.
- World Health Organization: Adherence to long-term therapies. Evidence for action. Geneva: World Health Organization; 2003.
- World Health Organization. 2016. Global Report on Diabetes. Geneva: World Health Organization. http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257_eng.pdf. Accessed on 18 March 2017
- Wu, J. R., Corley, D. J., Lennie, T. A., & Moser, D. K. (2012). Effect of a medication-taking behavior feedback Theory-Based intervention on outcomes in patients with heart failure. *Journal of cardiac failure*, 18(1), 1-9.
- Yau, J. W., Rogers, S. L., Kawasaki, R., Lamoureux, E. L., Kowalski, J. W., Bek, T., ... & Wong, T. Y. (2012). Global prevalence and major risk factors of diabetic retinopathy. *Diabetes care*, 35(3):556-564.
- Yoon, K.H., Lee, J.H., Kim, J.W., Cho, J.H., Choi, Y.H., Ko, S.H., Zimmet, P., Son, H.Y. (2006). Epidemic obesity and type 2 diabetes in Asia. *Lancet* , 368, 1681–1688.

Zhao F, Suhonen R, Koskinen S, Leino-Kilpi H. Theory-based self-management educational interventions on patients with type 2 diabetes: a systematic review and meta-analysis of randomized controlled trials. *Journal of advanced nursing*. 2016 Sep 1.

Zwikker HE, van den Ende CH, van Lankveld WG, den Broeder AA, van den Hoogen FH, van de Mosselaar B, van Dulmen S, van den Bemt BJ. Effectiveness of a group-based intervention to change medication beliefs and improve medication adherence in patients with rheumatoid arthritis: a randomized controlled trial. *Patient Education and Counseling*. 2014 Mar 31;94(3):356-61.