Prevalence and Predictors of Undiagnosed Diabetes Mellitus in Indonesia

Laurentius A. Pramono*, Siti Setiati**, Pradana Soewondo**, Imam Subekti**, Asri Adisasmita*, Nasrin Kodim*, Bambang Sutrisna*

** Department of Epidemiology, Faculty of Public Health University of Indonesia. Depok 16424, Indonesia.*
*** Department of Internal Medicine, Faculty of Medicine, University of Indonesia - dr. Cipto Mangunkusumo Hospital, Jakarta Pusat 10430, Indonesia.*

Correspondence mail to: *l_aswin@hotmail.com*

ABSTRACT

Aim: *to find the prevalence and prediction factors of undiagnosed diabetes mellitus in an Indonesian adult population. By recognizing the prediction factors, we can make epidemiological modeling and scoring system of undiagnosed diabetes mellitus in Indonesia which can be used as a screening tool in primary health care and health care with minimal diagnostic facility.*

Methods: *cross-sectional design was conducted on subjects from National Health Survey, Ministry of Health Republic of Indonesia 2007. Research population was upper than 18th years old. Diabetes mellitus was diagnosed by oral glucose tolerance test based on WHO 1999 standard which has been adapted by Indonesian Society for Endocrinologist. Subjects were categorized undiagnosed if they were newly diagnosed from the survey.*

Results: *from 24417 subjects who undergo oral glucose tolerance test, we choose 20249 subjects who have complete data on important variables. After eliminating subjects bellow 18 years old, we have 18956 subjects included in the study. Prevalence of undiagnosed diabetes mellitus is 4.1% from total 5.6% of diabetic population in Indonesia. Subjects are included in the analysis is undiagnosed diabetes mellitus subjects (778 subjects) and subjects with normal blood glucose or non-diabetes (16011 subjects). From bivariate analysis, variables age, sex, social economic status, education level, obesity, central obesity, hypertension, physical inactivity, and smoking habit have significant association with undiagnosed diabetes mellitus (p<0,05). From multivariate analysis, we found prediction factors of undiagnosed diabetes mellitus are age, obesity, central obesity, hypertension, and smoking habit.*

Conclusion: *prevalence of undiagnosed diabetes mellitus is 4.1%. Prediction factors of undiagnosed diabetes mellitus in Indonesia are age, obesity, central obesity, hypertension, and smoking habit.*

Key words: *undiagnosed diabetes mellitus, predictors, Indonesian, adult population.*

INTRODUCTION

One of the problems faced by medical professionals nowadays in diabetic management is undiagnosed diabetic mellitus (UDDM). Diagnosis of UDDM is made only based on blood glucose level examination, without any clinical symptoms reported, diagnosis from medical doctor, or previous history of diabetic medication. UDDM patient does not know that he suffers from diabetes. However, the oral glucose tolerance test could indicate the diagnosis of diabetes.[1]

The prevalence of UDDM in United States is 2.4% or equals to 4.9 million people. This number comprises 30% of total number of diabetic patients in the country.[2] Fifty percent of diabetic patients in India are undiagnosed. Mohan et al[3] emphasized that the national health concern and identification plan for this particular problem are needed. UDDM makes people unaware of life style modification, medication, and education. This condition leads to the increasing risk of acute and chronic complication which causes serious impacts to the patient.

UDDM is related to various risk factors. Heikes et al[4] in their study found that factors related to UDDM and prediabetic state are age, waist circumference, history of gestational diabetes (in women), body height and weight, race, hypertension, family history, and sedentary lifestyle. In a cross-sectional study, Harris et al[5] showed that UDDM is related to prevalence of hypertension, obesity, dyslipidemia, and other diabetic complication. In a study aimed to determine risk score for UDDM identification, Mohan et al[3] found important variables such as age, central obesity, sedentary lifestyle, and family history of diabetes. Woolthuis et al[6] concluded in their study that obesity is the best predictor to identify UDDM.

In Indonesia, 4.2% population above 15 years old is categorized as UDDM.[7] This number contributes significantly to the total prevalence of diabetes in Indonesia (5.7%), in which the prevalence of diagnosed diabetes mellitus is 1.5%. The high prevalence of UDDM needs serious concern from all stakeholders such as clinicians, epidemiologists, and health department of the Republic of Indonesia. Mass identification to people with high risk of UDDM is necessary.

The Indonesian government needs to study the predictors of UDDM in its population. Information of the relationship between UDDM and its predictors is needed to determine risk scoring and screening plan. This is the first study conducted in the national level in Indonesian population, which aims to determine the prevalence of UDDM and its predictors. The result of this study is very important to construct epidemiologic model of UDDM, which will further be used particularly to perform screening for population at risk in Indonesia.

METHODS

The study design is cross-sectional. Data are obtained from Basic Health Research Survey of Health Department in 2007 (Riskesdas 2007). This study is performed in The Department of Epidemiology Faculty of Public Health University of Indonesia for four weeks in January 2010.

Study population is all people above 18 years old in Indonesia. Accessible population is population in the data of Riskesdas 2007. The sample in this study is based on inclusion and exclusion criteria.

Inclusion criteria are subjects aged more than 18 years old who are categorized as UDDM based on the data of Riskesdas 2007 and subject with complete data of dependent and independent variables. An exclusion criterion is subjects with incomplete data of dependent and independent variables.

Based on the data of Riskesdas 2007, there are 24.417 subjects undergoing OGTT test. To increase robustness of this study, subjects with complete data of all important variables are included. The important variables are diagnosis of UDDM, age, gender, socio-economic level, education level, obesity, central obesity, hypertension, family history of diabetes, sedentary lifestyle, diet pattern, smoking habit, and accessibility to health care facilities.

To make diagnosis of diabetes, WHO guideline 1999 and American Diabetes Association 2003 adapted by Executive Board of Indonesian Endocrinology Association are used. Diagnosis of UDDM is made if blood glucose level reaches higher than 200 mg/dL after two hours of glucose administration and previously there is no history of diagnosis and treatment of diabetes. These data are further analyzed using SPSS 13.0 with the analysis of univariate, bivariate, and multivariate.

RESULTS

Of 27.417 subjects who underwent OGTT, 20.249 of them have complete data on the status of diabetes diagnosis. Using inclusion criteria, 18.956 subjects aged 18 years old or more are included in this study. The sample can be classified based on diagnostic criteria of diabetes as shown on **Table 1**.

Table 1. Classification of study population based on diagnostic criteria of diabetes

Category of diagnosis	Number (n)	Prevalence (%)
Diagnosed Diabetes Mellitus (DDM)	280	1.5%
Undiagnosed Diabetes Mellitus (UDDM)	778	4.1%
Impaired Glucose Tolerance (IGT)	1887	10.0%
Non-diabetes (normal)	16011	84.5%
Total	18956	100.0%

In order to determine predictors of UDDM, this study compares subjects with UDDM and non-diabetes (normal). Subjects with DDM and IGT are not included. The comparison is necessary to explore the characteristics of subjects with UDDM which differentiate them from non-diabetes population.

The total of study subjects analyzed in this study is 16.789. The next table describes sociodemographic characteristics of the study subjects.

Table 2. Sociodemographic characteristics of study subjects

Characteristics	Number (n)	Percentage (%)
Gender		
- Male	7788	46.4%
- Female	9001	53.6%
Total	16789	100.0%
Age		
- 18-27 years old	5256	31.3%
- 28-37 years old	3964	23.6%
- 38-47 years old	3432	20.4%
- 48-57 years old	2230	13.3%
- > 58 years old	1907	11.4%
Total	16789	100.0%
Socio-economic level		
- Low	6554	39%
- High	10235	61%
Total	16789	100%
Education level		
- High	6376	38.2%
- Low	10295	61.8%
Total	16671	100%

Univariate analysis shows that the study subjects comprises 46.4% male and 53.6% female. Most subjects aged 18-27 years old (31.3%), followed by 28-37 age groups (23.6%). The number of subject with high socio-economic level is higher than low level group (61%). There are more subjects with low education level (61.8%).

Characteristics of study subjects can be categorized into some predictors: obesity, central obesity, hypertension, sedentary lifestyle, diet pattern at risk, smoking habit, and accessibility to health care facilities. The table below shows the characteristics of study subjects based on predictors mentioned above.

Characteristics of study subjects can be categorized into some predictors of UDDM. Percentage of subjects with obesity is 23.1%, while subjects without obesity are 76.9%. subjects with central obesity are 28%, this number shows that the portion of central obesity in this study higher than the number subjects with obesity. Hypertension is suffered by 32.7% of study subjects. Sedentary life style occurs in 27% of subjects while diet pattern at risk is 98.1% subjects. Smoking habit in the study subjects is never smoke (65%), everyday (24.7%), occasionally (6%), and ex-smoker (4.4%). Accessibility to health care facilities is divided into easy (97%) and difficult (3%).

Bivariate analysis explores the relationship between dependent variables and each independent variable. In bivariate analysis, normal subjects (non-diabetes) are used as control (no UDDM) with the reason that this study is intended to compare subjects with and without UDDM.

Based on bivariate analysis, there are some variables which have statistically significant association with UDDM with p value < 0.05. They are gender, age, socio-economic level, obesity, central obesity, hypertension, sedentary lifestyle, and smoking habit. There are two variables do not have statistically significant association: diet pattern at risk (p=0,688) and accessibility to health care facilities (p=0.326). It is possibly caused by high prevalence of lack of vegetable and fruit intake in Indonesia (98.1%) based on cut off point determined. The easiness to access health care facilities is also high (97%). These two factors could possibly make no significant association to UDDM. Change on cut off point can alter the significance of relationship of variables related to UDDM.

Multivariate analysis is necessary to find out predictors of UDDM after controlling other variables. In multivariate analysis, multivariate logistic regression test is used. Variables examined in multivariate model are variables which have p value less than 0.25 in bivariate analysis. Following table shows the analysis result containing coefficient score, standard error, Wald, and p value for epidemiologic model.

Table 3. Characteristics of study subjects based on UDDM predictors

Characteristics	Number (n)	Percentage (%)
Obesity		
- No	12989	76.9%
- Yes	3882	23.1%
Total	16780	100.0%
Central Obesity		
- No	11902	72%
- Yes	4634	28%
Total	16536	100.0%
Hypertension		
- No	11129	67.3%
- Yes	5407	32.7%
Total	16536	100.0%
Sedentary lifestyle		
- No	12264	73.0%
- Yes	4525	27.0%
Total	16789	100.0%
Diet pattern at risk		
- No	311	1.9%
- Yes	16360	98.1%
Total	16671	100.0%
Smoking habit		
- Everyday	4117	24.7%
- Occasionally	992	6%
- Ex-smoker	728	4.4%
- Never smokes	10834	65%
Total	16671	100.0%
Access to health care facilities		
- Easy	16280	97%
- Difficult	509	3%
Total	16789	100.0%

Based on multivariate analysis above, it is seen that significant predictors of UDDM in Indonesian adult population are age, obesity, central obesity, hypertension, and smoking habit. On age variable, the age group used as categorical reference is 18-27 years old. The group of 28-37 years old tends to 2.135 times more likely (OR 2.135 95% CI 1.491-3.056) to suffer UDDM. The age group of 38-47 years old is 4.711 times more likely (OR 4.711 95% CI 3.382-6.562) to have UDDM. The age group of 48-57 years old is 7.160 times more likely (OR 7.160 95% CI 5.117-10.019)to suffer from UDDM,. The group with 58 years old or more is 9.912 times more likely (OR 9.912 95% CI 7.087-13.864) to have UDDM.

On variable of obesity, subjects with obesity is 1.463 times more likely (OR 1.463 95% CI 1.222-1.752) to have UDDM than subjects without obesity. On variable of central obesity, subjects with central

Table 4. Result of bivariate analysis of independent variable to UDDM

		Category				Total	
		Normal (No)		UDDM (Yes)		n	p-value
		N	%	N	%		
Gender	Male	7486	96.1%	302	3.9%	7788	
	Female	8525	94.7%	476	5.3%	9001	**0.000**
Total		16011	95.4%	778	4.6%	16789	
Age	18 – 27	5206	99.0%	50	1.0%	5256	
	28 - 37	3870	97.6%	94	2.4%	3964	
	38 - 47	3235	94.3%	197	5.7%	3432	**0.000**
	48 - 57	2028	90.9%	202	9.1%	2230	
	> 58	1672	87.7%	235	12.3%	1907	
Total		16011	95.4%	778	4.6%	16789	
Socioeconomic level	High	9730	95.1%	505	4.9%	10235	**0.021**
	Low	6281	95.8%	273	4.2%	6554	
Total		16011	95.4%	778	4.6%	16789	
Education	High	6132	96.2%	244	3.8%	6376	**0.000**
	Low	9763	94.8%	532	5.2%	10295	
Total		15895	95.3%	776	4.7%	16671	
Hypertension	No	10830	97.3%	299	2.7%	11129	**0.000**
	Yes	4932	91.2%	475	8.8%	5407	
Total		15762	95.3%	774	4.7%	16536	
Diet pattern at risk	No	15597	95.3%	763	4.7%	16360	0.688
	Yes	298	95.8%	13	4.2%	311	
Total		15895	95.3%	776	4.7%	16671	
Smoking habit	Everyday	3987	96.8%	130	3.2%	4117	
	Occasionally	959	96.7%	33	3.3%	992	**0.000**
	Ex-smoker	669	91.9%	59	8.1%	728	
	Never smokes	10280	94.9%	554	5.1%	10834	
Total		15895	95.3%	776	4.7%	16671	
Accesss	Easy	15521	95.3%	759	4.7%	16280	0.326
	Difficult	490	96.3%	19	3.7%	509	
Total		16011	95.4%	778	4.6%	16789	
Central obesity	No	11517	96.8%	385	3.2%	11902	**0.000**
	Yes	4245	91.6%	389	8.4%	4634	
Total		15762	95.3%	774	4.7%	16536	
Obesity	No	12446	96.5%	452	3.5%	12898	**0.000**
	Yes	3556	91.6%	326	8.4%	3882	
Total		16002	95.4%	778	4.6%	16780	
Sedentary lifesyle	No	11722	95,6%	542	4.4%	12264	**0.029**
	Yes	4289	94,8%	236	5.2%	4525	
Total		16011	95,4%	778	4.6%	16789	

Table 5. Coefficient score, *standard error*, Wald, and p value (*sig*) of variables in model

	Coefficient B	*Standard error*	Wald	p value (*sig*)	OR	95% CI
Constanta	- 5.231	0.167	981.528	0.000	0.005	
Age of 18-27 (categorical reference)						
Age of 28-37	0.758	0.183	17.146	0.000	2.135	1.491-3.056
Age of 38-47	1.550	0.169	84.024	0.000	4.711	3.382-6.562
Age of 48-57	1.969	0.171	131.919	0.000	7.160	5.117-10.019
Age of ? 58 tahun	2.294	0.171	179.548	0.000	9.912	7.087-13.864
No hypertension						
Hypertension	0.549	0.083	43.857	0.000	1.732	1.472-2.037
No obesity						
Obesity	0.381	0.092	17.160	0.000	1.463	1.222-1.752
No central obesity						
Central obesity	0.425	0.092	21.327	0.000	1.529	1.277-1.831
Smoker (categorical reference)						
Ex-smoker	0.511	0.163	9.898	0.002	1.668	1.213-2.293
Never smoking	0.393	0.096	16.665	0.000	1.481	1.227-1.789

obesity are 1.529 times more likely (OR 1.529 95% CI 1.277-1.831) to suffer from UDDM. On hypertension variable, subjects with hypertension are 1.732 times more likely (OR 1.732 95% CI 1.472-2.037) to have UDDM than subjects without hypertension.

On smoking habit, the smokers (everyday and occasionally) used as categorical reference. Ex-smoker is 1.668 times more likely (OR 1.668 95% CI 1.213-2.293) to have UDDM, while never-smoking persons are 1.481 times more likely (OR 1.481 95% CI 1.227-1.789) to suffer from UDDM. Constanta obtained from multivariate analysis is -5.231.

After explaining the result of multivariate analysis, the next step is to calculate the epidemiologic model of UDDM predictors. Epidemiologic model of UDDM predictors in adult population of Indonesia is shown in the box below.

Probability to have UDDM in adult population of Indonesia:

$$\frac{1}{1 + e^{-(F)}}$$

Notes:

F = -5.231 + 0.758 (Age of 28-37) + 1.550 (Age of 38-47) + 1.969 (Age of 48-57) + 2.249 (Age ≥ 58) + 0.549 (Hypertension) + 0.511 (Ex-smoker) + 0.393 (Never smoking) + 0.425 (Central obesity) + 0.381 (Obesity)

DISCUSSION

There are some limitations in this study: absence of family history in the data of Riskesdas 2007, incomplete data of some important variables, and tendency of inter-observer bias because data collection is performed by more than one person. The absence of family history of diabetes is a significant weakness. Valdez mentioned that family history is an important non-invasive variable in the screening questionnaire of UDDM.[8] This weakness limits the completeness of epidemiologic model of UDDM in Indonesia.

Nevertheless, this study has some strength. The data are obtained from Riskesdas 2007 which covers 33 provinces in Indonesia, which means this study utilizes national level data. Furthermore, epidemiologic model acquired in this study is a model with non-invasive examination. Thus, this model can be used as a screening tool due to its effectiveness and efficiency. Mass screening can use this model, either in rural or urban area.

Other epidemiological study in Indonesia shows more specific variables such as lipid profile (prevalence and related factors of dyslipidemia) or prediabetic state, which is very useful to describe specific condition in Indonesian diabetes patients.[9,10] But, the population of these studies is smaller than recent study because only covering an area in Jakarta (urban) and Depok, West Java (semi-urban). Using national data will generate the result of study; especially can be used in areas with minimal diagnostic facilities, so it can be very useful for screening tools.

Prevalence of UDDM in Adult Population of Indonesia

In this study it is revealed that the prevalence of UDDM in adult population of Indonesia is 4.1% from total diabetes prevalence of 5.6%. The prevalence of 4.1% is very high because its proportion to total diabetic adult patient is 73.2%. These numbers have a slight different with Mihardja's study because of the different operational definition of the study.[11] Similar number was found by Ramachandran et al in India.[12] They stated that 70% of diabetes patients in India are undiagnosed. Other Mohan mentioned that 50% of diabetic patients in India are not aware of their disease. This condition leads to high burden of medication cost because at the time of diagnosis the patient already have one or more complication.

In developed countries such as the United States, proportion of UDDM is 30% which shows lower prevalence of UDDM than India and Indonesia.[2] In 1998, Harris et al found that the prevalence of UDDM is 2.7%, while the prevalence of DDM is 5.1%.[13] Therefore, the proportion of UDDM from total diabetic patients in US is 34.6%. According to a study performed by Young et al, prevalence of UDDM in Canada is 2.2%, comprising 33.3% of total diabetic patient in this country.[1] This condition is due to high quality of health service in these countries. Furthermore, the education level is quite high which makes people aware to do health examination.

Samuel et al stated that the lateness or unawareness of diabetes diagnosis is caused by some factors which can be classified as environment and human resources.[14] The factors are health care facilities in a district or country, skill and knowledge of clinicians or public health experts, and accessibility and acceptability of the people to the diagnostic tools.

Predictors of UDDM in Adult Population in Indonesia

Multivariate analysis reveals some variables that can be included in epidemiologic model of UDDM. The variables are age, obesity, central obesity, hypertension, and smoking habit. All five variables are predictors of UDDM in adult population (above 18 years

old) in Indonesia. Other six variables (gender, socio-economic level, education level, diet pattern at risk, sedentary lifestyle, and accessibility to health care facilities) are not included in the predictor model of UDDM although bivariate analysis shows that gender, socio-economic level, education level, and sedentary lifestyle have statistical significance ($p<0.05$) to UDDM. Variable controlling in multivariate analysis shows that these variables do not have statistical significance to predict UDDM.

Table 6. Statistically significant variables for UDDM in Indonesia

Variable Category	Variable	Remarks
Not significant in bivariate analysis	Risky diet patterns Access to health services	
Significant in bivariate analysis	Sex Age Socio-economic status Education level Obesity Central Obesity Hypertension Physical inactivity Smoking Habit	
Significant in bivariate analysis	Age Obesity Central Obesity Hypertension Smoking Habit	Included in the UDDM prediction model of adult age population in Indonesia

The UUDM prediction model obtained in this study has similarities and differences from prediction models obtained by other researchers abroad (using other populations).

UDDM Predictor Epidemiologic Model of Adult Age Population in Indonesia

Based on multivariate logistic regression analysis, a UDDM predictor epidemiologic model of adult age population in Indonesia is obtained. Using that model, clinician, researcher, or other health personnel can predict the probability of a subject having UDDM.

Example: the probability of Mr. X, 50 years old, an ex-smoker with hypertension and central obesity, having UDDM is as follows:

Answer: *F = -5.231 + 1.969 (1) + 0.549 (1) + 0.511 (1) + 0.425 (1) = - 1.777*

Probability or chance of UDDM in Mr. X:

$$\frac{1}{1 + e^{-(-1.777)}}$$

Using the calculation above, the probability of Mr. X having UDDM is 14.47%.

Then, for the use of referring to health personnel (clinician), a cut-off point probability where a subject should be referred should be determined. That means the subject has a probability of having UDDM above the average of normal population, so he needs to undergo diagnostic examination based on anamnesis, physical examination, and laboratory in a healthcare service.

To obtain an accurate cut off point that produces high validity and reliability, further research should be done in the form of screening test on certain population (with adequate number of samples). In a series of screening test, some probability with cut off point that gives the highest validity result based on the gold standard (in this case, fasting blood glucose test or oral glucose tolerance test) is determined.

UDDM Scoring System of Adult Age Population in Indonesia

Based on multivariate analysis and epidemiologic model obtained, a scoring system to ease the public in using this screening tool is developed.

Table 7. UDDM scoring system of adult age population in Indonesia

Variable	Category	Score
Age	18-27 years old	0
	28-37 years old	2
	38-47 years old	8
	48-57 years old	13
	? 58 years old	18
Obesity	Obesity	2
Central obesity	Central obesity	2
Hypertension	Hypertension	4
Smoking habit	Smoker	0
	Ex-smoker	1
	Non-smoker	2
Maximum score		**28**
Minimum score		**0**

The next step is to find a cut-off point total score that gives the highest sensitivity and specificity value towards UDDM incidence. The best cut off point is a total score that best differentiate between UDDM subjects or normal subjects based on the calculation of predicting factors total score. In practice, the best cut-off point is determined by plotting sensitivity and specificity in a receiving operator characteristic (ROC) curve. The best cut-off point is given by the total score that gives the highest area under the curve (AUC) value. Table 8 below explains all cut-off point candidates along with their sensitivity and 1-specificity. In this table, it cannot be determined which cut-off point gives the largest AUC.

Table 8. Cut off point, sensitivity, and 1-specificity

Cut off point	Sensitivity	1-Specificity
-1.0000	1.000	1.000
.5000	.988	.988
1.5000	.986	.986
2.5000	.951	.909
3.5000	.951	.903
4.5000	.888	.726
5.5000	.871	.719
6.5000	.786	.649
7.5000	.778	.646
8.5000	.693	.547
9.5000	.686	.542
10.5000	.597	.453
11.5000	.597	.452
12.5000	.575	.405
13.5000	.556	.367
14.5000	.527	.321
15.5000	.497	.274
16.5000	.490	.262
17.5000	.457	.223
18.5000	.415	.187
19.5000	.340	.141
20.5000	.309	.118
21.5000	.278	.103
22.5000	.222	.077
23.5000	.156	.058
24.5000	.101	.031
25.5000	.101	.030
26.5000	.057	.016
27.5000	.052	.015
29.0000	.000	.000

To know which cut-off point gives the largest AUC (AUC=64%) from the ROC curve, an intersecting curve between sensitivity and specificity (ordinate) is made based on the cut-off point candidate axis (UDDM prediction total score).

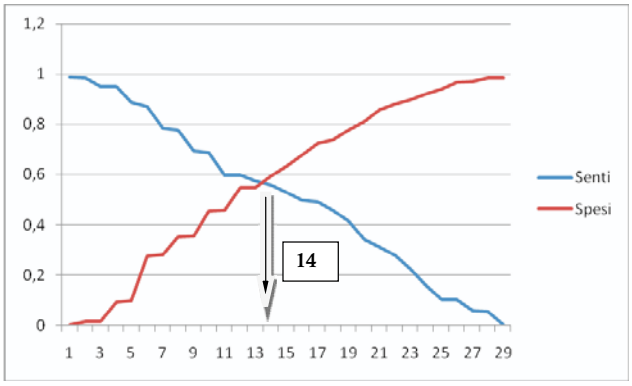

Figure 1. Sensitivity and specificity intersection curve

Remarks:
X Axis: total score (cut-off point candidate)
Y Axis: sensitivity and specificity value
Intersection point of sensitivity and specificity: the cut-off point that gives the largest AUC

In the curve, it can be seen that the intersection between sensitivity and specificity is at the cut off point of total score 14. This means total score of 14 is the best limiting value to differentiate between UDDM subject and normal subject. Subjects that have a total score ≥14 have a high probability of having UDDM, so they are suggested to be reffered to healthcare services to undergo more accurate examination (anamnesis, physcial examination, and laboratory). Meanwhile, subjects with a total score of <14 have a low probability of having UDDM.

Further studies to use the screening test design on certain population to test validity, reliability, and efficacy of this epidemiologic model should be done. The epidemiologic model and scoring system that is obtained can be used as a screening tool for the public in primary healthcare services. Furthermore, socialization of predicting factors and UDDM epidemiologic model should be given to healthcare personnel, academician, researcher, policy maker, and the public. Through socialization of this model, there is a chance to use this model to screen the population extensively with certain characteristics, for example remote areas, or areas that do not have any laboratory facilities.

In the end, the attention of clinicians, academicians, researchers, and the public should be increased toward degenerative diseases as a whole, and especially toward diabetes. In this case, a national awareness on the diabetes pandemic in the future should be conducted, from primary to tertiary healthcare services, and policy makers.

CONCLUSION

The prevalence of UDDM in the adult age population of Indonesia is 4.1% of the 5.6% total prevalence of diabetes of the adult age population in Indonesia. UDDM predicting factors of adult age population in Indonesia are variables that are significant in multivariate analysis, namely age, obesity, central obesity, hypertension, and smoking habit.

Old age (≥58 years old) is the most important predicting factor for adult age population in Indonesia after controlling the obesity, central obesity, hypertension, and smoking habit variables. The older the subject is, the bigger the probability of having UDDM. In subject that has obesity, central obesity, or hypertension, his probability of having UDDM gets bigger. Ex-smokers and subjects who never smoke (combined into non-smoker) have a higher probability of having UDDM compared to smoking subjects. This is connected to the health disorders experienced by smokers that bring them to healthcare services to get a diagnosis of their health disorders including diabetes mellitus.

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