ORIGINAL ARTICLE

Effectiveness of a Theory-Based Intervention to Improve Postpartum Type-2 Diabetes Mellitus Screening Uptake Among Women with Gestational Diabetes Mellitus in Malaysia: A Prospective Quasi-Experimental Study

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ABSTRACT

Introduction: Despite the importance of postpartum type-2 diabetes mellitus (T2DM) screening to ensure early detection and effective management of T2DM among women previously diagnosed with gestational diabetes mellitus, low uptake has been reported. In view of the proven effectiveness of theory-based interventions, this study aimed to evaluate the effectiveness of Information Motivation Behavioural Skills (IMB)-based intervention to improve postpartum T2DM screening uptake among pregnant women with GDM in Negeri Sembilan, Malaysia. **Methods:** A prospective quasi-experimental study was carried out among comparable respondents in the intervention and control groups, involving 61 and 55 respondents respectively. Validated and reliable self-administered questionnaire was used to measure pre- and post-intervention of knowledge, attitude and self-efficacy, based on the constructs of the IMB model, with postpartum T2DM screening uptake measured at 6-week postpartum. **Results:** The IMB-based intervention was effectively improved knowledge on gestational diabetes mellitus (GDM), and attitude as well as self-efficacy related to the screening, with significant difference in the 6-week postpartum T2DM screening uptake between the intervention and control groups. Between groups comparison revealed significantly higher mean scores for knowledge (η_p^2=0.11), attitude (η_p^2=0.031) and self-efficacy (η_p^2=0.52) in the intervention group compared to the control group, with self-efficacy is showing the largest size effect. **Conclusion:** The IMB-based health intervention had effectively improved the 6-week postpartum T2DM screening among women with GDM in the intervention group, through the significant improvement of knowledge on GDM and attitude as well as self-efficacy related to the screening.
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INTRODUCTION

Postpartum type 2 diabetes mellitus (T2DM) is relatively common in women who have gestational diabetes mellitus (GDM), which is defined as any degree of dysglycaemia that occurs for the first time or is first detected during pregnancy (1). GDM is one of the leading causes of mortality and morbidity for both the mother and the infant (2). The condition is diagnosed through routine prenatal screening among high-risk pregnant women, rather than reported symptoms, when blood glucose values are above normal but still below those diagnostics of diabetes. Women with GDM are at risk of developing T2DM within 5 to 10 years of the index pregnancy (3) and is associated with up to 7-fold increase in the risk of T2DM compared with normoglycemic pregnancies (4-6), with Asian women reported to have more likelihood to develop gestational diabetes (7).

Postpartum screening for T2DM was introduced to assess the postpartum diabetic status of GDM mothers, to ensure early detection and effective management of T2DM. In Malaysia, the screening is conducted at 6-week postpartum to facilitate early detection of pre-diabetes and necessary dietary adjustment and lifestyle modification, to reduce the likelihood of future diabetes (8,9). Despite its importance, poor screening uptake has been reported (10), which among others have been

determined by the mother's knowledge, attitude (11) and self-efficacy (12) related to the screening.

The use of theory-based interventions has been suggested to produce larger and more long-lasting effects compared to those without an explicit basis in theory (13). Information Motivation Behavioural Skills is one of the behavioural theories, reported to effectively promote better health among diabetic patients (14). Based on available evidence on the factors influencing the adherence towards the postpartum T2DM screening, the Information Motivation Behavioural skills Model was found to be appropriate to be applied for this study. However, there has been limited studies on GDM and the 6-week postpartum T2DM screening uptake in general, particularly related to the utilization of IMB-based intervention for discussion and comparison purposes. By employing the IMB model which offers simple clarification for complex health behaviours, this study developed, implemented and evaluated the effectiveness of IMB-based intervention to improve postpartum T2DM screening uptake, by tackling the knowledge on GDM and attitude as well as self-efficacy related to the postpartum screening.

MATERIALS AND METHODS

Study design and eligibility criteria
A two-arm parallel prospective quasi-experimental study design was employed to evaluate the effectiveness of the newly developed IMB-based intervention module, which was delivered among antenatal women with GDM, attended the antenatal check-up at the government health clinics in Seremban, Negeri Sembilan. The overall study was conducted over a period of 18 months between September 2017 and December 2019. Eligibility criteria include Malaysian women aged 18 years old and older, diagnosed with GDM (based on deranged MGTT) and between 24 to 28 weeks gestation during data collection. Those who were clinically unstable or with pre-existing type 1 or 2 diabetes prior to pregnancy were excluded.

Study Instruments
Data was collected using self-administered questionnaire, adapted from several studies related to GDM and postpartum screening (15-19), to measure knowledge on GDM, attitude towards attending 6-week postpartum T2DM screening, self-efficacy towards attending 6-week postpartum T2DM screening and T2DM screening uptake at 6-week postpartum. Face validation was conducted among 15 GDM mothers from health clinic which was not recruited in the study. Meanwhile, the content validity of the questionnaire and intervention module have been assessed by three panels of expert from the field of public health and family medicine, with the mean I-CVI values obtained ranging from 0.95 to 1.0.

Knowledge was measured using 3-point likert scale, with attitude and self-efficacy were measured using 5-point likert scales, which were measured at baseline (24 to 28 weeks of gestation), immediately after intervention and 6-week postpartum. Test-retest reliability revealed good internal consistency with reported Cronbach's alpha values of 0.76, 0.95 and 0.81 for knowledge, attitude and self-efficacy respectively. Meanwhile the postpartum T2DM screening was measured using nominal scale at 6-week post-delivery, based on the attendance of the respondents on the given appointment date by the clinics.

The intervention was developed based on the three constructs of the IMB model; information, motivation and behavioural skills, which were measured as knowledge, attitude and behavioural skills accordingly. The intervention was delivered as health education talk, group discussion and counselling, interactive games and reminders as well as informative brochures and role play scenario, which were divided into three sessions, with a maximum of 20 participants were allocated per session.

Allocation of respondents
This study was employing a multi-stage cluster sampling. Recruitment and enrolment detail of respondents according to the clinics is shown in Fig 1., presented according to the CONSORT statement. Thirty-seven
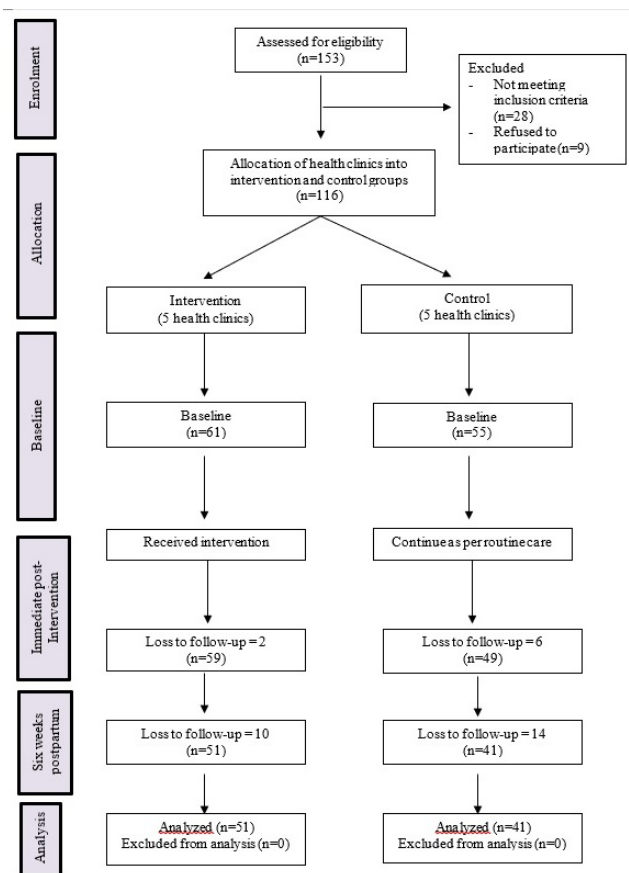
Figure 1: CONSORT Flow Diagram

potential respondents were excluded, with nine refused to participate and 28 were not within the pre-determined gestational week. A total of 10 clinics with pre-identified GDM cases were conveniently allocated equally into intervention (n=61) and control (n=55) groups, with 92.5% participation rate based on estimated sample size of 120 which was calculated using the two proportions formula hypothesis testing by Lwanga and Lemeshow (20), adjusted for 20% attrition rate and 90% eligibility of respondent.

Statistical analysis
Data was analysed using the standard statistical software package (SPSS) version 25, with two-tailed P-values was considered statistically significant at $p < 0.05$. Normality distribution of variables was assessed by the Kolmogorov-Smirnov test. Continuous variables were reported as mean ±standard deviation (SD) or median with interquartile range (IQR). Effectiveness of the intervention was tested using repeated measure ANOVA for knowledge, attitude and self-efficacy with Chi square used to measure postpartum T2DM uptake between the groups.

Trial registration
The trial was registered under the Thai Clinical Trials Registry (TCTR), certified by the World Health Organization, International Clinical Trials Registry Platform (ICTRP) with the TCTR identification number of TCTR20200124001. Registered 24 January 2020 - Retrospectively registered, https://www.thaiclinicaltrials.org/show/TCTR20200124001.

Ethical clearance
The study protocol was approved by the Medical Research Ethics Committee, the National Medical Research Register, Ministry of Health Malaysia (research registration number NMRR-18-2902-42875). Prior to enrolment, the objectives and study protocol were explained to all respondents, and a written informed consent was obtained from them.

RESULTS

The comparison on the 6-week postpartum T2DM screening uptake between the intervention and control groups is illustrated in Table I, with statistically significant difference on the proportion of respondents adhered to the screening observed between the groups ($\chi2 = 3.982$, df=1, P=.046).

The within group comparisons of knowledge, attitude and self-efficacy related to the 6-week postpartum T2DM screening at three-time intervals (baseline, immediately and 6-week post intervention) are shown in Table II (control) and Table III (intervention). Statistically significant mean differences for knowledge, attitude and self-efficacy were only demonstrated in the intervention group (Table III).

Meanwhile, Table IV is showing the between groups comparison, with significantly higher mean scores for knowledge, attitude and self-efficacy were observed in the intervention group. Self-efficacy shows the largest effect (partial eta squared) is observed.

DISCUSSION

The findings of current study support the existing knowledge on theory application in research to stimulate research and the extension of knowledge by providing both direction and impetus. The IMB-based intervention module had significantly improved knowledge on GDM,

Table I : Comparison of uptake towards 6-week postpartum T2DM screening between the intervention and control groups

Variables	Uptake towards 6-week postpartum T2DM screening		$\chi2$	P-value
	Yes n (%)	No n (%)		
Intervention	27 (52.9)	24 (47.1)	3.982	0.046*
Control	14 (34.1)	27 (65.9)		

*Significant at $P<0.05$

Table II: Within control group comparison

	Immediate post-intervention - Baseline		6-week postpartum – Immediate post-intervention		6-week postpartum - Baseline	
	MD (95% CI)	P	MD (95% CI)	P	MD (95% CI)	P
Knowledge	-0.046(-1.908, -1.165)	1.073	0.320(-0.230, 0.871)	0.469	0.274(-0.911, 1.460)	0.989
Attitude	1.217(-0.290, 2.723)	0.153	-0.003(-1.132, 1.127)	0.998	1.214(-0.182, 2.610)	0.108
Self-efficacy	0.226(-0.937, 1.390)	0.986	-0.095(-1.306, 1.117)	0.907	0.132(-1.078, 1.341)	0.877

MD=Mean difference, CI=Confidence Interval, *Significance at $P<0.05$

Table III: Within intervention group comparison

	Immediate post-intervention - Baseline		6-week postpartum – Immediate post-intervention		6-week postpartum - Baseline	
	MD (95% CI)	P	MD (95% CI)	P	MD (95% CI)	P
Knowledge	3.761 (2.879, 4.643)	0.000*	-1.529 (-2.615, -0.444)	0.003*	2.232 (0.991, 3.473)	0.000*
Attitude	4.917 (3.763, 6.071)	0.000*	-1.249 (-2.051, -0.448)	0.001	3.668 (2.248, 5.088)	0.000*
Self-efficacy	2.999 (1.892, 4.107)	0.000*	-1.654 (-2.528, -0.781)	0.000*	1.345 (0.182. 2.509)	0.018

MD=Mean difference, CI=Confidence Interval, *Significance at $P<0.001$

Table IV: Between groups comparison (intervention effect regardless of time point)

	Trial group	Adjusted mean (SD)	MD (95%CI)	F	P	η_p^2
Knowledge	I	11.98 (1.95)	1.60 (0.74,2.45)	13.675	0.000**	0.11
	C	10.39 (2.67)				
Attitude	I	22.24 (1.29)	0.54 (-0.03,1.11)	3.642	0.043*	0.031
	C	21.70 (1.73)				
Self-efficacy	I	20.60 (1.99)	1.08 (0.22,1.93)	6.264	0.014*	0.52
	C	19.51 (2.62)				

I=Intervention, C=Control, SD=Standard deviation, MD=Mean difference, CI=Confidence Interval, *Significant at P<0.05, **Significant at P<0.001= Partial eta square

attitude, self-efficacy related to the 6-week postpartum T2DM screening as well as the postpartum screening uptake.

Significant improvement on the 6-week T2DM postpartum screening uptake was also reported in a cluster randomized controlled trial among Egyptian women, with significantly more women in the intervention group adhered to screening for T2DM at 6 weeks postpartum compared to the control group (21). However, health belief model was utilised, with knowledge as one of the outcomes measured. Apart from knowledge, attitude and self-efficacy related to the screening, the ability to receive optimal follow-up care can be complicated by challenges with healthcare access, fragmented care delivery, and other social determinants of health (6). Women with a history of GDM has persistent risk of developing T2DM for more than 25 years (22), indicating the needs for life-long follow-up.

Having poor knowledge has been linked with many adverse health related outcomes, including poor GDM control and adherence towards the 6-week postpartum T2DM screening. Available evidence showed women with lack of knowledge and information on GDM and the related consequences as well as those that had not received appropriate counselling of future risks of T2DM due to GDM, failed to return for their postpartum follow up (23). Although having better knowledge often linked with better education level, a related study conducted among Turkish women reported those with lower educational level were more likely to adhere to the screening (15). However, according to Wasalathanthri (16), having the knowledge on risk to develop diabetes among women with GDM did not motivate them for proper action, if a low level of awareness remains, which does not only justify the need to effectively intervene awareness through health education and counselling programs, but also to tackle intermediate factors such as attitude and self-efficacy as proposed by the IMB model.

Attitude is one of the most important and frequently linked factors with behaviour, including self-management behaviours of women with GDM. The concepts in behavioural theories have been used in the development of numerous interventions aiming to change behaviour. The valid use of IMB model on diabetes self-care was demonstrated by Osborn and Egede (11), who concluded that having more information (more diabetes knowledge), personal motivation (less fatalistic attitudes), and social motivation (more social support) was associated with behaviour; and behaviour was the sole predictor of glycaemic control. Theory of planned behaviour was among other theories which was proven to be effective to improve attitude related to diabetes management (17). According to the theory, a behaviour intention (i.e., thinking about engaging in a behaviour) is generated from an attitude towards the related behaviour, which commonly refers to the positive or negative evaluations of performing the desired behaviour (17). Similarly, in another study assessing self-management behaviour among Iranian women with T2DM, an educational intervention based on the extended theory of reasoned action led to significant improvements in attitudes toward the practice of self-care behaviours among diabetic women (18).

Current study also demonstrated the largest impact of the IMB-based intervention on self-efficacy. Self-efficacy refers to one's perceived ability to behave in such a manner to exert a desired effect (self-efficacy beliefs), which greatly affects subsequent health behaviour (19). The largest impact of the intervention on self-efficacy maybe related to the use of role play scenario as well as the impact of improved knowledge and attitude. In a pilot study testing the feasibility of an educational intervention in women with GDM reported that self-efficacy was the only significant predictor for adopting healthy lifestyle behaviours for GDM mothers (24). Self-efficacy has been included in most of the theory-based interventions related to improving T2DM treatment adherence included in a systematic review and was identified as the most effective element, with IMB was one of the theories used in the included articles (12). In a systematic review, Somayeh et al. (25) had identified four theories appeared to be more effective to target behaviour change related to diabetes self-care training, which were social support theory and the combination of empowerment theory and health belief model, social cognitive theory and self-efficacy theory.

This study adds evidence on the effectiveness of theory-based intervention module in general, particularly the utilization of IMB model to improve 6-week postpartum T2DM screening. The effectiveness of the intervention module was complemented by the diverse intervention delivery approaches involving health talk, group

discussion and counselling, interactive games, and reminders as well as informative brochures and role play scenario. To increase comparability and generalization of findings, a randomized controlled trial is preferable as the golden standard for evaluation because it enables a robust and clean evaluation of how effective a new intervention is, as well as a more generalized findings are produced.

CONCLUSION

This study has expanded the effective application of IMB model in the intervention involving chronic disease rather than communicable disease as previously reported. The effectiveness of the newly developed module is reflected by the increased in the 6-week postpartum T2DM screening among women with GDM in the intervention group, which is believed related to the significant improvement of knowledge on GDM and attitude as well as self-efficacy related to the screening. The largest effect demonstrated on self-efficacy is potentially contributed by the improved knowledge and attitude, as well as the use of role play scenario to target the self-efficacy of the respondents. Future consideration to utilise potential behavioural model or theory in health-related intervention is necessary to ensure effective change of health-related behaviour.

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