IMPROVING HbA1c CONTROL AMONG NEWLY INITIATED INSULIN TYPE II DIABETES MELLITUS PATIENTS IN *KLINIK KESIHATAN KELANA JAYA*

Chong Yee Theng[1], Lim Sue Yee[2], Nik Mazlina Mohammad[3], Rupinder Kaur Hardyal Singh[1], Lim Ying Jun[1], Goh Chong Yong[1].

[1] Kelana Jaya Health Clinic, Selangor State Health Department, Ministry of Health Malaysia

[2] Kuala Lumpur Health Clinic, Kuala Lumpur and Putrajaya Federal Territory Health Department, Ministry of Health Malaysia

[3] Putrajaya Presint 18 Health Clinic, Kuala Lumpur and Putrajaya Federal Territory Health Department, Ministry of Health Malaysia

Corresponding Author:
✉ *Email: pf.yeetheng@moh.gov.my*

Abstract

HbA1c is an important indicator of glycaemic control as it correlates with the risk of long-term diabetes complications. In 2017, only 17.4% of Type II Diabetes Mellitus (T2DM) patients at *Klinik Kesihatan Kelana Jaya* (KKKJ) newly initiated on insulin achieved at least a 1% reduction in HbA1c after six months. This contributed to 40.9% of patients developing diabetic nephropathy, 48.6% experiencing diabetic neuropathy, and 20.1% being diagnosed with diabetic retinopathy. Our study indicator is the percentage of T2DM patients who achieved at least a 1% reduction in HbA1c six months after insulin initiation. A target of 80% was set, based on consensus reached during 2018 Non-Communicable Disease (NCD) meeting at KKKJ. This quality improvement study employed a universal sampling method from July 2018 to July 2020. Data were collected using questionnaires distributed to healthcare professionals (HCPs), an audit checklist, and a patient assessment form completed during clinic visits. The data were analysed using Microsoft Excel. During the verification study, the achievement rate was 23.8%. The identified contributing factors to poor HbA1c control were poor patient adherence to insulin, lack of awareness among HCPs regarding the latest insulin guidelines, insufficient coordination among the multidisciplinary team, lack of self-monitoring of blood glucose and self-adjustment of insulin doses, and patient's non-adherence to lifestyle interventions. Several strategies were introduced, including the "One Sweet Centre," which involved a multidisciplinary team comprising a medical officer, pharmacist, dietitian, diabetes educator, and occupational therapist. Additionally, glucometers were loaned to patients with financial difficulties. Phone consultations and a drive-through service were offered during the Movement Control Order (MCO) period of the Covid-19 pandemic. Post-intervention results showed that the percentage of T2DM patients achieving at least a 1% reduction in HbA1C after six months of insulin initiation increased from 23.8% to 50% in cycle one, 70% in cycle two, and 83.3% in cycle three. Moving forward, we plan to share our remedial actions with other clinics and expand this initiative by setting up a peer support club and collaborating with Non-Governmental Organisations (NGOs) to empower the community.

KEYWORDS: HbA1c, Insulin initiation, Multidisciplinary team

Problem

KKKJ is one of the health clinics in the Petaling Jaya district in Selangor (1). This health clinic comprises various departments, including the Outpatient Department (OPD), Maternal and Child Health (MCH), pharmacy, laboratory, dental services, dietetic services, and physiotherapy. The OPD offers a wide range of services, which include managing NCDs, a quit smoking clinic, health screening, medical check-ups, mental health care, asthma clinic, diabetes clinic, tuberculosis clinic, HIV clinic, pre-exposure prophylaxis (PrEP) programme, methadone and hepatitis C clinic, PEKA B40 screening services, Influenza-Like Illness clinic (ILI) clinic, Covid-19 Centre and a virtual clinic. Health services in KKKJ are provided by multi professional team consists of a Family Medicine Specialist (FMS), medical officers (MO), medical assistant, pharmacist, pharmacist assistant, dietician, physiotherapist, nurses. The daily total attendance at the OPD ranges between 250 and 400 patients. Of these, NCD cases are the most frequently seen, with 50 – 65% being T2DM cases. According to the T2DM registry under the Petaling Jaya District Health Office, there were 3,504 active T2DM patients in KKKJ in 2017. Glycated haemoglobin (HbA1c) is used as one of the key monitoring tools to assess glycaemic control in these patients.

In 2017, almost 39% of T2DM patients in KKKJ were on insulin, either as a single agent or in combination with oral hypoglycaemic agents (OHA). However, only 17.4% of newly initiated insulin patients achieved at least a 1% reduction in HbA1c after six months. Among these patients, 40.9% had diabetic nephropathy, 48.6% had diabetic neuropathy, and 20.1% had diabetic retinopathy.

As a result, a quality improvement study was conducted to address the low percentage of T2DM patients achieving significant HbA1c reduction after insulin initiation. The primary aim of this study was to ensure that at least 80% of T2DM patients achieved a minimum of 1% reduction in HbA1c after six months of insulin initiation, with a target to reach this goal within 24 months.

Background

Insulin is widely used as one of the treatment options in managing T2DM to achieve target HbA1c levels (2). The Malaysia National Diabetes Registry report showed that insulin use in the treatment of T2DM increased from 11.7% in 2009 to 21.4% in 2012 (3). Selangor is one of the top five states in Malaysia with the highest percentage (30.4%) of T2DM patients receiving insulin (4) .

HbA1c is an important indicator of glycaemic control as it reflects the average blood glucose level over the past three months and correlates with the risk of long-term diabetes complications (5). Studies have shown that a 1.5% reduction in HbA1c is achievable with basal insulin plus OHA using a target-to-treat approach, especially in previously insulin naive patients (6,7). The mean HbA1c overall has decreased from 9.2% at baseline to 7.9% at a six-month follow up, with the largest mean reduction of 2.4% observed in patients with baseline HbA1c >9% when basal insulin was added to oral therapy (8).

The UK Prospective Diabetes Study (UKPDS) demonstrated that an early reduction in HbA1c of at least 1% is associated with a 21% reduction in diabetes-related deaths, a 37% reduction in microvascular complications (e.g., kidney disease, blindness), a 14% reduction in heart attacks, a 43% reduction in amputations or fatal peripheral blood vessel disease, and a 12% reduction in stroke (9).

Early insulin therapy initiation can help reduce blood glucose and HbA1c levels, therefore enabling patients to benefit from a favourable “legacy effect”. This phenomenon refers to the significant reduction of micro- and macrovascular complications through early intensive blood glucose control (10). As a result, the healthcare costs associated with managing T2DM complications can be markedly reduced (11).

Despite the fact that insulin is the most effective drug available for achieving glycaemic targets T2DM patients, a large study in the public healthcare system showed that only 26% of these patients had good glycaemic control (12). Several issues in clinical practice pose barriers to achieving

optimal glycaemic control with insulin therapy, such as poor patient acceptance, hypoglycaemia, weight gain after starting insulin, and suboptimal insulin regimen adjustments (13,14). Non-adherence to insulin regimens is another significant factor that delays the achievement of satisfactory glycaemic control. Multiple daily injections using syringes or insulin pens often cause discomfort and require a substantial commitment to self-management and daily living adjustments (15,16,17,18). Approximately 34.6% of diabetes patients reported missing insulin doses at least once a month (19).

To address poor glycaemic control despite insulin initiation, health care providers, both locally and internationally, have adopted several strategies. These include overcoming patient barriers by referring them for diabetes self-management education, providing medical nutrition therapy, offering ongoing self-management support, addressing emotional concerns related to insulin use, ensuring timely follow-up to promote adherence, and identifying and resolving potential challenges. Developing and implementing comprehensive algorithms for optimising and intensifying insulin therapy are also essential (20). It is crucial to involve patients in the decision-making process to ensure adherence and subsequently achieve glycaemic control. Education and empowerment through shared decision-making allow patients' preferences to be acknowledged and considered, leading to the creation of an individualised treatment plan for each patient (21). In addition, more frequent medical visits, coupled with treatment interventions including the use of insulin pens and self-monitoring, have improved glycaemic control in elderly patients with chronically decompensated diabetes (22). Effective interventions, including innovative medication delivery devices, improve the management of individuals with T2DM who are treated with insulin (23,24).

Measurement

The objective of this study was to increase the percentage of T2DM patients achieving at least 1% reduction in HbA1c after six months of insulin initiation at KKKJ. The percentage of patients meeting this target was used as the primary improvement indicator. This was calculated as the total number of T2DM patients achieving at least a 1% HbA1c reduction after six months of insulin initiation, divided by the total number of patients newly initiated on insulin. An 80% standard was set during the NCD meeting held at KKKJ in 2018.

This quality improvement study involved three cycles, conducted between October 2018 and June 2020. The verification study was conducted from July to September 2018, followed by post intervention cycles: Cycle One (October 2018 to May 2019), Cycle Two (June 2019 to December 2019), and Cycle Three (January 2020 to July 2020). The selected study population consisted of insulin naive T2DM patients at KKKJ, newly initiated on insulin during the study period. Patients with gestational diabetes mellitus were excluded. All newly initiated insulin patients were recruited at the start of each cycle, and followed up for six months. In Cycle One, 30 patients were included; in Cycle Two, 50 patients; and in Cycle Three, 42 patients.

A patient assessment form was used to track HbA1c readings six months after insulin initiation and to assess any new T2DM-related complications. An audit checklist was used to review the process of insulin initiation and optimisation for newly initiated patients. All data were compiled and analysed using Excel. Pareto analysis was used to determine the main factors contributing to the low percentage of T2DM patients achieving at least a 1% HbA1c reduction after insulin initiation.

The verification study found that only 23.8% of T2DM patients achieved the target 1% HbA1c reduction after six months, compared to the 80% standard, resulting in an Achievable Benefit Not Achieved (ABNA) rate of 56.2%.

Initial Assessment of the Problem

The process of care, as depicted in Figure 1, was reviewed at the beginning to identify critical steps contributing to the low percentage of T2DM patients achieving at least 1% reduction in HbA1c six months after insulin initiation. Appendix 1 (Before Quality

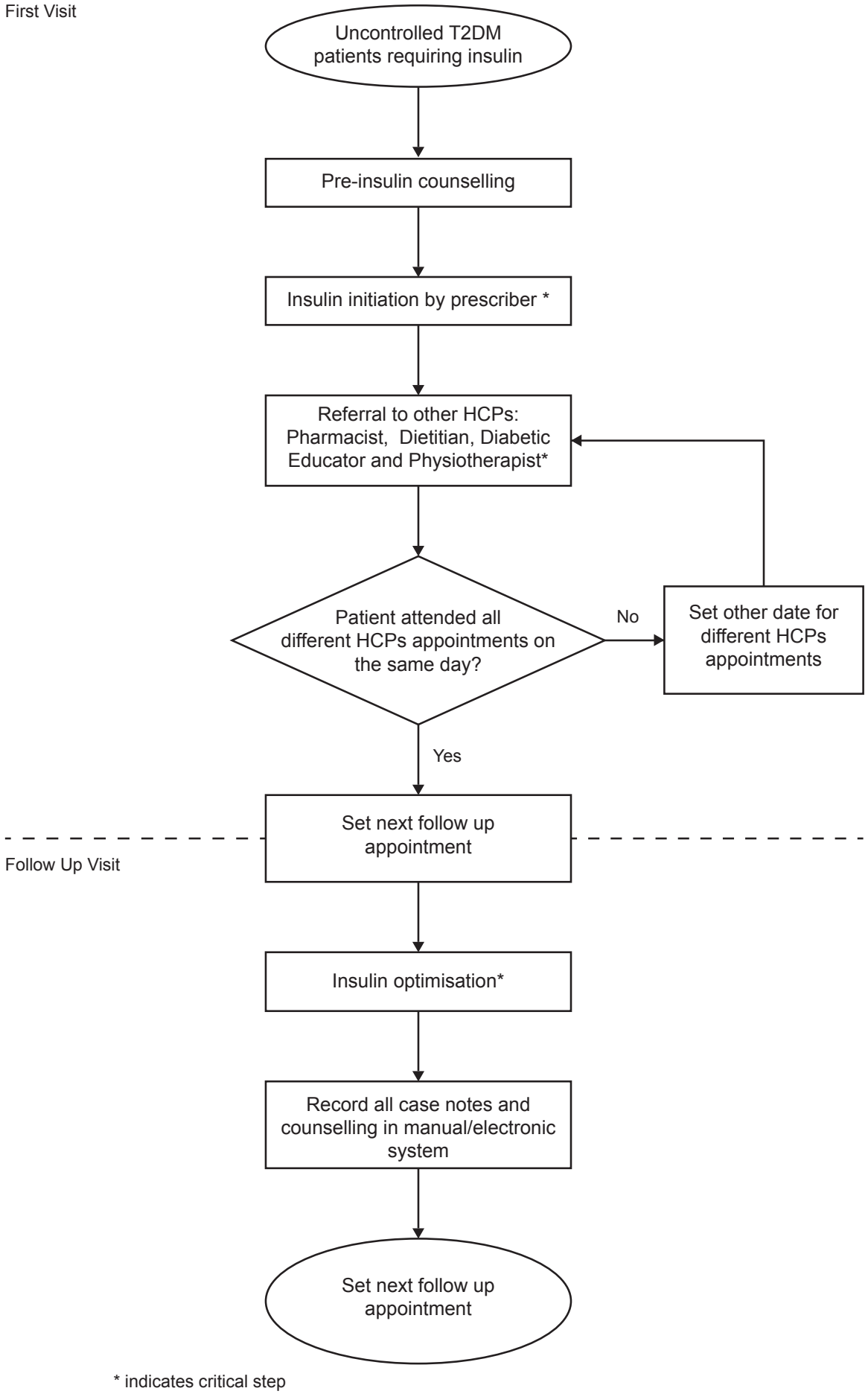


Figure 1: Process of care for uncontrolled T2DM patients requiring insulin (*indicates critical steps)

Study) outlines the 12-month appointment schedule for newly initiated insulin patients. The process involved the prescriber providing pre-insulin counselling, initiating appropriate insulin therapy (including type of insulin, starting dose, and insulin regimen), and referring patients to other HCPs such as pharmacists for insulin pen injection technique, diabetic educators for self-monitoring of blood glucose (SMBG), and dietitians for diabetes diet education. Once patient attended all counselling sessions provided, following two appointments were scheduled. However, some patients missed counselling sessions with HCPs and needed to be rescheduled. Frequent appointments during the first six months were essential, ensuring insulin dose titration could be performed to achieve optimal dosing and lowering HbA1c levels. The critical steps identified were insulin initiation by the prescriber, HCP involvement, and insulin optimisation.

A problem analysis chart, shown in Figure 2, was used to identify possible factors contributing to the low percentage of patients achieving the target HbA1c reduction. Data were collected through three methods – an HCP questionnaire, an audit checklist, and a patient assessment form during clinic visits. The questionnaire was distributed to 66 HCPs at KKKJ, including medical officers, pharmacists, dietitians, and diabetic educators. It aimed to identify factors contributing to low percentage of T2DM patients with HbA1c reduction following insulin initiation. Audit checklist was used to review the process of insulin initiation and optimisation while a patient assessment form was used to track HbA1c reading after 6 months of insulin initiation and occurrence of new T2DM-related complications.

Among the 66 participating HCPs (53% MOs, 47% other HCPs), 65.1% had over five years of working experience. Pareto chart analysis showed that the main contributing factors to low HbA1c reduction were poor patient adherence to insulin therapy (24.2%), lack of awareness among HCPs about the latest insulin therapy guidelines (22.7%), lack of multidisciplinary team coordination (16.7%), lack of SMBG and self-adjustment on insulin doses (10.6%), and patient non-adherence to lifestyle interventions (6.1%).

Table 1 depicts the Model of Good Care for the critical steps in the insulin initiation process. Among the three critical aspects identified, the lowest process scores were observed in the involvement of other HCPs including assessments by pharmacists or diabetic educators (DEs) post insulin initiation, individualised meal planning by dietitians, and insulin optimisation.

Specifically, there was no assessment by pharmacists or DEs post insulin initiation. This includes a complete absence of evaluations related to correct injection technique and handling of the insulin pen (0%), adherence to insulin therapy (0%), engagement in minimal exercise (0%), and weight loss of ≥1kg after six months for overweight or obese patients (0%). In terms of individualised meal planning by dietitians, only 7.1% of patients attended dietitian counselling within three months of insulin initiation, and 2.4% adhered to the diabetes plate method following dietetic counselling.

For the third critical step, insulin optimisation, involved both patients and prescribers, no patient (0%) managed to titrate their insulin dose at home, nor did any attend the second, third, or fourth review appointments as scheduled at the clinic. Furthermore, there was no (0%) insulin titration based on SMBG by prescribers during the second, third, or fourth clinic reviews.

Strategy

A holistic approach was used in formulating remedial actions, which involved all HCPs, patients, and a pharmaceutical company. The remedial actions implementation was divided into three phases across the study's cycle - two strategies in Cycle One, three strategies in Cycle Two and two strategies in Cycle Three.

Before the quality improvement study, patients newly initiated on insulin were given longer intervals between clinic appointments, which compromised insulin adherence and delayed insulin dose optimisation. Additionally, there was no structured monitoring by other HCPs after insulin initiation by the prescribers. During Cycle One (October 2018 – May 2019), a holistic program named "One Sweet Centre" (OSC) was introduced to address these

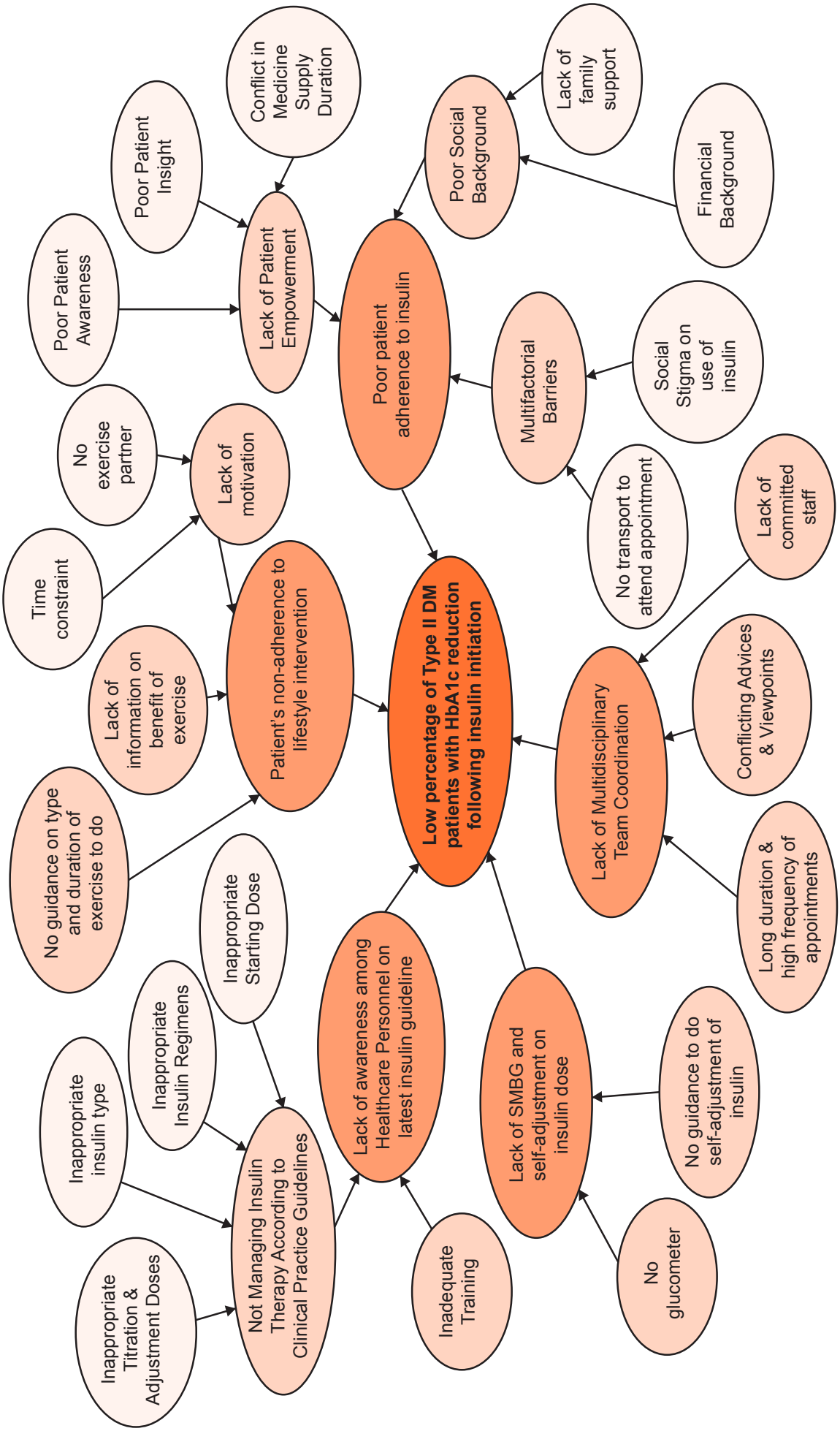


Figure 2: Problem analysis chart for low percentage of T2DM patients with HbA1c reduction following insulin initiation

gaps. It was a dedicated multidisciplinary clinic which emphasised patient education, self-empowerment, and individualised patient care, operating every Thursday and Friday from 8am to 1pm. The prescriber and Diabetes Medication Therapy Adherence Clinic (DMTAC) pharmacist were involved in the clinic. All T2DM patients newly initiated on insulin were reviewed in the OSC post insulin initiation, with follow up (visit two - four) appointments scheduled for insulin dose optimisation. OSC was set up with the aim to: 1) increase patient adherence to insulin by enhancing their understanding of insulin therapy; 2) provide individualised counselling on potential adverse effects, boosting confidence in insulin use; 3) educate patients on self-care devices like insulin pens and glucometers, and ensure proper technique and device handling; and 4) improve patient knowledge on SMBG and insulin dose titration through frequent monitoring and more regular clinic visits (Appendix 1).

In addition to patient focused interventions, a series of Continuous Medical Education (CME) were conducted to update HCPs as part of the knowledge empowerment and adherence to the latest insulin practical guidelines. A total of ten CME slots were delivered, with topics related to insulin initiation and optimisation, and incorporating Kahoot games to enhance engagement. Prizes such as goody bags and food vouchers were awarded to the top three HCPs, encouraging their interest in the insulin practical guidelines.

During the re-evaluation post Cycle One, it was found that T2DM patients were unable to perform exercise, follow a diabetic diet, or conduct SMBG due to not own a glucometer at home (Table 1). Hence, during Cycle Two (June 2019 – December 2019), patients without glucometers, experiencing financial challenges, or poor understanding were referred to the DE to obtain loaned glucometers for SMBG monitoring. These were provided free of charge by a pharmaceutical company with approval by the clinic FMS. Additional HCPs, including DEs, dietitians, and physiotherapists, were incorporated into the OSC team to offer a comprehensive care approach (Appendix 1). This strategy reduced patient burden by allowing patients to be reviewed by multiple HCPs in one visit and facilitated timely insulin dose titration by the prescribers. A detailed counselling and assessment checklist (Appendix 2), involving five HCPs in OSC, was introduced to streamline the process. The inclusion of a physiotherapist was particularly important, as they advised patients on appropriate types of exercises and durations according to patient capabilities. This intervention improved clinic attendance and insulin adherence.

Cycle Three (January – July 2020) coincided with the MCO during the COVID-19 pandemic. The pandemic presented additional challenges, including patients being unable to exercise outdoors, facing disruptions in their diets, and experiencing weight gain, worsening their T2DM management. Moreover, some patients feared attending clinic appointments and collecting medications due to the risk of infection, as T2DM patients are at greater risk for severe COVID-19 complications. In view of that, phone consultations were introduced for patients who missed appointments, covering SMBG, dose titration of insulin, and lifestyle advice. A value-added service, like drive through medication and insulin collection service was offered to ensure adherence while minimising the risk of exposure to COVID-19.

Results

Upon implementation of the above strategies, significant improvements were observed in the percentage of T2DM patients achieving at least a 1% reduction in HbA1c after six months of insulin initiation. Following the introduction of the OSC and multidisciplinary interventions in Cycle One, the percentage of patients with at least a 1% reduction in HbA1c increased from 23.8% during the verification cycle to 50%. However, this still fell short of the target of 80%.

In Cycle Two, the inclusion of the loaned glucometer programme and involvement of additional HCPs, such as physiotherapists and dietitians, further improved the outcome. The percentage of T2DM patients achieving the target HbA1c reduction increased from 50% (Cycle one) to 70%.

Despite the challenges posed by the COVID-19 pandemic and the MCO in Cycle Three, strategies such as phone consultations and drive-through services proved effective. The percentage of T2DM patients achieving the HbA1c reduction target rose from 70% (Cycle Two) to 83.3%, surpassing the 80% standard (Figure 3).

In addition to improvements in HbA1c control, this study also observed a reduction in the percentage of patients experiencing new onset T2DM complications, such as myocardial infarction, stroke, retinopathy, peripheral vascular disease requiring foot amputation, nephropathy requiring haemodialysis, cataracts, and heart failure. During the verification cycle, 23.8% (10/42) of patients experienced new complications due to failure to reduce HbA1c by at least a 1%. However, with the implementation of the strategies mentioned above, we successfully reduced the percentage of patients with new onset T2DM complications to 13.3% (4/30) in Cycle One, followed by 6.0% (3/50) in Cycle Two and lastly 2.4% (1/42) in Cycle Three.

Furthermore, the estimated direct cost of managing T2DM complications significantly decreased, from MYR 55,344 during the verification cycle to MYR 10,587 in Cycle One, MYR 10,103 in Cycle Two and lastly, MYR 479 in Cycle Three, owing to the improvement in HbA1c control post insulin initiation and optimisation. The cost estimates for managing T2DM complications were based on the journal published by Mustapa et al (25). Table 2 outlines the estimated direct cost of managing T2DM complications during this quality improvement study.

Overall, the ABNA was successfully reduced from 56.2% to -3.3%. The three critical aspects that were previously subpar all showed improvements following the implementations of the strategies.

Lessons and Limitations

This study imparted a crucial lesson: a dedicated multidisciplinary team involving FMS, MO, DMTAC pharmacist, DE, physiotherapist, and dietitians is important for improving HbA1c control in patients newly initiated on insulin. Proper diabetes education and guidance to empower patients to achieve target HbA1c levels earlier, thereby delaying or preventing both micro- and macrovascular complications. Through the various strategies implemented, T2DM patients learned to handle devices like insulin pens and glucometers properly, reducing medication wastage and disposal due to poor handling, which often leads to mechanical errors and non-adherence. Additionally, patients recruited during intervention Cycles One, Two and Three managed to perform SMBG as instructed, enabling prescribers to

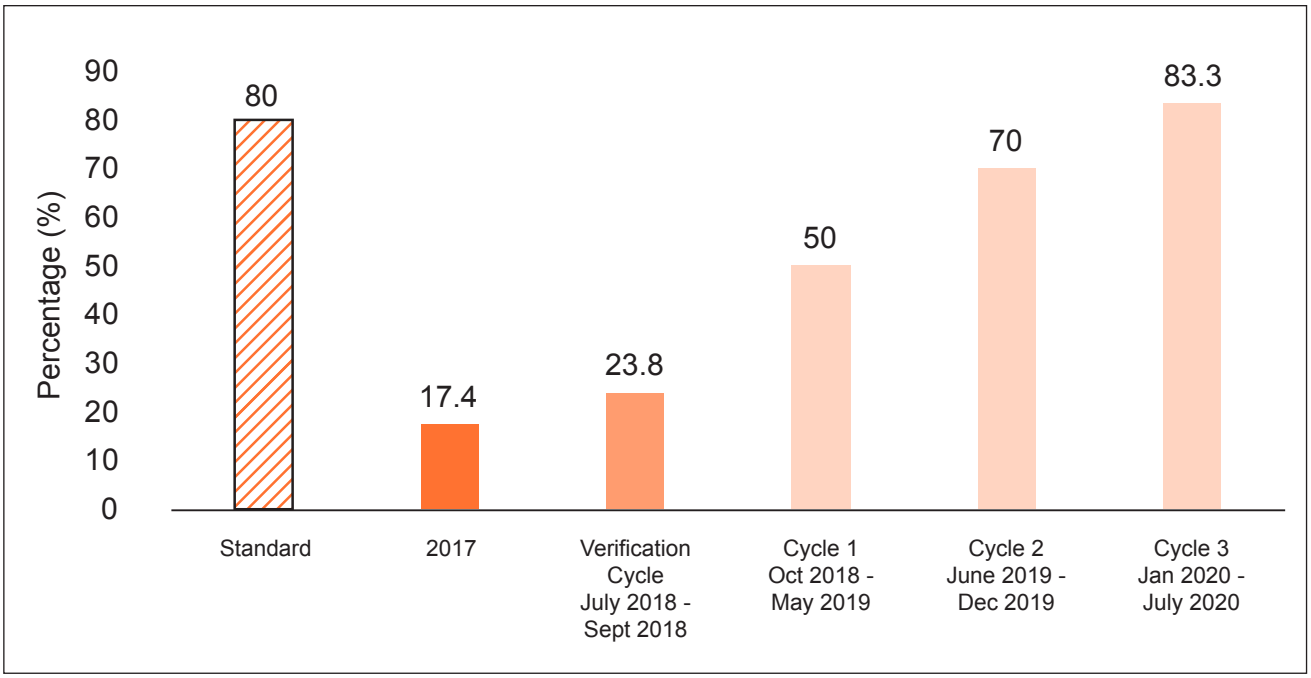


Figure 3: Percentage of T2DM patients who achieve at least 1% reduction HbA1c following insulin initiation

Table 1: Improvement in implementation of critical steps in Cycle One, Cycle Two and Cycle Three.

No	Process	Criteria	Standard	Verification (n=42)	Cycle One (n=30)	Cycle Two (n=30)	Cycle Three (n=30)
1	Insulin initiation by medical officer	• Select the correct insulin regimen as per guideline.	100%	83.3%	93.3%	98.0%	100.0%
		• Prescribe the correct type of insulin as per drug formulary.	100%	83.3%	93.3%	98.0%	100.0%
		• Prescribe the correct dose of insulin as per guideline.	100%	21.4%	70.0%	92.0%	97.6%
2	Referral to other HCPs: Pharmacist, dietitian, Diabetic Educator and Physiotherapist	(A) Diabetes education by pharmacist/DE upon insulin initiation					
		• Insulin pen injection technique	100%	95.2%	100%	100%	100%
		• SMBG counselling	100%	28.6%	100%	100%	100%
		(B) Assessment on patient by pharmacist/DE post insulin initiation					
		• Correct injection technique and handling of insulin pen	100%	0.0%	86.7%	92.0%	97.6%
		• Adherence to insulin therapy	100%	0.0%	86.7%	90.0%	97.6%
		• Perform minimal exercise of 150 mins/week	100%	0.0%	43.3%	72.0%	83.3%
		• Weight loss of ≥1kg after six months for overweight/obese	100%	0.0%	26.7%	28.0%	31.0%
		(C) Individualised meal planning by dietitian					
		• Patient has attended dietitian counselling within 3 month of insulin initiation	100%	7.1%	53.3%	64.0%	69.1%
		• Adherence to diabetes plate method by patient post counselling	100%	2.4%	53.3%	76.0%	78.6%

No	Process	Criteria	Standard	Verification (n=42)	Cycle One (n=30)	Cycle Two (n=30)	Cycle Three (n=30)
3	Insulin optimisation	(A) Patient					
		• Having glucometer for SMBG	100%	16.7%	40.0%	78.0%	85.7%
		• Able to perform SMBG	100%	14.3%	40.0%	78.0%	85.7%
		• Able to titrate insulin dose at home	100%	0.0%	30.0%	60.0%	69.1%
		• Attend clinic appointment as scheduled	100%				
		(i) 1st review: 1 month after initiation	100%	66.7%	100.0%	100.0%	100.0%
		(ii) 2nd review: 1 month after 1st review	100%	0.0%	100.0%	100.0%	100.0%
		(iii) 3rd review: 2 months after 2nd review	100%	0.0%	96.7%	96.0%	97.6%
		(iv) 4th review: 2 months after 3rd review	100%	0.0%	93.3%	96.0%	97.6%
		(B) Prescriber					
		• 1st review: titrate insulin dose based on SMBG 1 month after initiation	100%	45.2%	100.0%	100.0%	100.0%
		• 2nd review: titrate insulin dose based on SMBG 1 month after 1st review	100%	0.0%	100.0%	100.0%	100.0%
		• 3rd review: titrate insulin dose based on SMBG 2 months after 2nd review	100%	0.0%	100.0%	94.0%	97.6%
		• Order HbA1c test on 3rd review	100%	0.0%	93.3%	94.0%	97.6%
		• 4th review: review HbA1c reading 2 months after 3rd review	100%	0.0%	93.3%	94.0%	97.6%

Table 2: Estimated direct cost of management of complications due to T2DM.

Complication	Verification (n=42)		Cycle One (n=30)		Cycle Two (n=50)		Cycle Three (n=42)	
	Number of patients x direct cost	Total cost (MYR)	Number of patients x direct cost	Total cost (MYR)	Number of patients x direct cost	Total cost (MYR)	Number of patients x direct cost	Total cost (MYR)
Myocardial infarction	1 X MYR4,817	4,817	1 X MYR4,817	4,817	0	0	0	0
Stroke	0	0	0	0	0	0	0	0
Retinopathy	7 X MYR479	3,353	2 X MYR479	958	1X MYR479	479	1X MYR479	479
Peripheral vascular disease requiring foot amputation	0	0	0	0	0	0	0	0
Nephropathy (HD/CAPD)	1 X MYR42,362	42,362	0	0	0	0	0	0
Cataract	1 X MYR4,812	4,812	1 X MYR4,812	4,812	2 X MYR4,812	9,624	0	0
Heart Failure	0	0	0	0	0	0	0	0
TOTAL (MYR)		55,344	0	10,587	0	10,103	0	479

Note: The cost estimates for managing T2DM complications were calculated based on an article published by Mustapa et al (25).

accurately titrate and optimise insulin doses. This timely intervention contributed to the reduction in HbA1c levels, as reflected in the ABNA results.

Our dedicated multidisciplinary team also recognised the importance of fostering strong patient relationship with all HCPs. This connection encouraged patients to attend frequent follow up appointments, allowing prescribers to perform insulin dose titration and optimisation in a timely manner. Thus, achieving early reductions in HbA1c not only benefited the patients but also reduced healthcare costs associated with managing complications from poorly controlled T2DM.

Despite these positive outcomes, our team faced challenges during the MCO of COVID-19 pandemic. Cycle Three posed a great challenge as patients were unable to attend clinic appointments for proper counselling and guidance. In response, strategies such as virtual phone consultations to review SMBG results and discuss insulin dose adjustments was implemented. The pharmacy department also introduced an “instant drive through” service, enabling patients to refill insulin and medications during the pandemic, ensuring continuity of supply and adherence.

Conclusion and the Next Steps

In conclusion, our team is pleased to have observed a substantial improvement in HbA1c levels among patients newly initiated on insulin through holistic approach implemented in this study. We successfully improved the percentage of T2DM patients achieving at least a 1% reduction in HbA1c from 23.8% to 83.3% after six months of insulin initiation. As a dedicated multidisciplinary team, we are committed to continuously auditing and improving the work processes to ensure the highest quality of diabetic care for our patients. These strategies incurred minimal cost and are self-sustainable for future cycles. We plan to share these remedial actions with other government health clinics, aiming to improve national health outcomes and indirectly reduce healthcare costs by delaying or preventing both micro- and macrovascular complications of T2DM.

We would like to extend this service to all our diabetic patients. Expanding the program could involve setting up a peer support club between patients and HCPs, using platforms such as WhatsApp or WeChat to share experiences related to

insulin use. Additionally, we plan to create a QR code system providing information on topics such as insulin injection techniques, dose adjustment based on SMBG, complications of T2DM, and carbohydrate counting, based on the counselling given in the OSC.

On top of that, we aim to empower the community through social media platforms like Facebook, Instagram, and Twitter. These platforms could feature success stories of patients who have achieved their HbA1c targets post insulin initiation, using social media trends to influence and inspire others to follow good practices.

In collaboration with the National Diabetes Institute (NADI), non-government organisations (NGOs) and the *Kesihatan Pekerjaan dan Alam Sekitar* (KPAS) unit in our clinic, we also plan to provide affordable exercise classes, engaging physical activities, and diabetic-friendly cooking competitions. These initiatives will raise awareness about the importance of adhering to a healthy lifestyle, ultimately leading to improve diabetic control for our patients.

Acknowledgement

We would like to express our sincere gratitude to the Director General of Health Malaysia for his approval to publish this article. We are deeply thankful for the dedicated multidisciplinary team at the One Sweet Centre in KKKJ for their tireless efforts in guiding and supporting all T2DM patients newly initiated on insulin. Additionally, we would like to extend our thanks to FMS and the pharmaceutical company for the loaned glucometer programme. Lastly, we are grateful to the patients themselves for their trust, cooperation, and determination in managing their diabetes.

Conflict of Interest

The authors declare that there was no conflict of interest.

Funding

This study received no specific grants from any funding agencies from the public, commercial or non-profit sectors.

References

1. Portal Rasmi Kementerian Kesihatan Malaysia [Internet]. [cited 2024 Mar 7]. Available from: https://www.moh.gov.my/index.php/database_stores/store_view_page/1/2298

2. Ministry of Health Malaysia. Practical Guide to Insulin Therapy in Type 2 Diabetes Mellitus. 2010.

3. Disease Control Division Ministry of Health Malaysia National Diabetes Registry Report. 2020.

4. Variation in Insulin usage between states among Type 2 Diabetes patients attending government health clinics in Malaysia [Internet]. [cited 2024 Mar 7]. Available from: https://e-mjm.org/2015/v70s1/mjm-sept-suppl-2181.html

5. Use of Glycated Haemoglobin (HbA1c) in the Diagnosis of Diabetes Mellitus: Abbreviated Report of a WHO Consultation. Geneva: World Health Organization; 2011. PMID: 26158184.

6. Tsai ST, Pathan F, Ji L, Yeung VTF, Chadha M, Suastika K, et al. First insulinization with basal insulin in patients with Type 2 diabetes in a real-world setting in Asia. J Diabetes. 2011 Sep;3(3):208–16.

7. DeVries JH, Nattrass M, Pieber TR. Refining basal insulin therapy: What have we learned in the age of analogues? Vol. 23, Diabetes/Metabolism Research and Reviews. 2007. p. 441–54.

8. Brož Denisa Janíčková ˇ dárská Radka S ˇ těpánová Milan Kvapil JZ. Addition of Basal Insulin to Oral Antidiabetic Agents in Patients with Inadequately Controlled Type 2 Diabetes Leads to Improved HbA1c Levels: Metabolic Control, Frequency of Hypoglycemia, and Insulin Titration Analysis as Results of a Prospective Observational Study (BALI Study). Diabetes Therapy [Internet]. 2019;10. Available from: https://doi.org/10.6084/

9. Stratton IM, Adler AI, Neil AW, Matthews DR, Manley SE, Cull CA, et al. Papers Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study.

10. I Ranjit Unnikrishnan RAVM. importance_of_controlling_diabetes_early_the_concept_of_metabolic_memory_legacy_effect_and_the_case_for_early_insulinisation. J Associate Physicians India. 2011 Apr;(59):8–12.

11. Mustapha et al. What are the direct medical costs of managing Type 2 Diabetes Mellitus in Malaysia? Med J Malaysia [Internet]. 2017 Oct [cited 2019 Nov 11]; 72(5):271-277. Available from: http://www.e-mjm.org/2017/v72n5/medical-cost-of-diabetes.pdf

12. Viana LV, Leitão CB, Kramer CK, Zucatti ATN, Jezini DL, Felício J, et al. Poor glycaemic control in Brazilian patients with type 2 diabetes attending the public healthcare system: a cross-sectional study. BMJ Open. 2013;3(9):e003336.

13. Mafauzy M, Hussein Z, Chan SP. The status of diabetes control in Malaysia: results of DiabCare 2008. Med J Malaysia. 2011 Aug;66(3):175-81. PMID: 22111435.

14. Chan JCN, Gagliardino JJ, Baik SH, Chantelot JM, Ferreira SRG, Hancu N, et al. Multifaceted determinants for achieving glycemic control the international diabetes management practice study (IDMPS). Diabetes Care. 2009 Feb;32(2):227–33.

15. Professional Practice Committee: Standards of Medical Care in Diabetes-2018. Diabetes Care. 2018;41(Suppl 1):S3.

16. Farsaei S, Radfar M, Heydari Z, Abbasi F, Qorbani M. Insulin adherence in patients with diabetes: risk factors for injection omission. Prim Care Diabetes. 2014;8(4):338-45.

17. Gherman A, Schnur J, Montgomery G, Sassu R, Veresiu I, David D. How are adherent people more likely to think? A meta-analysis of health beliefs and diabetes self-care. Diabetes Educ. 2011;37(3):392-408.

18. Sarbacker GB, Urteaga EM. Adherence to insulin therapy. Diabetes Spectr. 2016;29(3):166-70.

19. Peyrot M, Barnett AH, Meneghini LF, Schumm-Draeger PM. Factors associated with injection omission/non adherence in the Global Attitudes of Patients and Physicians in Insulin Therapy study. Diabetes Obes Metab. 2012;14(12):1081–1087.

20. Funnell MM. Overcoming Barriers to the Initiation of Insulin Therapy [Internet]. Vol. 25, CLINICAL DIABETES. 2007. Available from: http://diabetesjournals.org/clinical/article-pdf/25/1/36/320977/0036.pdf

21. Rodriguez-Gutierrez R, Lipska KJ, McCoy RG. Intensive glycemic control in type 2 diabetes mellitus—a balancing act of latent benefit and avoidable harm: a teachable moment. JAMA Intern Med 2016;176:300—301.

22. : Machry RV, Pedroso HU, Vasconcellos LS, Nunes RR, Evaldt CA, Yunes Filho EB, et al. Multifactorial intervention for diabetes control among older users of insulin. Rev Saude Publica. 2018;52:60.

23. Sherman BW. Novel devices for delivering diabetes medications: their value and some coverage considerations. Manag Care. 2017;26(3):42-45.

24. Zullig LL, Gellad WF, Moaddeb J, et al.. Improving diabetes medication adherence: successful, scalable interventions. Patient Prefer Adherence. 2015;9:139-49.

25. Mustapha et al. What are the direct medical costs of managing Type 2 Diabetes Mellitus in Malaysia? Med J Malaysia [Internet]. 2017 Oct [cited 2019 Nov 11]; 72(5):271-277. Available from: http://www.e-mjm.org/2017/v72n5/medical-cost-of-diabetes.pdf

Appendix 1: Comparison between the frequency of clinic appointment, HbA1c blood test monitoring and involvement of number of HCPs before quality study and after quality study.

Month		1	2	3	4	5	6	7	8	9	10	11	12
Before Quality Study	OPD DM CLINIC	Initiation	1st review				2nd review			3rd review			4th review
	Order HbA1c test									HbA1c blood test			
	Involvement of HCPs	MO P	MO				MO			MO			MO
Cycle One	One Sweet Centre	Initiation	1st review	2nd review		3rd review		4th review					
	Order HbA1c test					HbA1c blood test							
	Involvement of HCPs	MO P	MO P	MO P		MO P		MO P					
Cycle Two and Three	One Sweet Centre	Initiation	1st review	2nd review		3rd review		4th review					
	Order HbA1c test					HbA1c blood test							
	Involvement of HCPs	MO P/DE	MO+P+ DE+ D+ OT	MO+P+ DE+ D+ OT		MO+P+ DE+ D+ OT		MO+P+ DE+ D+ OT					

Appendix 2: Counselling and assessment checklist involved five HCPs in OSC during cycle two.

NO	ASPECT	VISIT 1	VISIT 2	VISIT 3	VISIT 4
1	Introduction to ONE SWEET CENTRE.	MO/P			
2	Pathophysiology of diabetes.	MO/P			
3	Role of insulin in management of type II DM.	MO/P	MO/P	MO/P	MO/P
4	Therapeutic goals. • Glucose profile (HbA1c, FBG, RBG) • Lipid profile • BP • Renal profile • LFT	MO	MO	MO	MO
5	Assess adherence level towards oral medications and insulin	P	P	P	P
6	Assess understanding of medications and insulin – DFIT	P	P	P	P
7	Assess insulin injection issue: • Dose/timing/technique/site of injection/ needle use • Storage of insulin and insulin pen • Frequency to change needles/disposal of needles	P	P	P	P
8	Hypo and hyperglycaemia • Symptoms • Management	P/DE	P/DE	P/DE	P/DE

NO	ASPECT	VISIT 1	VISIT 2	VISIT 3	VISIT 4
9	Discuss side effect of oral medications and insulin.	P	P	P	P
10	Assess any adverse events experienced by patient due to medication/insulin.	P	P	P	P
11	Counsel on DM complications • Micro & macrovascular	MO	MO	MO	MO
12	Assess any complications experience by patient	MO	MO	MO	MO
13	Counsel about SMBG • How, when, where • Give booklet to record result of home SMBG • Dose titration based on SMBG • Emphasize the importance of SMBG	MO/P /DE	MO/P /DE	MO/P /DE	MO/P
14	Assess patient on knowledge regarding SMBG • Able to perform home SMBG • Able to titrate insulin dose based on SMBG	MO/P /DE	MO/P /DE	MO/P /DE	MO/P
15	Counsel about diet and lifestyle modification • Individualise meal planning • Carbohydrate counting • Exercise/smoking/alcohol • Weight management	MO/P /D/OT	MO/P /D/OT	MO/P /D/OT	MO/P
16	Assessment on lifestyle intervention: • Frequency of exercise • BW • Adherence to diabetic plate method • Quit smoking	MO/P /D	MO/P /D	MO/P /D	MO/P

NO	ASPECT	VISIT 1	VISIT 2	VISIT 3	VISIT 4
17	Sick day management	P/DE	P/DE	P/DE	P
18	Foot Care	DE	DE	DE	DE
19	Travelling • Insulin storage • Adequate supply/stock	P	P	P	P
20	At the end of each visit, plan for patient: • Set individualised targets	MO	MO	MO	MO
	• discuss on changes in medication/ insulin (if any) • discuss on insulin dose adjustment (if any)	P	P	P	P
	• Give new TCA for next appointment • Referral for other procedure (fundoscopy/physio) if any	MO	MO	MO	MO