Outcomes of Diabetes Care in Primary Care Services at Malaysia: A Retrospective Analysis of National Diabetes Registry (NDR) Database

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Abstract- Aims: To evaluate the impacts and outcomes of diabetes care on patients with Type 2 diabetes mellitus (T2DM) in primary care services at Malaysia through analysis of National Diabetes Registry (NDR) Database. Methods: This is a cross-sectional study using audit dataset extracted from NDR from 2012-2016 for 13 primary health clinics located at Johor Bahru (JB) district, Malaysia. Results: Five subsets of 1314, 702, 778, 774 and 762 patients with T2DM (2012-2016) from NDR registry were studied. Only 23.3% of patients achieved a target of haemoglobin A1c ≤6.5% (48mmol/mol) in 2016 with a mean reading of 8.1% (65mmol/mol). Suboptimal control of blood pressure (BP), lipid profile and body mass index were noted. Increased usage of oral anti-diabetes agents (OAD), insulin, anti-hypertensive agents (AHA) and anti-lipid agents (ALA) was observed. Conclusion: Majority of the T2DM patients managed in the primary health clinics in JB do not achieve optimal glycemic control and other parameters for the past 5 years. Improvements are seen in terms of treatment target achievement among T2DM patients. However, increasing use of OAD, insulin, AHA and ALA do not translate into clinical benefits. A structured and coordinated effort is necessary at the basic primary care level to improve future outcomes.

Index Terms- HbA1c, Malaysia, primary health clinics, registry, type 2 diabetes mellitus

I. Introduction

Diabetes mellitus (DM) is an emerging pandemic which has become one of the global major public health problems. The prevalence of type 2 diabetes mellitus (T2DM) worldwide is growing at an alarming rate and has increased 5-fold during the last 15 years [1]. According to World Health Organization (WHO), diabetes is the seventh causes of killer diseases at Malaysia in 2015 [2] and the National Health and Morbidity Survey (NHMS) 2015 has reported the drastic increase in the prevalence of T2DM in Malaysia from 11.6% in 2006 to 17.5% in 2015. Malaysia also ranked fourth amongst Asian countries for highest number of patients with T2DM in 2015. More worryingly, the increase was mostly contributed by the increased proportion of undiagnosed diabetes [3]. An estimated 1.1 million T2DM patients in Malaysia receive treatment at public health care facilities. Of these patients receiving public health care services, about 70% attended primary health care settings, whereas the remaining received treatment and follow-up at public hospitals [4].

The National Diabetes Registry (NDR) is an initiative taken by the Ministry of Health (MOH) of Malaysia to monitor the quality of care in patients with diabetes who are managed at public primary care clinics. The data for NDR was initially collected using manual data collection in 2009 and was subsequently upgraded to a web-based data collection system in 2011 [5].

A well designed diabetes registry should involve collection and sharing of quality data, comparison between current practices and existing guidelines for care, giving feedback and to generate insights into research, evaluation and planning of healthcare service. Also, the registry can be an useful tool to assess the quality of care through evaluating process measures and clinical outcomes [6]. Diabetes registries are used in many countries for population and outcome managements; for instance, National Diabetes Registry (NDR) established by The Swedish Association for Diabetology in 1996, to persuade European countries to reduce the prevalence of diabetes complications [7]. A quality-oriented registry called Diabetes Collaborative Registry (DCR) was formed by American College of Cardiology, the American Diabetes Association, the American College of Physicians, the American Association of Clinical Endocrinologists, and the Joslin Diabetes Center in 2014. It covers primary to specialty outpatient care in the United State, thereby permitting evaluations of multidisciplinary diabetes care across the spectrum of the disease process and the relationship between treatment regimens and health outcomes [8].

The purpose of this study is to describe and analyze the audit dataset based on the basic demographic characteristics, clinical and outcome data extracted from 13 selected primary health clinics located at Johor Bahru district through NDR. The results can help us understand T2DM management over time. Furthermore, it can help to improve patient management and future outcomes through the assessment of process indicators, medications use and clinical outcomes data captured for audited patients with T2DM and hence advocate for its continuance.

2. Materials and methods

This research is registered on the Malaysian National Medical Research Register (ID NMRR-16-2349-33372 IIR) and

approved by the Medical Research Ethical Committee of Ministry of Health Malaysia.

2.1 Data sources

This study utilized data from NDR Malaysia. All patients receiving diabetes care at 644 participating governmental primary health clinics are required to be registered into NDR and the status of patients is regularly updated. The updates included occurrence of any new complication(s), co-morbidities, loss of follow-up and death. The active T2DM patients are the population pool from which patients are selected for the annual clinical audit. Active patients diagnosed with T2DM from the registry are randomly selected annually by MOH for auditing of clinical variables as well as clinical outcomes. The audit dataset is a subset of the patient registry. The data of audited patients are required to be completed and uploaded into the NDR database before 31st August of every year [8]. Data collection was performed by the clinic staff using 3 main case report forms (CRF), which are patient registration CRF, outcome update CRF and clinical audit CRF. The presence of co-morbidities or complications were determined based on doctor reported and clinical measures in CRF.

2.2 Study design and settings

This is a cross-sectional study based on the audit dataset extracted from the NDR from 2012 to 2016 for thirteen primary health clinics located in Johor Bahru district, Malaysia. The NDR includes all patients with diabetes managed at 644 primary health clinics throughout Malaysia. However, only the demographic data (age, gender, ethnicity and duration of diabetes), clinical variables such as haemoglobin A1c (HbA1c), systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL), low density lipoprotein (LDL), body mass index (BMI), medications (oral anti-diabetes drugs (OAD), insulin, antihypertensive agents (AHA), anti-lipid agents (ALA) and anti-platelet agents) and clinical outcomes (presence of co-morbidities) from thirteen selected health clinics will be analyzed [8].

2.3 Sample size and sampling method

The NDR annual Diabetes Clinical Audit was only conducted for T2DM through random sampling from the registration dataset of active patients with T2DM. Different samples of patients are drawn every year by MOH. Patients sampled in the previous year have an equal chance of being selected in the subsequent years. The sample size is determined by the number of active patients with T2DM within a particular district. This was done to minimize the number of patients audited yet remain useful for inter-district comparability. The sample size is calculated to estimate the proportion of patients with T2DM-related complications managed at the primary health clinics. The number of patients expected to have complications was estimated by consensus by a group of clinicians from MOH. The largest sample size was calculated from the prevalence of stroke (10%) with acceptable difference in stroke prevalence of 20%, with power of 80% and alpha value of 0.05. In total there were about 750 to 800 patients sampled randomly for yearly clinical audit from thirteen health clinics [8]. The data was collected retrospectively.

2.4 Outcomes

Based on the latest Malaysia Clinical Practice Guideline (CPG) on the management of T2DM published in 2016, on target/optimum diabetes control of this study was defined as HbA1c either less than or equal to 6.5% (48mmol/mol). On target BP was defined as BP reading <130/80mmHg. HDL, LDL and TG were said to be on target if they ≥1.1mmol/L, ≤2.6mmol/L and ≤1.7mmol/L, respectively. A BMI> 23kg/m^2 is considered overweight or obese [8].

2.5 Participating sites

Thirteen primary health clinics that were involved in this study are all located within Johor Bahru District, including Mahmoodiah Health Clinic, Gelang Patah Health Clinic, Majidee Health Clinic, Kempas Health Clinic, Larkin Health Clinic, Masai Health Clinic, Pasir Gudang Health Clinic, Sultan Ismail Health Clinic, Taman Seri Orkid Health Clinic, Taman University Health Clinic, Tampoi Health Clinic, Tebrau Health Clinic and Ulu Tiram Health Clinic.

2.6 Statistical analysis

Continuous data are presented as means with 95% confidence intervals while categorical data are presented percentages. Data is managed and analyzed using Microsoft Office Excel® 2013 and STATA v13.0 (StataCorp LP, College Station, TX).

3. Results

From 2012 to 2016 there were 43120 patients with T2DM from thirteen health clinics involved in this study were registered in the NDR. The mean age of T2DM patients across the samples was 60 years old (95% CI: 60.3-60.6), 44.1% were males and 55.9% were females. The mean age of diagnosis for T2DM patients across the samples was 52 years old (95% CI: 52.2-52.4) with diabetes duration of 8.3 years (95% CI: 8.3-8.4). Majority of the patients were Malays (50.7%), followed by Chinese (27.2%) and Indians (20.8%). Based on the sample calculation done by MOH, five samples of 2010, 835, 836, 843 and 839 patients should be audited from the thirteen health clinics involved in the study from 2012 to 2016. However, actual samples of 1314, 702, 778, 774 and 762 patients were taken for each year between 2012 and 2016 from the annual NDR audit dataset due to the incomplete documentation and missing data. In the 5-year period since 2012 audit, the average age of T2DM patients decreased from 62 to 59 years old and means duration of diabetes reduced from 10.6 to 7 years.

In terms of optimal therapeutic goals for T2DM, only 23.3% of patients achieved the target of HbA1c ≤ 6.5% (48mmol/mol) in 2016 with a mean reading of 8.1% (65mmol/mol), which is lower than that in 2012 (Table 1). Also, only 33.3% of audited patients meeting target BP despite a rising level of AHA used over the year from 2012 to 2016. It is interesting to note that while table 2 showed increased usage of OAD, insulin as well as ALA from 2012 to 2016, there was no much improvements observed in the percentage of patients achieving HbA1c and cholesterol level (TG, HDL and LDL).

Mean BMI increased from 2012 to 2016, with highest BMI value of 27.8kg/m^2 recorded in audit dataset in 2016.

Table 1: Clinical target achievement based on clinical investigations from 2012-2016 (audit dataset)

	2012 N=1314	2013 N=702	2014 N=778	2015 N=774	2016 N=761
HbA1c, mean, % (95% CI)	7.7 (7.6-7.8)	8.0 (7.9-8.2)	7.9 (7.8-8.1)	8.2 (8.0-8.3)	8.1 (8.0-8.3)
HbA1c, mean, mmol/L (95% CI)	61 (60-62)	64 (63-66)	63 (62-65)	66 (64-67)	65 (64-67)
HbA1c, % achieved target	27.2	25.6	22.3	22.9	23.3
SBP, mean, mmHg (95% CI)	135.8 (134.9-136.7)	135.4 (134.0-136.7)	137.8 (136.5-139.1)	137.1 (135.9-138.4)	136.2 (134.9-137.4)
DBP, mean, mmHg (95% CI)	78.6 (78.1-79.2)	78.0 (77.2-78.7)	78.1 (77.4-78.9)	77.7 (77.0-78.5)	78.1 (77.3-78.9)
BP, % achieved target	38.3	39.9	33.2	30.2	33.3
TG, mean, mmol/L (95% CI)	1.7 (1.7-1.8)	1.7 (1.6-1.8)	1.8 (1.7-1.9)	1.7 (1.6-1.7)	1.8 (1.7-1.9)
TG, % achieved target	64.3	65.7	61.8	66.5	64.8
HDL, mean, mmol/L (95% CI)	1.3 (1.2-1.3)	1.3 (1.3-1.3)	1.3 (1.2-1.3)	1.3 (1.3-1.4)	1.3 (1.2-1.3)
HDL, % achieved target	74.0	65.7	71.5	71.8	66.4
LDL, mean, mmol/L (95% CI)	3.2 (3.1-3.2)	3.0 (2.9-3.1)	3.0 (2.9-3.1)	3.0 (3.0-3.1)	3.1 (3.0-3.1)
LDL, % achieved target	33.9	35.0	39.0	38.3	37.8
BMI, mean, kg/m^2 (95% CI)	27.5 (27.2-27.8)	27.5 (27.1-28.0)	27.7 (27.3-28.1)	27.7 (27.3-28.1)	27.8 (27.4-28.2)
BMI, % achieved target	17.7	18.2	14.6	15.3	15.9

3.1 *Pharmacological treatment in patients with T2DM*

The use of anti-diabetes agents is shown in table 2. There were 33.6% of patients on monotherapy in 2016, which was highest in the past 5 years, while the number of patients using more than two OAD was lowest (27.8%) since 2012. The use of combination treatment with OAD and insulin increased from 13.1% in 2012 to 22.3% in 2016. Among the four OADs available in health clinics (metformin, sulphonyureas, α-glucosidase inhibitors and saxagliptin), metformin was the most commonly prescribed OAD, followed by sulphonyureas (41.1%). The use of insulin increased tremendously from 18.6% in 2012 to 33.6% in 2016.

Table 2: Anti-diabetes agents and other concomitant drugs used from 2012-2016 (audit dataset)

Therapy	2012 n (%)	2013 n (%)	2014 n (%)	2015 n (%)	2016 n (%)
Total patients audited (n)	1314	702	778	774	761
Monotherapy (OAD)	358 (26.7)	195 (27.8)	244 (31.4)	216 (27.9)	256 (33.6)
≥2 OAD	602 (44.9)	261 (37.2)	237 (30.5)	262 (33.9)	212 (27.8)
OAD + insulin	175 (13.1)	88 (12.5)	138 (17.7)	182 (23.5)	170 (22.3)
Diet only	131 (9.8)	99 (14.1)	84 (10.8)	32 (4.1)	38 (5.0)
Type of OAD					
Metformin	1054 (78.6)	492 (70.1)	564 (72.5)	595 (76.9)	564 (74.0)
Sulphonyureas	685 (51.1)	322 (45.9)	307 (39.5)	354 (45.7)	313 (41.1)
α-Glucosidase Inhibitors	61 (4.6)	27 (3.9)	22 (2.8)	30 (3.9)	33 (4.3)
Other OADs	57 (4.3)	18 (2.6)	18 (2.3)	21 (2.7)	14 (1.8)
Insulin	250 (18.6)	147 (21.0)	213 (27.4)	264 (34.1)	256 (33.6)
Type of ALA					
ACEIs	434 (32.4)	237 (33.8)	295 (37.9)	287 (37.1)	333 (43.8)
ARBs	30 (2.2)	19 (2.71)	28 (3.6)	29 (3.8)	16 (2.1)
Beta blockers	383 (28.6)	151 (21.5)	197 (25.3)	218 (28.2)	187 (24.6)
Calcium channel blockers	406 (30.3)	253 (36.0)	327 (42.0)	374 (48.3)	376 (49.4)
Diuretics	180 (13.4)	118 (16.8)	141 (18.1)	147 (19.0)	131 (17.2)
Alpha blockers	57 (4.3)	33 (4.7)	62 (8.0)	49 (6.3)	55 (7.2)
Central-acting agents	0 (0.0)	1 (0.14)	1 (0.13)	0 (0.0)	2 (0.3)
Others	15 (1.12)	1 (0.14)	1 (0.13)	1 (0.13)	1 (0.13)
Anti-platelet agents					
Acetyl salicylic acid	243 (18.1)	111 (15.8)	150 (19.3)	175 (22.6)	162 (21.3)
Ticlopidine	9 (0.7)	6 (0.9)	9 (1.2)	9 (1.2)	12 (1.6)
Others	3 (0.2)	1 (0.14)	3 (0.4)	2 (0.3)	5 (0.7)

Type of ALA					
Statins	733 (54.7)	399 (56.8)	485 (62.3)	551 (71.2)	551 (72.4)
Fibrates	73 (5.4)	51 (7.3)	91 (11.7)	39 (5.0)	35 (4.6)
Others	2 (0.2)	1 (0.1)	2 (0.3)	4 (0.5)	3 (0.4)

In term of antihypertensive, calcium channel blockers (CCBs) were the most commonly prescribed AHA (49.4%) instead of the recommended first-line agents, angiotensin converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs) [9]. Acetyl salicylic acid was the most commonly prescribed anti-platelet agents (21.3%) while statins were the mostly used ALA (72.4%).

Table 3 shows the proportion of patients who had routine clinical investigations performed, including HbA1c, fasting blood glucose (FBG), random blood glucose (RBG), 2-hour post prandial blood glucose (2HPP), BP, body weight (BW), BMI, TG, HDL, LDL, creatinine, protenuria, microalbuminuria, foot examination, fundoscopy and electrocardiogram (ECG) tests. According to the latest CPG, these clinical investigations mentioned should be done at least annually for the purpose of monitoring co-morbidities, complications and other cardiovascular (CVD) risk factors [9]. Among the 761 patients from selected health clinics for audit in 2016, 91.9% of patients had their HbA1c checked, while 91.1% of the patients had their TC, TG, HDL and LDL tested. Creatinine was measured in 90% of the audited patients, but only 70.8% and 61.5% of patients were tested for protenuria and microalbuminuria, respectively, in 2016. Meanwhile, foot examination, funduscopy and ECGs were performed in 71.1%, 69.8% and 80.7% of audited patients, respectively. Comparing data from 2012 to 2016, higher percentage of patients (>90%) were given several routine clinical tests, such as HbA1c, BMI, test for cholesterol level and creatinine. More than two-thirds of the audited patients having funduscopy performed, compare to only about 50% of the patients having the same test in 2012.

The most common co-morbidity was hypertension which affected about 64.8% of the registered T2DM patients from 2012 to 2016, followed by dyslipidemia in 43% of the patients; while the highest rate of complication documented was ishaemic heart disease (IHD) (2.5%), followed by nephropathy (0.9%).

Table 3: Proportion of T2DM patients receiving clinical investigations from 2012-2016 (audit dataset)

Therapy	2012 n (%)	2013 n (%)	2014 n (%)	2015 n (%)	2016 n (%)
Total patients audited (n)	1314	702	778	774	761
HbA1c	1006 (75.2)	488 (69.5)	651 (83.7)	642 (83.0)	699 (91.9)
FBG	753 (56.2)	498 (70.9)	581 (74.7)	592 (76.5)	554 (72.8)
RBG	425 (31.7)	203 (28.9)	308 (39.6)	236 (30.5)	305 (40.1)
2HPP blood glucose	10 (0.8)	5 (0.7)	9 (1.7)	67 (8.7)	2 (0.3)
BP	1232 (91.9)	625 (89.0)	745 (95.8)	739 (95.5)	739 (97.1)
BW	1214 (90.5)	613 (87.3)	733 (94.2)	719 (92.9)	720 (94.6)
BMI	1157 (86.3)	565 (80.5)	721 (92.7)	671 (86.7)	712 (93.6)
TC	990 (73.8)	561 (79.9)	699 (89.9)	649 (83.9)	693 (91.1)
TG	1005 (74.9)	562 (80.1)	701 (90.1)	650 (84.0)	693 (91.1)
HDL	1020 (76.1)	544 (77.5)	688 (88.4)	639 (82.6)	693 (91.1)
LDL	1020 (76.1)	548 (78.1)	689 (88.6)	639 (82.6)	693 (91.1)
Creatinine	974 (72.6)	553 (78.8)	699 (89.9)	657 (84.9)	685 (90.0)
Proteinuria	774 (57.7)	391 (55.7)	545 (70.1)	564 (72.9)	539 (70.8)
Microalbuminuria	766 (57.1)	291 (41.5)	524 (67.4)	468 (60.5)	468 (61.5)
Foot examination	892 (66.5)	452 (64.4)	605 (77.8)	580 (75.0)	541 (71.1)
Fundus examination	731 (54.5)	180 (25.6)	412 (53.0)	401 (51.8)	531 (69.8)
ECG tests	839 (62.6)	437 (62.3)	608 (78.2)	560 (72.4)	614 (80.7)

4. Discussion

In this study, the audit dataset in 2016 shown that only 23.3% of T2DM patients achieved HbA1c goal of ≤6.5% (48mmol/mol) and 36.8% recorded a HbA1c ≤7% (53mmol/mol). The mean reading of HbA1c of 8.1% (65mmol/mol) in 2016 was found to be comparable to the data reported in the descriptive report from 2009 to 2012 NDR database [8]. Suboptimal controls of BP, lipid profiles and BMI were noted in the study too. This must be highlighted as these sub optimally controlled of T2DM patients can cause large health care and economic burden.

Though the reduction in HbA1c level is the key in reducing diabetes-related complications, a well glycaemic control has not been associated with a significant decrease in cardiovascular disease except in overweight diabetic patients who were given metformin. As a result, the control of other risk factors such as hyperlipidemia, hypertension and obesity is necessary [9], [10]. Besides maintaining control of blood glucose, achieving treatment targets for blood pressure and lipids are also important to minimize cardiovascular risks in patients with T2DM [11]. Among 64.8% of patients who were hypertensive and 43% of patients with dyslipidemia, only 33.3% of the patients attained BP target of ≤130/80mmHg and 37.8% had LDL level ≤2.6mmol/L. Data from patients who are hypertensive and prescribed with AHA was not able to be extracted from NDR. This study showed that two-thirds of the patients were not achieving the target BP and LDL level. As a result, more effective and earlier use of OAD, insulin, AHA and ALA should be warranted [12].

In terms of pharmacological treatment of T2DM, the use of insulin had increased from 18.6% in 2012 to 33.6% in 2016,

which is in line with the recommendations of Malaysian CPG on T2DM [9]. Among those of OAD, 74% of the patients were given metformin, followed by sulphonylureas, at 41.1%. Rather unexpectedly, the patients on monotherapy with OAD have increased between 2015 and 2016, but the number of patients given more than two OAD reduced while the use of OAD with insulin remained almost unchanged. The association of the increased use of insulin and improved HbA1c was not seen in the audit dataset. Similar findings were found between the use of AHA and the BP control, as well as the use of statin with lipid profiles.

Provision of medications for T2DM takes place at all primary health clinics in Malaysia and they are free of charge. As a result, the government is facing crucial challenge on an increasing demand on the rising health care costs. Currently there are 7 different classes of OAD available in Malaysia but only 5 types of OAD obtainable in primary health clinics, namely metformin, gliclazide, glibenclamide, acarbose and saxagliptin. Also, simvastatin and atorvastatin are the only statins that can be prescribed in the primary health clinics. Human insulin is prescribed in the majority of patients (>98%) with gradual increased use of insulin analogues in recent years, especially those who are at risk of hypoglycemia. Current CPG promote early treatment with combination therapy and the need to optimize medications without undue delay to achieve individualized therapeutic goals [4]. Unlike the recommendation suggested in CPG [9], most T2DM patients with hypertension in audit dataset were prescribed with CCBs instead of ACEI or ARBs. Overall treatment inadequacy and poor control of other measures may be due to underuse or limited choices of OAD, AHA and ALA available in primary health clinics. This finding raises significant concern as these are the modifiable factors which can lead to early complications if no action is taken. The other reason could be lack of adherence of the doctors to the CPG.

NDR is based on the data collection in health clinics and annual audit is heavily dependent on the quality of documentation of the patient's case notes and accurate data entry. There were several disparities found in the audit dataset. For instances, there were 43% of patients documented as having dyslipidemia but 72.4% of patients were on statin, yet only 37.8% patients had their LDL level controlled ≤2.6mmol/L in 2016. Similarly, only 33.3% of patients have good blood pressure control (≤130/80mmHg) regardless the rising level of AHA use over the year from 2012 to 2016. These finding is likely due to under-reporting or lack of update on data system. For example, the coverage of HbA1c testing was 91.1% in 2016 and the analysis of target HbA1c achievement (so as other clinical investigations) only included those who underwent HbA1c test and with HbA1c results documented in their case notes. As a result, the percentage of patients achieving HbA1c target would be higher or lower. Based on the latest CPG, the target of HbA1c≤6.5% (48mmol/mol) should be advocated for patients with a shorter duration of diabetes, no evidence of significant cardiovascular disease and longer life expectancy and have minimal risk of hypoglycemia [9]. A variable target HbA1c level of ≥ 6.5% (48mmol/mol) to ≤8% (64mmol/mol) may apply to certain groups of patients instead of ≤6.5% which if adapted the percentage of patients of achieving HbA1c target may be higher if the system were able to customize different target to fit each patient better. Also, the target BP had been changed from 130/80mmHg to 135/75mmHg in 2015 [9], so the number of patients achieved optimal BP may vary in the audit dataset after NDR update their system. Nevertheless, the mean reading of SBP and DBP were still above 135/75mmHg based on the audit dataset from 2012-2016.

This study also highlights the prevalence of overweight and obesity in T2DM patients as the mean value of BMI was not improved for the past 5 years (≥27.5kg/m^2). Worryingly, less than 20% of the patients from 2012-2016 audit dataset had normal BMI value, which is even lower than the data (25%) observed in the 2008 Malaysia DiabCare study[4]. The association between overweight/obesity and the increased risk of CVD is well established [14]. In the management of T2DM, weight loss has a beneficial effect in glycaemic control and treatment requirements. Normalization of insulin sensitivity and blood glucose level are seen in T2DM patients who achieve pronounced weight loss [15]. In the study done by C Daousi *et al* (2006), he found that the obese patients had worse glycaemic control and lipid profiles and higher BP compared with the non-obese patients, despite the younger age of the obese patients. Obesity prevention is urgent and should include cooperation of public health institutions, the school systems, and the private (e.g. food sector industry) in fighting the growing obesity amongst type 2 diabetic patients.

Some variables, such as urine protein test, urine albumin test, foot examination, funduscopy and ECGs test should be of concern due to their low coverage. The use of urine dipstick for protenuria, visual inspection of the feet, funduscope and ECG machine are easily available in normal health clinics and even the remotest health clinics. The low coverage rate may possibly because of inadequate or incomplete data documentation. Insufficient testing has the potential to impact on measures of overall diabetic control especially in small audit datasets. There is a risk of underestimation on the true severity of diabetes if the test missing was from poorly controlled T2DM patients. As a result, measures to improve supervision at clinics include having internal audits with feedback and education should be advocated for timely screening. Adequate budget should be allocated for regular laboratory testing of the disease biomarkers, such as HbA1c and lipid profiles [12] for better T2DM management.

This study was limited by the fact that the studied sample only reflects the diabetes care in one community which may not be representative of the country. Furthermore, the audit dataset was acquired from the appointment book completed by nurses and doctors at different levels. As a result, if the documentation in the medical records is weak, the true burden and performance of a clinic might not be reflected accurately.

Diabetes care is generally available at all the governmental hospitals and primary health clinics at Malaysia. Majority of T2DM patients are being managed in the health clinics as the services are heavily subsidized by the government. It is increasingly being recognized that multidisciplinary team management, appropriate referral system and delivery of self-management support for T2DM have positive impacts on glycaemic control and diabetes related health maintenance [16]. Patients can be referred for consultation with pharmacists, diabetes educators, dieticians or occupational therapists on an

individual basis. However, the implementations are constrained by shortages of trained primary care providers in health clinics. Due to the diversity of the community and logistic variation of the health clinic location, each health clinic has adapted its own healthcare delivery system based on individual strengths and weaknesses, leading to nonstandardized primary care units. One clinic may have a special diabetes team led by trained doctors, pharmacists or diabetes educators, and others may not even have a team especially the clinics in rural area [4]. Redefining the roles of the health care providers and promoting self-management are fundamental to the successful implementation of the diabetes care. Existing diabetes care in Malaysian primary health clinics needs to be strengthened by providing supports in organization of diabetes care, delivery system design, decision support (adherence to CPG or regular graded training of health care providers), clinical information system (registry), self-management support and community resources and policies.

5. Conclusion

This study shows that majority of the T2DM patients managed in the primary health clinics in Johor Bahru district do not achieve optimal glycemic control and other parameters, such as BP and lipid profiles for the past 5 years. Improvements are seen in terms of treatment target achievement and insulinasation among T2DM patients. However, increasing use of OAD, insulin, AHA and ALA do not translate into clinical benefits from the audit dataset extracted from NDR. A structured and coordinated effort is necessary at the basic primary care level in order to reduce the risk of diabetes complications.

Conflict of interest
The author has no conflict of interest to declare.

Disclosure statement
The author has nothing to disclose, there is no funder for this project.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

It's the foremost preliminary step for proceeding with any research work writing. While doing this go through a complete thought process of your Journal subject and research for it's viability by following means:

1) Read already published work in the same field.
2) Goggling on the topic of your research work.
3) Attend conferences, workshops and symposiums on the same fields or on related counterparts.
4) Understand the scientific terms and jargon related to your research work.

III. WRITE DOWN YOUR STUDIES AND FINDINGS

Now it is the time to articulate the research work with ideas gathered in above steps by adopting any of below suitable approaches:

A. Bits and Pieces together

In this approach combine all your researched information in form of a journal or research paper. In this researcher can take the reference of already accomplished work as a starting building block of its paper.
Jump Start
This approach works the best in guidance of fellow researchers. In this the authors continuously receives or asks inputs from their fellows. It enriches the information pool of your paper with expert comments or up gradations. And the researcher feels confident about their work and takes a jump to start the paper writing.

B. Use of Simulation software

There are numbers of software available which can mimic the process involved in your research work and can produce the possible result. One of such type of software is Matlab. You can readily find Mfiles related to your research work on internet or in some cases these can require few modifications. Once these Mfiles are uploaded in software, you can get the simulated results of your paper and it easies the process of paper writing.
As by adopting the above practices all major constructs of a research paper can be written and together compiled to form a completeresearch ready for Peer review.

IV. GET PEER REVIEWED

Here comes the most crucial step for yourresearch publication. Ensure the drafted journal is critically reviewed by your peers or any subject matter experts. Always try to get maximum review comments even if you are well confident about your paper.

For peer review send you research paper in IJSRP format to editor@ijsrp.org.

V. IMPROVEMENT AS PER REVIEWER COMMENTS

Analyze and understand all the provided review comments thoroughly. Now make the required amendments in your paper. If you are not confident about any review comment, then don't forget to get clarity about that comment. And in some cases there could be chances where your paper receives number of critical remarks. In that cases don't get disheartened and try to improvise the maximum.

After submission IJSRP will send you reviewer comment within 10-15 days of submission and you can send us the updated paper within a week for publishing.

This completes the entire process required for widespread of research work on open front. Generally all International Journals are governed by an Intellectual body and they select the most suitable paper for publishing after a thorough analysis of submitted paper. Selected paper get published (online and printed) in their periodicals and get indexed by number of sources.

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VI. CONCLUSION

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

APPENDIX

Appendixes, if needed, appear before the acknowledgment.

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