Clinical Research

DiabCare Asia 2012: diabetes management, control, and complications in patients with type 2 diabetes in Indonesia

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ABSTRACT

BACKGROUND Indonesia was a part of the most recent edition of DiabCare Asia held in 2008. DiabCare Asia 2012 is modeled after a similar project to provide the latest information to facilitate healthcare policymaking in this area.

METHODS This was an observational, non-interventional, cross-sectional study of patients with type 2 diabetes mellitus from primary, secondary, and tertiary care centers in Indonesia. Patient data collected included demography, medical history complications, eye and foot examinations, diabetes management, and most recent laboratory investigations. Blood samples were collected from all patients for the analysis of glycated hemoglobin (HbA1c).

RESULTS A total of 1,967 patients participated in the study, with a mean (SD) age of 58.4 (9.5) years and a median (range) duration of diabetes 6.0 (0.1–47.0) years. The percentage of patients with HbA1c <7.0% was 30.8% and the mean (SD) HbA1c level was 8.3 (2.2%). The proportion of patients using insulin was 34.7% with a mean (SD) total daily dose of 37.9 (24.1) IU. The most common diabetes-related complications were peripheral neuropathy (59.1%), erectile dysfunction (32.4%), and eye complications (29.1%).

CONCLUSIONS Glycemic and metabolic control remain unsatisfactory in type 2 diabetes patients in Indonesia. Efforts are needed to optimize control and prevent complications in these patients.

KEYWORDS diabcare, diabetes complication, diabetes mellitus, hypoglycemia, prevention, treatment adherence

The South East Asia Region is home to approximately 75 million people living with diabetes, and there are nearly 140 million people living with diabetes in the Western Pacific region.[1] The prevalence of diabetes in both South East Asia and the Western Pacific already exceeds that of in Europe, South and Central America, and most of Africa, and by 2035, the larger Asia Pacific Region expects diabetes prevalence to increase by 30–40%.[1] Undiagnosed diabetes is acknowledged as a significant problem in the region.[2] Urbanization, a change in lifestyle, and increases in life expectancy are cited as reasons for the increasing disease burden,[3–4] which now presents significant challenges to developing countries and emerging economies.[2,3,5] In parallel with these shifts, the incidence of diabetes-related complications can be expected to increase. Between 1990 and 2010, the total disability-adjusted life years (DALYs) due to diabetes increased by nearly 70%, whereas DALYs attributed to cardiovascular disease and cancer each increased by approximately 25%.[5]

The prevalence of urban Indonesia was 6.2% whereas that of impaired glucose tolerance was

more than 14%.[6] According to *Riset Kesehatan Dasar* (Riskesdas) 2013, the prevalence of diabetes mellitus which is showing symptoms and diagnosed by doctor is 2.1%. The prevalence of diabetes in women tends to be higher than in men. Urban areas tend to show higher prevalence levels of diabetes than rural areas.[7] The prevalence of diabetes diagnosed by doctors or by symptoms is highest in Central Sulawesi (3.7%), North Sulawesi (3.6%), South Sulawesi (3.4%), Nusa Tenggara Timur (3.3%), Yogyakarta (3.0%), and Jakarta (3.0%).[7] DiabCare is a series of cross-sectional observational studies performed in various regions, with the most recent being DiabCare 2012. The series of DiabCare studies aim to assess diabetes management, control, and complications in patients with type 2 diabetes and to evaluate the associated primary and secondary prevention efforts and treatment adherence in these patients. Previous DiabCare studies have informed healthcare policy and have influenced diabetes management programs.[8–18]

Proper surveillance and reliable baseline measurements are necessary for planning and monitoring prevention and control of diabetes and diabetes-related complications. They will be essential in directing the World Health Organization's action plan[3] to halt the rise of diabetes and non-communicable diseases regionally and globally. This study was aimed to describe current diabetes management, control, and complications in Indonesia.

METHODS

Study design and setting

An observational, noninterventional, cross-sectional design was used for this study. The study was conducted at 18 primary, 17 secondary, and 16 tertiary care centers in Indonesia between September 2013 and March 2014. The list was further validated by the National Diabetes Association with respect to the representativeness of the sample. All aspects of the study were conducted in accordance with the Declaration of Helsinki[19] and the Guidelines for Good Pharmacoepidemiology Practice.[20] Ethical approvals were obtained from the Institutional Review Board of the Indonesia National Agency of Drug and Food Control and the Ethical Committee of the Faculty of Medicine, Universitas Brawijaya. Because of the observational nature of this study, there were no study-specific visits or investigational products, and patients were treated according to routine clinical practice at the discretion of the attending physician.

Study participants

The target of this study was people with type 2 diabetes mellitus (T2DM) who were being treated with any of the non-pharmacological or pharmacological options, at a particular center for at least 1 year and had visited the center within the last 3–6 months, adult patients (≥18 years old) of either sex, and patients willing to sign the informed consent form. Exclusion criteria of this study were patients who had previously participated in the study, had suspected or confirmed pregnancy, or were unable to comply with protocol requirements. Informed consent was obtained from all individual participants included in the study.

Study endpoints

The primary endpoint of the study was defined as the proportion of patients with glycosylated hemoglobin (HbA1c) <7%. The secondary endpoints were duration of diabetes and duration and type of treatment; other measures of glycemic control—fasting plasma glucose (FPG) and postprandial plasma glucose (PPG); measures of lipid control—total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides; presence of known risk factors or diabetes-related complications—dyslipidemia, hypertension, cardiovascular complications, peripheral vascular disease, diabetic nephropathy, diabetic neuropathy and diabetic eye complications; frequency and response to hypoglycemia; and treatment adherence.

Data sources and measurement

Data were captured by reviewing the patient's medical records and interviews. Patient data collected included demography, medical history complications, eye and foot examinations, diabetes management, and most recent laboratory investigations. Venous or capillary blood samples were collected from all patients for the analysis of HbA1c as per the National Glycosylated Standardization Program guidelines. In addition, data related to the patient's psychological well-being, adherence to treatment, and perceptions of hypoglycemia were collected by interview and completion of questionnaires (the treatment adherence questionnaire, hypoglycemia questionnaire, and EuroQol-5D [EQ-5D] health questionnaire).

The treatment adherence questionnaire included patient adherence to dieting, exercising, taking medication as prescribed, performing self-monitoring blood glucose (SMBG), and keeping appointments with healthcare professionals. The hypoglycemia questionnaire assessed symptoms of hypoglycemia categorized as mild (sweating, dizziness, trembling, tingling in the hands, feet, or lips, blurred vision, difficulty in concentrating, palpitations, and occasional headache); moderate (odd behavior such as rudeness or laughter, bad temper or moodiness, aggressive behavior, and confusion); severe (loss of consciousness or needing help from another person); and nocturnal (any symptoms between bedtime and breakfast). It also assessed patient responses to hypoglycemia including SMBG testing, snacking, skipping or changing medication doses, and visiting a hospital and patient concern. The EQ-5D questionnaire measured health-related quality of life for five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.[21]

Study size

The study was aimed to enroll a total of 1,825 patients across Indonesia. The prevalence estimates and sample size were estimated based on published literature,[22] as well as on consultation with local external experts who agreed on the list of sites visited by most patients for routine diabetes care and thus provided a representative national sample in each country to fulfill the objectives of the study. Assuming a cardiovascular disease prevalence of 2.3%, a sample size of 1,825 was needed in order to attain a 5% level of significance.

Statistical analysis

The full analysis set included all patients with at least one data point, and it was used for all analyses. Missing data were not replaced. Continuous variables were summarized using descriptive statistics: mean (SD), median (range), and number missing. Categorical variables were presented as number and percentages (%). Percentage (%) values were calculated from the total non-missing.

RESULTS

General patient characteristics and demographics

A total of 1,967 patients participated in the study. The mean (SD) age of patients was 58.4 (9.5) years, with a slight preponderance to the female gender (58.6%). The median duration of diabetes was 6.0 (0.1–47.0) years. The mean (SD) for weight, body mass index (BMI), and waist circumference were 63.1 (11.7) kg, 25.2 (4.2) kg/m^2, and 90.4 (11.5) cm, respectively. Almost all patients were Indonesian (n=1,959, 99.6%), followed by Chinese (n=6, 0.3%) and Malays (n=2, 0.1%). Over 50% of patients had up to 5 or 10 years of formal education, and most (n=1,511, 76.9%) belonged to the middle-income group. Health expenses were mainly borne by government or community hospitals (72.2%), 17.9% by self, and 16.8% by insurance. Half of the patients had a family history of diabetes. More than one-third (n=755, 38.4%) of patients led a sedentary lifestyle, and approximately 10% (n=199, 10.1%) were current smokers.

Control status

Table 1 showed the glycemic control status characteristics. The mean (SD) and median (range) of HbA1c were 8.3 (2.2%) and 7.8% (4.1–19.2%), respectively. Less than one-third of patients (30.8%) achieved the American Diabetes Association (ADA)'s recommendation on HbA1c target of <7%.[23] The mean (SD) and median (range) of FPG were 164.3 (69.2) mg/dl and 145.9 (43.1–584.0) mg/dl, respectively. The mean (SD) and the median (range) of PPG was 226.8 (95.7) mg/dl and 211.0 (65.9–975.0) mg/dl, respectively.

Table 2 showed the control status of blood pressure and lipids. The mean (SD) systolic blood pressure was 131.2 (18.8) mmHg, and the mean diastolic blood pressure was 80.4 (9.8) mmHg. Approximately two-thirds of patients were hypertensive, and 57.1% were receiving antihypertensive medications. The most frequently prescribed antihypertensive agents were calcium channel antagonists (44.0%), angiotensin II receptor blockers (42.8%), and angiotensin-converting enzyme inhibitors (30.8%). Beta blockers were used by 11.4% of patients and diuretics by 7.6%. Other antihypertensive agents were less frequently prescribed (0.8%–3.8%).

The mean (SD) values for lipid parameters were 96.4 (22.5) mg/dl for total cholesterol, 24.1 (12.3) mg/dl for HDL cholesterol, 60.0 (19.1) mg/dl for LDL cholesterol, and 33.0 (19.1) mg/dl for triglycerides levels. Approximately two-thirds of patients had dyslipidemia, with 43.3% receiving lipid-lowering agents. Statins were used by 91.8% of the treated patients and fibrates 9.5%. Other lipid-lowering agents were less frequently prescribed (0.2–1.4%).

Table 1. Glycemic control status characteristics (n=1,967)

Blood glucose parameters	Value
Central laboratory measured HbA1c (%)*	
Mean (SD)	8.3 (2.2)
Median (min–max)	7.8 (4.1–19.2)
HbA1c quantile, n (%)*†	
<7.0%	606 (30.8)
7.0% to <8.0%	407 (20.7)
8.0% to <9.0%	258 (13.1)
9.0% to <10.0%	243 (12.4)
≥10.0%	420 (21.4)
Plasma glucose‡	
FPG (mg/dl)	
Mean (SD)	164.3 (69.2)
Median (min–max)	145.9 (43.1–584.0)
PPG (mg/dl)§	
Mean (SD)	226.8 (95.7)
Median (min–max)	211.0 (65.9–975.0)

All continuous data are presented as mean (SD) and median (range). Percentage (%) values calculated from total non-missing. *Missing values <5%; †HbA1c quantile: < 7.0%=<53 mmol/mol; 7.0% to <8.0%=53 mmol/mol to <64 mmol/mol; 8.0% to <9.0%=64 mmol/mol to 75 mmol/mol; 9.0% to <10.0%=75 mmol/mol to <86 mmol/mol; ≥10.0%=86 mmol/mol; ‡Missing values 10–20%; §Missing values >20%. HbA1c=glycated hemoglobin. FPG=fasting plasma glucose; PPG=postprandial plasma glucose

Table 2. Control status of blood pressure and lipids (n=1,967)

Parameters	Value
Blood pressure	
Systolic (mmHg)*	
Mean (SD)	131.2 (18.8)
Median (min–max)	130.0 (54.0–200.0)
Diastolic (mmHg)*	
Mean (SD)	80.4 (9.8)
Median (min–max)	80.0 (40.0–120.0)
Hypertension, n (%)*†	1,287 (65.4)
Hypertensive medication, n (%)*	1,123 (57.1)
Antihypertensive medication, n (%)*	
Ca2+ channel antagonist	494 (44.0)
Angiotensin II receptor blockers	481 (42.8)
ACE inhibitor	346 (30.8)
Beta blocker	128 (11.4)
Diuretics	85 (7.6)
Alpha blocker	10 (0.9)
Alpha-2-agonist	9 (0.8)
Other	43 (3.8)
Lipids	
Total cholesterol (mg/dl)‡	
Mean (SD)	96.4 (22.5)
Median (min–max)	94.2 (26.1–221.6)
HDL cholesterol (mg/dl)‡	
Mean (SD)	24.1 (12.3)
Median (min–max)	22.3 (5.2–272.1)
LDL cholesterol (mg/dl)‡	
Mean (SD)	60.0 (19.1)
Median (min–max)	58.4 (9.4–175.3)
Fasting triglycerides (mg/dl)‡	
Mean (SD)	33.0 (19.1)
Median (min–max)	28.8 (4.5–229.0)
Dyslipidemia, n (%)*§	1,248 (63.4)
Dyslipidemia medication*	852 (43.3)
Statin	782 (91.8)
Fibrates	81 (9.5)
Ezetimibe	2 (0.2)
Missing	1 (0.1)
Other	12 (1.4)

All continuous data are presented as mean (SD) and median (range). Percentage (%) values calculated from total non-missing. *Missing values <5%; †Hypertension defined as (i) currently taking medication for hypertension, or (ii) systolic blood pressure ≥140, or diastolic blood pressure ≥90 mmHg; ‡Missing values >20%; §Dyslipidemia defined as (i) LDL cholesterol >2.6mmol/l or (ii) HDL cholesterol <1.0mmol/l in males and <1.3 mmol/l in females, or (iii) TG >1.7mmol/l or currently taking medication for dyslipidemia. ACE=angiotensin-converting enzyme; HDL=high-density lipoprotein; LDL=low-density lipoprotein

Diabetes-related complications

Peripheral neuropathy (59.1%), erectile dysfunction (32.4%), eye complications (29.1%), and cardiovascular complications (22.8%) were the most commonly reported complications related to diabetes. Renal and foot complications were the least reported (14.5% and 12.4%, respectively). Cataract (17.3%) and nonproliferative retinopathy (10.5%) were the most commonly reported eye complications. Angina (8.1%), myocardial infarction (7.2%), and left ventricular hypertrophy (6.9%) were the most commonly reported cardiovascular complications. Microalbuminuria (8.8%) and gross proteinuria (8.7%) were the most commonly reported renal complications. The prevalence of foot complications was as follows: healed ulcer (10.0%), active ulcer (3.8%), and amputation (1.5%). The complete prevalence of various diabetes complications observed in this study is shown in Table 3.

Management of diabetes

At study entry, 84.2% were receiving oral antidiabetic drugs (OADs), and 34.7% were receiving

insulin. The median (range) and mean (SD) duration of OAD treatment were 5.0 (0.1–47.0) years and 6.5 (5.8) years, respectively. The median (range) and mean (SD) duration of insulin treatment were 2.0 (0.1–34.0) years and 2.8 (3.4) years, respectively. Biguanides–metformin (77.8%) and sulphonylureas (58.5%) were the most commonly used OADs among treated patients. Other OADs were less frequently prescribed (0.4–1.6%). The most commonly prescribed insulin regimens were basal-bolus (32.4%), twice-daily premix (30.6%), and basal+OAD (18.3%). The median (range) and mean (SD) number of injections per day were 2.0 (1.0–5.0) and 2.6 (1.1), respectively. The median (range) and mean (SD) total daily dose of insulin were 32.0 (1.0–188.0) IU/U and 37.9 (24.1) IU/U, respectively. Insulin was mainly administered by a pen device (95.9%).

More than one-third of patients (38.9%) had performed SMBG over the past year, with median (range) and mean (SD) frequencies of 2.0 (1.0–88.0) times and 4.3 (7.7) times, respectively, in the past month. Of the patients, 38% were evaluated for HbA1c over the past year, with median (range) and mean (SD) testing frequencies of 1.0 (1.0–14.0) times and 1.7 (1.6) times per year, respectively.

In the prevention of diabetes complications, antihypertensive treatment was the most common intervention received by patients for primary and secondary prevention (29.4% and 29.5%, respectively), followed by lipid-lowering treatment (23.3% for both), antiplatelet treatment (17.3% and 14.8%, respectively), and foot ulcer prevention program (4.9% and 4.1%, respectively). Only a small proportion of patients received special care treatments-foot ulcer program (3.5%), special ulcer treatment (1.9%), and extra (special) foot care treatment to avoid amputation (1.6%). Of all patients who had screening data over the past 2 years, (98.3%, 98%, and 98.4% for renal disease, eye disease, and peripheral neuropathy, respectively), 43.0% of patients were screened for diabetic renal disease, 35.9% for eye disease, and 31.5% for peripheral neuropathy. Tables 4 summarize the management of diabetes in the study population.

Table 3. Diabetes-related complications (n=1,967)

Diabetes-related complications	n (%)
Eye complications	
Screened for eye disease within the last two years*	692 (35.2)
Any recorded eye complications	572 (29.1)
Cataract†	341 (17.3)
Background diabetic retinopathy nonproliferative‡	206 (10.5)
Proliferative diabetic retinopathy‡	112 (5.7)
Severe vision loss†	60 (3.1)
History of photocoagulation†	11 (0.6)
Macular edema‡	8 (0.4)
Cardiovascular complications	
Any recorded cardiovascular complications	449 (22.8)
Angina†	159 (8.1)
Myocardial infarction†	141 (7.2)
Left ventricular hypertrophy†	135 (6.9)
Congestive heart failure†	108 (5.5)
Peripheral vascular disease†	80 (4.1)
Stroke§	90 (4.6)
History of a revascularisation procedure (e.g. CABG)§	41 (2.1)
Atrial fibrillation†	8 (0.4)
Renal complications	
Screened for renal disease within the last two years*	833 (42.3)
Any recorded renal complications	285 (14.5)
Microalbuminuria‡	174 (8.8)
Gross proteinuria†	172 (8.7)
End-stage renal disease†	26 (1.3)
Dialysis§	6 (0.3)
Foot complications	
Any recorded foot complications	243 (12.4)
Healed ulcer*	197 (10.0)
Active ulcer*	75 (3.8)
History of amputation*	30 (1.5)
Erectile dysfunction§¶	264 (32.4)
Peripheral neuropathy*	1,163 (59.1)

Percentage (%) values calculated from total non-missing. *Missing values <5%; †Missing values 10–20%; ‡Missing values >20%; §Missing values 5–<10%; ¶Based on the total number of male patients. CABG=coronary artery bypass grafting

Treatment adherence

Patient responses to the treatment adherence questionnaire are summarized in Table 5. A high proportion of patients did not fully adhere to doctors' or nurses' recommendations on self-testing (78.8%), exercise (78.6%), or diet (68.7%). Of the patients, 30% did not fully adhere to scheduled appointments with healthcare professionals and 26.5% to their prescribed medications.

Table 4. Pharmacological diabetes treatments (n=1,967)

Pharmacological diabetes treatments	Value
Currently using antidiabetic therapy, n (%)*	1,656 (84.2)
Current antidiabetic therapy, n (%)*	
Metformin	1,289 (77.8)
Sulphonylurea	968 (58.5)
Glucosidase inhibitor	389 (23.5)
Thiazolidinedione	127 (7.7)
Glinide	20 (1.2)
DPP-4 inhibitor	13 (0.8)
GLP-1 analogue	7 (0.4)
Herbal/traditional medicine	27 (1.6)
Other	17 (1.0)
Currently using insulin, n (%)	683 (34.7)
Insulin delivery, n (%)	
Pen device	655 (95.9)
Vial/syringe	28 (4.1)
Insulin regimens, n (%)†	
Basal-bolus	221 (32.4)
Premix BID	209 (30.6)
Basal+OAD	125 (18.3)
Premix TID	53 (7.8)
Premix OD	14 (2.0)
Others	57 (8.3)
Total daily insulin dose (IU/d)	
Mean (SD)	37.9 (24.1)
Median (min–max)	32.0 (1.0–188.0)

All continuous data are presented as mean (SD) and median (range). Percentage (%) values calculated from total non-missing. *Oral/non-insulin injectable; †Missing values <5%. DPP-4=dipeptidyl peptidase-4; GLP-1=glucagon-like peptide-1; BID=twice a day; OAD=oral antidiabetic drug; TID=thrice a day; OD=once a day

Table 5. Patient responses to treatment adherence questionnaire (n=1,967)

Treatment adherence	n (%)
Diet*	
Completely	598 (30.4)
Partially	869 (44.2)
Rarely	352 (17.9)
Never	129 (6.6)
No recommendation	12 (0.6)
Don't know/refused	1 (0.1)
Exercise*	
Completely	403 (20.5)
Partially	679 (34.5)
Rarely	617 (31.4)
Never	249 (12.7)
No recommendation	14 (0.7)
Taking medications as prescribed*	
Completely	1,440 (73.2)
Partially	400 (20.3)
Rarely	108 (5.5)
Never	13 (0.7)
No recommendation	1 (0.1)
Don't know/refused	1 (0.1)
Testing yourself*	
Completely	379 (19.3)
Partially	504 (25.6)
Rarely	408 (20.7)
Never	640 (32.5)
No recommendation	16 (0.8)
Don't know/refused	14 (0.7)
Keeping appointment's with health care professional*	
Completely	1,351 (68.7)
Partially	426 (21.7)
Rarely	139 (7.1)
Never	28 (1.4)
No recommendation	14 (0.7)
Don't know/refused	3 (0.2)

Percentage (%) values calculated from total non-missing. *Missing values <5%

Hypoglycemia

Patient responses to the hypoglycemia questionnaire are shown in Table 6. Approximately a quarter (23.8%) of patients reported mild hypoglycemia, 3.5% moderate hypoglycemia, and 1.4% severe hypoglycemia in the past 3 months. The corresponding mean (SD) frequencies of hypoglycemic events over the same period were 3.6 (6.1), 3.6 (5.6), and 1.4 (0.7) events, respectively. The corresponding median (range) frequencies of hypoglycemic events over the same period were 2.0 (1.0–48.0), 1.0 (1.0–30.0), and 1.0 (1.0–3.0) events, respectively. One hundred and fifteen patients (5.8%) experienced nocturnal hypoglycemia, with mean (SD) frequencies and median (range) of 3.6 (5.1) events and 2.0 (1.0–30.0), respectively, in the past 3 months.

Among patients who experienced hypoglycemia, 71.3% did not check their blood glucose during an event or only checked it on some occasions. The majority (83.9%) did not visit the hospital during

Table 6. Patient responses to hypoglycaemia questionnaire (n=1,967)

Questions	n (%)	Number of episodes	
		Mean (SD)	Median (min–max)
Hypoglycemia symptoms in the last 3 months			
Mild 'hypo' - Sweating, dizziness, trembling, tingling in the hands, feet or lips, hunger, blurred vision, difficulty in concentrating, palpitations and occasional headache	468 (23.8)	3.6 (6.1)	2.0 (1.0–48.0)
Moderate 'hypo' - Odd behaviour such as rudeness or laughter (appearing drunk when you are not), bad temper or moodiness, aggressive behaviour, confusion	69 (3.5)	3.6 (5.6)	1.0 (1.0–30.0)
Severe 'hypo' - Unconsciousness or help from someone else	27 (1.4)	1.4 (0.7)	1. 0 (1.0–3.0)
Nocturnal 'hypo' - Symptoms between bedtime and breakfast	115 (5.8)	3.6 (5.1)	2.0 (1.0–30.0)
Did you check your blood glucose on these occasions?*			
Always	150 (28.7)		
Sometimes	144 (27.6)		
Never	228 (43.7)		
Did you visit hospital on these occasions?*			
Always	84 (16.1)		
Sometimes	138 (26.4)		
Never	300 (57.5)		
Following an episode, did you*			
Start snacking in between meals to avoid hypo?	452 (86.6)		
Skip or reduce your insulin or tablet dose?	166 (31.8)		
Measure blood glucose frequently for the next few days?	110 (21.1)		
Are you worried about the 'low blood sugar' (Hypo's)			
Yes	781 (39.7)		
No	1,180 (60.0)		

All continuous data are presented as mean (SD) and median (range). *Only for patients reporting hypoglycemia (percentage of all patients reporting hypoglycemia); missing values of all items are <5%

an event or only visited on some occasions. Following an event, 86.6% of patients indicated that they started snacking in between meals to avoid hypoglycemia, 31.8% skipped or reduced their diabetes medications, and 21.1% measured their blood glucose frequently in the next few days. Of the patients, 60% indicated that they were not worried about hypoglycemia.

Psychosocial assessment of people with diabetes mellitus

In general, patients perceived a healthy state of overall well-being, with a mean (SD) EQ-5D visual analog scale score of 75.1 (13.3). The patients reported having pain or discomfort (40.8%), anxiety or depression (26.4%), and limitations in mobility (20.0%), usual activities (14.5%), and self-care (6.3%).

DISCUSSION

This study provided an overview of the current status of diabetes care in T2DM patients in primary, secondary, and tertiary care settings in Indonesia. Diabetes control was unsatisfactory in the study population. Only around one-third of patients achieved the ADA-recommended target for HbA1c and FPG and above the recommended target PPG levels.[23] Hypertension and dyslipidemia were also prevalent and were found in approximately two-thirds of this study population. The mean LDL and triglyceride levels were also above the recommended targets. Further, one-fifth of patients with dyslipidemia did not receive lipid-lowering treatment, and nearly 10% of patients with hypertension did not receive antihypertensive treatment despite having elevated lipid or blood

pressure levels. These findings highlight the need to improve diabetes care to reduce the burden of diabetes and its related chronic conditions.

In this study, a high proportion of patients received OADs (84.2%) and/or insulin (34.7%) treatment. The most frequently prescribed OADs were biguanides and sulphonylureas. Close to two-thirds of patients were receiving basal-bolus insulin treatment or twice-daily premixed insulin. However, despite the majority of patients receiving antidiabetic pharmacotherapy, there remained a large proportion of patients who were above the HbA1c target. Several possible reasons may underlie the suboptimal glycemic control in this study. First, the frequency of HbA1c testing was lower than that recommended by the ADA,[24] with the majority of patients not having measured their HbA1c levels or monitor their blood glucose levels in the past year. Second, a high proportion of patients (26.5%) did not adhere to treatment-related advice (self-testing, exercise, and diet) and a quarter to their prescribed regimens. Third, over one-third of patients led a sedentary lifestyle. These findings emphasize the need to promote frequent HbA1c testing and improve patient adherence to lifestyle modification advice and medication.

The most common diabetes complication found in this study was peripheral neuropathy, which is similar with the finding of several other DiabCare studies such as those conducted in the South-Saharan African countries,[24] India,[25] the Gulf countries,[26] and Malaysia.[27] However, the 59.1% prevalence that we observed in Indonesia is higher than in other studies that ranged between 34.9% and 48.4%. The Indonesian cohort study also displayed a higher prevalence of cardiovascular complications (22.8%) than other studies that have less than 20% prevalence.

In this study, peripheral neuropathy, erectile dysfunction, eye complications, and cardiovascular complications were prevalent. However, the proportions who received interventions for primary or secondary prevention of diabetes complications were low. In addition, >50% of the patients did not participate in screening programs for diabetes complications. Considering the heightened risk of morbidity and mortality associated with the development of diabetes complications, glycemia needs to be maintained at a satisfactory level, and screening programs to identify patients who are at risk should be performed on a regular basis in routine practice.

Patients in this study perceived a healthy state of overall well-being. However, a substantial proportion of patients indicated that they experienced moderate or extreme pain or discomfort. A high proportion of patients did not adhere completely to doctors' or nurses' recommendations on diet, exercise, or self-testing. In addition, over a quarter did not adhere completely to their prescribed medications. Further, close to three-quarters of patients did not check their blood glucose during a hypoglycemic event or only checked it on some of the occasions, and close to one-third skipped or reduced their diabetes medications following an episode to avoid hypoglycemia. These findings indicate that more awareness needs to be created on the importance of adhering to treatment and self-monitoring.

Strategies aimed at helping patients to avoid or cope with hypoglycemia are needed to improve patients' adherence and quality of life. The results of this study may not be directly comparable with that of DiabCare 2008[12] because this is not a prospective, longitudinal study involving the same patient cohort. Further, the study setting was also different for both; the current study included patients from primary, secondary, and tertiary care centers, whereas DiabCare 2008 only included patients from the secondary and tertiary care settings. Nevertheless, the results from both studies provided an indication of the trends in diabetes care since the previous study. Although patients in this study had relatively shorter disease duration (mean: 7.7 *versus* 8.6 years in 2008), the proportions of patients receiving OADs (84.2% *versus* 81.3%) and insulin (34.7% *versus* 37.7%) were similar in both studies, suggesting that patients are starting diabetes treatment earlier. However, despite this, the glycemic status remained unsatisfactory. The mean HbA1c levels (8.3% in 2012 *versus* 8.2% in 2008) and mean FPG levels (164.0 mg/dl in 2012 *versus* 144.1 mg/dl in 2008) remained above the recommended target values. Further, the proportion of patients who were at the recommended target for HbA1c remained to be low (30.8% in 2012 *versus* 32.2% in 2008). These findings indicate that initiatives to improve diabetes control in the country were inadequate. A multi-disciplinary approach, encompassing patient and healthcare personnel education, self-testing, lifestyle changes, and adequate pharmacological treatment are necessary to achieve optimal diabetes management. Although an Indonesian guideline for the management

and prevention of T2DM exists since 1993, adherence to the guideline may be low.[28] Moreover, a lack of adequate training of healthcare providers regarding the management of diabetes also adversely affects the quality and efficiency of diabetes care in Indonesia.

This real-world study had certain limitations. First, this study was not randomized, and therefore, it was not possible to draw conclusions on the impact of treatment on diabetes control. Second, data on treatment adherence, hypoglycemia, and EQ-5D were self-reported, and the estimates may have been subject to recall bias. Third, data stratification of each primary, secondary, and tertiary care is not reported in the manuscript because subanalysis in more detail has not been done on the preparation of this manuscript. Further, because of the retrospective collection of laboratory findings, aside from HbA1c, it was not possible to fully assess the status of glycemic and lipid control in the entire study population.

The status of diabetes control in type 2 diabetes patients in Indonesia remains unsatisfactory, with suboptimal glycemic and metabolic control in the majority of patients. Adherence to treatment advice and management of hypoglycemia is suboptimal. More aggressive efforts are needed to increase awareness of the importance of treatment compliance and achieving guideline-driven treatment goals.

Conflict of Interest

Author, Achmad Rudijanto has received research funds from Novo Nordisk, Sanofi Aventis and Diastika; participated in advisory board of Novo Nordisk, Sanofi Aventis and Ely Lilly; received lecture fees from local Sanofi Aventis, Novo Nordisk, Tanabe, AstraZeneca, and Eli Lilly; and received travel grant from AstraZeneca, Sanofi Aventis and Novo Nordisk. Author, Tjokorda Gde Dalem Pemayun has received speaker fee from Sanofi Aventis, Novo Nordisk, Takeda, MSD, and Eli Lilly; participated in advisory board of Novo Nordisk, Sanofi Aventis, Takeda, MSD and Ely Lilly. Author, Dharma Lindarto has received speaker fee and travel grant from Sanofi Aventis, Novo Nordisk and AstraZeneca. Author, Wismandari Wisnu has received research funds from Novo Nordisk, AstraZeneca and Sanofi Aventis; participated in advisory board of Sanofi Aventis, Novartis, Roche and Ely Lilly; received lecture fees from local Sanofi Aventis, Novo Nordisk, Tanabe, AstraZeneca, Eli Lilly, MSD, Novartis, Roche and Boehringer Ingelheim; and received travel grant from Novo Nordisk, Boehringer Ingelheim, AstraZeneca, Sanofi Aventis, MSD and Abbott. Authors, Poppy Kumala and Happy Helene Sulung Puteri are employees of Novo Nordisk.

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