

Attainment of Treatment Targets in Patients with Diabetes

ประสิทธิภาพการดูแลผู้ป่วยเบาหวาน

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ABSTRACT

Objective: To determine the quality of our diabetes care, the degree of attainment goals and to determine factors associated with reduced achievement of these recommendations in diabetes patients.

Material and Method: We conducted retrospective review medical records of diabetes patients who were follow-up at out-patient department of internal medicine department, Ratchaburi Hospital, Thailand during October 2008 to September 2009. Demographic data, clinical status of diabetes and its complications were collected and analyzed for the quality of our new diabetes care.

Results: Of 2,273 diabetes patients who were recruited, 80% had received HbA1C and plasma lipid profiles measurement, respectively, whereas blood pressure measurement was done in all patients. Fifty-seven percent achieved the target HbA1C of less than 7%, 62% achieved LDL-C target, whereas 52.5% of the patients achieved the BP target recommendation. Only 16.6% of the patients were achieving all 3 "ABC" goals (HbA1C, blood pressure, LDL-cholesterol) and 54% achieved at least 2 items (achieved group). The rate of foot examination was highest at 72.4%, followed by retinal examination (69%). Urine microalbumin level was measured in 61.1%. 1,513 (66.5%) patients who attended new diabetes care had all clinical data better than those who attended usual care, only the lower level of FPG, diastolic blood pressure (DBP), and LDL-C had statistical significance. Also, the attending new diabetes care had been achieved group and screened diabetic retinopathy and urine microalbumin more than another. The patients who were achieved group had significant difference in lower rate of DN and DR (18.3% vs. 26.0%, $p = 0.002$, 14.5% vs. 22.3%, $p = 0.000$, respectively).

Conclusion: The proportion of attainment goals and proper diabetic complication assessment can improved by our new diabetes care targeting the system of chronic disease management, clinical reminder, and enhanced patient education.

Keywords: ADA practice recommendation, quality of diabetes care

บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาประสิทธิภาพการดูแลรักษาผู้ป่วยเบาหวานใน โรงพยาบาลราชบุรี ตามแนวทางการรักษาของสมาพันธ์เบาหวานแห่งสหรัฐอเมริกา

วัสดุและวิธีการ: เป็นการศึกษาแบบ retrospective โดยทบทวนเวชระเบียนของผู้ป่วยเบาหวาน ที่ติดตามการรักษาที่แผนกผู้ป่วยนอกอายุรกรรม โรงพยาบาลราชบุรี ในช่วงปีงบประมาณ 2552 คือ 1 ตุลาคม พ.ศ. 2551 ถึง 30 กันยายน พ.ศ. 2552 มีการเก็บข้อมูลด้านประวัติ, การตรวจร่างกายและ การตรวจเลือดเพื่อหาประสิทธิภาพในการดูแลรักษาโรคเบาหวานและความผิดปกติที่พบร่วม หลังจากการพัฒนากระบวนการดูแลผู้ป่วยเบาหวาน

ผลการศึกษา: ผู้ป่วยเบาหวาน 2,273 คน ที่ทำการศึกษาพบว่าร้อยละ 80 ได้รับการตรวจระดับฮีโมโกลบินเอวันซี และระดับไขมันในเลือดในช่วง 1 ปีที่ทำการศึกษา ตามลำดับ ในขณะที่ผู้ป่วย ทุกคนได้รับการวัดความดันเลือด ผู้ป่วย ร้อยละ 57 มีระดับฮีโมโกลบินเอวันซีน้อยกว่า 7 ควบคุมระดับไขมันโคเลสเตอรอล LDL ได้ร้อยละ 62 และควบคุมระดับความดันเลือดย้อยละ 52.5 โดยพบว่าผู้ป่วยสามารถควบคุมทั้งสามเป้าหมายมีเพียงแค่อ้อยละ 16.6 และกลุ่มที่เรียกว่าบรรลุเป้าหมาย คือ ผู้ป่วยที่สามารถควบคุมอย่างน้อยสองในสาม เป้าหมายมีถึงร้อยละ 54 อัตราการตรวจหาภาวะแทรกซ้อนมากที่สุดคือการตรวจเท้าพบร้อยละ 72.4 รองลงมาคือการตรวจจอประสาทตาร้อยละ 66.5 ผู้ป่วยเบาหวาน 1,513 คน หรือร้อยละ 66.5 ได้รับการดูแลรักษาด้วยระบบใหม่ที่พัฒนาขึ้นมาทำให้สามารถควบคุมได้ตามเป้าหมายมากกว่ากลุ่มที่ได้รับการดูแลรักษาตั้งเดิมโดยเฉพาะการควบคุมระดับน้ำตาลขณะอดอาหาร ความดันเลือดไดแอสโตลิก ไขมันโคเลสเตอรอล LDL และมีจำนวนที่บรรลุเป้าหมายมากกว่าอย่างมีนัยสำคัญสถิติ รวมถึงมีการตรวจค้นหาภาวะแทรกซ้อนในระบบหลอดเลือดเล็กมากกว่าอย่างมีนัยสำคัญทางสถิติ กลุ่มผู้ป่วยเบาหวานที่บรรลุเป้าหมายได้มีความชุกของโรคแทรกซ้อนในระบบหลอดเลือดเล็กที่ไตและตาน้อยกว่ากลุ่มที่ไม่บรรลุเป้าหมายอย่างมีนัยสำคัญทางสถิติ

สรุป: การพัฒนาระบบการดูแลผู้ป่วยเบาหวานทั้งโครงสร้าง แพทย์ที่ดูแลรักษา และการให้ความรู้ผู้ป่วยเบาหวาน สามารถช่วยให้การดูแลผู้ป่วยเบาหวานได้บรรลุเป้าหมายและมีการตรวจค้นหาภาวะแทรกซ้อนที่เหมาะสม

คำสำคัญ: แนวทางการรักษาของสมาพันธ์เบาหวานแห่งสหรัฐอเมริกา, คุณภาพการดูแลเบาหวาน

Introduction

Diabetes affects around 7% of the Thai population and has reached epidemic proportions.¹ Patients with diabetes mellitus have high incidence of macrovascular and microvascular complications. Randomized trials that investigated the effect of intensified intervention involving risk factors in patient with diabetes demonstrated benefits in terms of macrovascular and microvascular complications.²⁻⁶

Both international and regional guidelines recommend treatment targets for diabetes man-

agement. However, national audits reported low rates of adherence to monitoring processes and poor attainment of these targets.⁷⁻⁸ Changing of the system care is necessary to improve the quality diabetes care.

Ratchaburi Hospital is a tertiary care in the west side of Thailand. Almost 5,000 diabetes patients have been attended the out-patient department (OPD) of the medicine department each year. We initiated the new diabetes care system in 2007. These consist of multidisciplinary health care

team of diabetes, case coordinators, clinical reminders, and enhanced patient education. The multidisciplinary team is medicine, surgery, rehabilitation, ophthalmologist, diabetes-trained nurse, and nutritionist care our patients. Case coordinators who enhance disease management by facilitating communication and coordination among providers, subspecialists, and other team members are filled by medicine and diabetes-trained nurses. Medicines see patients after they took diabetes education classes that emphasize calories-count diet, exercise, oral and injectable medications and microvascular and macrovascular complications of diabetes. A clinical reminder is the flow sheet added to the OPD card. They help clinicians comply with specific performance measures and guidelines in an effort to help improve patient care. Data from each visit are recorded on a flow sheet that stays with the patient's chart to allow easy review of laboratory data, screening tests, and medication. Also, we have applied our new software to collect the data. The objectives of this study were to identify the quality of our diabetes care, the degree of attainment goals and to determine factors associated with reduced achievement of these recommendations in diabetes patients.

Material and Method

Population and Sampling

From 5,000 diabetic patients who had attended internal medicine OPD Ratchaburi Hospital during October 2008 to September 2009, we randomly chose the one had two or more visits during that period. 2,273 diabetes patients were included in this

study. The computer-based data of each patient were reviewed.

General characteristics including age, sex, type of diabetes, duration of diabetes, and attending our new diabetes care. This system is composed of multidisciplinary health care teams of diabetes, case coordinators, diabetes education classes, clinical reminders. Primary data for patients included body weight, height, blood pressure (BP), dilated eye examination by ophthalmologists, foot examination, random fasting plasma glucose (FPG), the most recent hemoglobin A1C (HbA1C), lipid profile, and urine microalbumin. Data of diabetic complications could be assessed from the flow sheet. First, diagnosis of retinopathy was reported from ophthalmologists. Second, albuminuria was diagnosed if a spot urine microalbumin/creatinine ratio was ≥ 0.030 mg/mg that was confirmed by elevated levels in two of three collections. Finally, peripheral neuropathy was diagnosed if the patient failed the standard 10-g filament test.

Patients were stratified according to the number of targets attained: HbA1C $< 7\%$, BP $< 130/80$ mmHg, and low density lipoprotein-cholesterol (LDL-C) < 100 mg%, according to the American Diabetes Association recommendation.⁹ Patients who attained at least 2 items were defined as "achieved", while patients who met only 0-1 item of clinical recommendation were defined as "not -achieved".

Statistical analysis

Demographic data were expressed as means. Statistical analysis was carried out with SPSS

software, version 11.5. Comparisons between groups were analyzed by unpaired t-test, chi-square test, where appropriate. Statistical significance was declared if p-value was less than 0.05.

Results

A total of 2,273 patients were included in the study, and 66.3% were female. Patients had an average age of 63 ± 11.4 years. Most of the subjects (60.2%) were obese, and the mean body mass index (BMI) was 27 ± 4.8 kg/m². The majority (97.1%) of the patients were diagnosed as having type 2 diabetes mellitus (T2DM), and the rest were type 1 diabetes mellitus (T1DM) 2.6%. Only 6 cases (0.3%) were other type. The mean duration of diabetes was 8.52 ± 5.24 years, and 35.9% had diabetes for more than 10 years as shown in Table 1.

According to the American Diabetes Association (ADA) guideline of metabolic control for diabetes patients, the mean fasting plasma glucose level was 132 ± 38.5 mg/dl and 48.7% of the subjects had FPG 70-130 mg/dl. Almost of patients (97.3%) had received HbA1C measurement during the study period. Fifty-seven percent achieved the target HbA1C of less than 7%, while mean HbA1C was $7.12 \pm 1.4\%$ as shown in Fig.1. Nearly 20% of the patient had HbA1C of more than 8%. Only 80% of the patients had received measurements of plasma lipid profiles during the study period. The finding was more favorable for LDL-C less than 100 mg/dl, 62% of the patients achieved. The average of LDL-C was 96.8 ± 43.6 mg/dl. In contrast to HbA1C and lipid measurements, BP was measured all of the

patients. The mean of BP was $129 \pm 12/75 \pm 10$, and only 52.5% of them had BP achieved the target. Of 2,273 patients, 378 (16.6%) patients achieved all of three clinical recommendations, and 15.8% of them did not achieve any recommendations. As shown in Fig.2, fifty-four percent of them achieved at least 2 items (achieved group) and forty-six percent of them achieved only 0-1 item (not achieved group).

Screening studies in most patients approached ADA guidelines. The rate of documented foot examinations at the most recent visit was highest at 72.4% of patients, followed by dilated eye examination within the study period (69%). Urine microalbumin screening was performed least frequently, with measurements within that period in 61.1% of patients as shown in Fig. 3.

Table 2 compared each clinical data between attending new diabetes care and usual care. 1,513 (66.5%) patients who attended new diabetes care had all clinical data better than those who attended usual care, only the lower level of FPG, diastolic blood pressure (DBP), and LDL-C had statistical significance. Also, the attending new diabetes care had been achieved group and screened diabetic retinopathy and urine microalbumin more than another as shown in Fig.4.

Many patients had microvascular complications from their diabetes. A total of 22.3% had diabetic nephropathy (DN), 18.2% had diabetic retinopathy (DR), and 3.2% had peripheral neuropathy. The prevalence of DN and DR were lower in the attending new diabetic care than another. As shown in Fig.5, the patients who achieved at least 2 targets had significant difference in lower rate of DN and

Table 1 Characteristics of adults aged ≥ 15 years with diabetes.

Characteristic	n	Mean \pm S.D. or proportion
Age (mean years) (%)	2,273	63 \pm 11.4
15-30		0.5
31-40		1.8
41-50		9.9
51-60		28.1
61-70		31.3
> 70		28.4
Sex (% female)	2,273	66.3
BMI (kg/m ²)	2,273	27 \pm 4.8
< 25		39.8
≥ 25		60.2
Type of diabetes	2,273	
T1DM		2.6
T2DM		97.1
Others		0.3
Duration of diabetes (years)	2,273	8.5 \pm 5.2
0-4.9		23.7
5-9.9		40.3
≥ 10		35.9

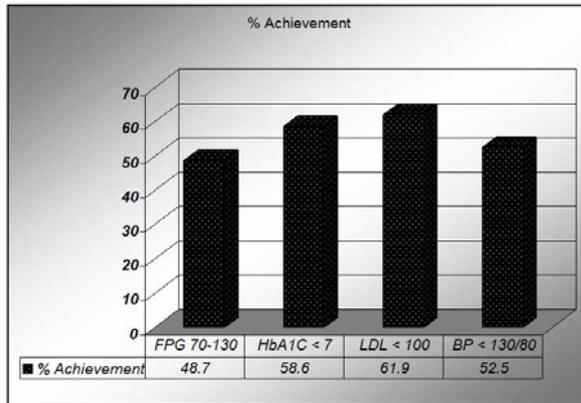


Fig.1 Percent achievement of metabolic control according to the ADA guideline 2007.

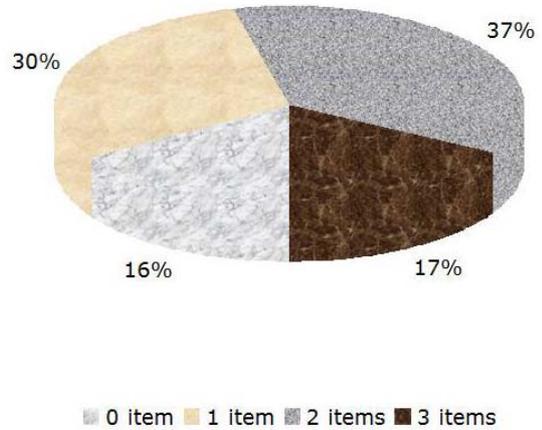


Fig.2 Number (%) of patient achieving each ADA clinical recommendations

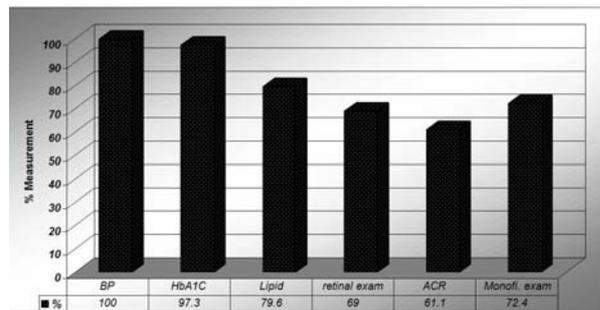


Fig.3 Percent of measurement clinical recommendation and screening complications.

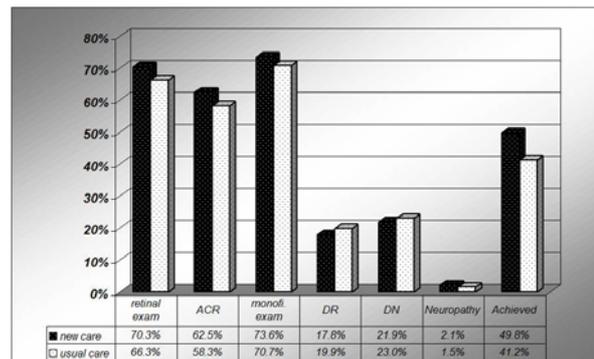


Fig.4 Prevalence for screening microvascular complications, microvascular complications, and achieved group by attending new diabetic care and usual care. *is meaning p-value less than 0.05. **is meaning p-value less than 0.01.

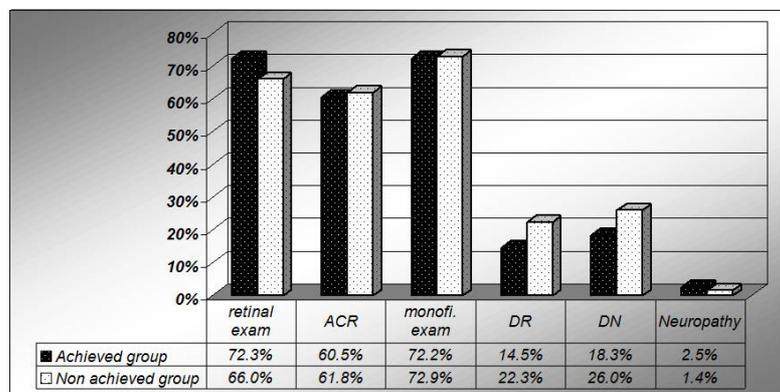


Fig.5 Prevalence for screening microvascular complications, and microvascular complications by achieved group. *is meaning p-value less than 0.05. **is meaning p-value less than 0.01.

Table 2 between attending diabetic education and not attending diabetic education group.

	Attending new diabetic care		P-value
	Yes	No	
BMI	26.59	26.61	0.933
FPG	137.14	143.70	0.000**
HbA1C	6.98	8.09	0.192
SBP	128.38	129.04	0.226
DBP	74.10	75.36	0.003**
LDL-C	95.40	100.84	0.019*

DR (18.3% vs. 26.0%, $p = 0.002$, 14.5% vs. 22.3%, $p = 0.000$, respectively).

Discussion

After 2007, we have improved strategies on the management of diabetes such as multidisciplinary health care team, case coordinators, flow sheets, diabetes educators, and electronic system to collect the data. It's the first time to demonstrate the quality of our diabetes care. More than 80% of diabetes patients had HbA1C and lipid assessments yearly, and about 60-70% received annual eye, urine, and foot examination. According to ADA clinical practice recommendation, the percentage of patients achieving each of the HbA1C levels below 7%, blood pressure target of less than 130/80 mmHg, or LDL cholesterol less than 100 mg/dL were more than 50%. Here, the proportions have more improvement than the study of Thailand Diabetes Registry (TDR) project in 2003⁸, and the study by

Sriwijitkamol A, et al. in 2006¹⁰, according to the tertiary care medical centers. 54% of the patients were achieving at least 2 "ABC" goals (HbA1C, blood pressure, cholesterol).

66.5% of diabetes patients who took care with new diabetes care had more proportion of achieved group than another significantly. Also, they received more proper diabetic retinopathy and diabetic nephropathy assessments. Only the achieved group had lower rate of diabetic retinopathy and diabetic nephropathy than another significantly. It's similar as the nonclinical trial setting in Chinese patients with type 2 diabetes, the importance of achieving treatment goals and periodic monitoring of renal parameters for prevention and intensified therapy.¹¹ Reaching more treatment targets was associated with reduced risk of new onset of coronary heart disease. Patients who received proper diabetic complication assessment had a lower rate of diabetic complication especially cardiovascular complication.¹²

A recent study has demonstrated that screening for diabetic nephropathy, followed by optimized treatment resulted in a 44% reduction of the incidence of ESRD.¹³ Similar several studies showed that assessment for diabetic complications in type 2 diabetes can improve clinical outcomes and cost effectiveness.¹⁴⁻¹⁷ In the Steno-2 study demonstrated that a target-driven, long-term, intensified intervention aimed at multiple risk factors in patients with type 2 diabetes and microalbuminuria reduces the risk of cardiovascular and microvascular events by about 50 percent⁶. This intervention had sustained beneficial effects with respect to vascular complications and on rates of death from any cause and from cardiovascular causes.¹⁸ A previous study of Sriwijitkamol A, et al.¹⁰ showed that health care providers were independent factor for attainment of clinical practice recommendation. The gap between ideal and actual care is high in view of the complex nature of diabetes management. Obstacles including lifestyle habits, lack of comparative effectiveness data, poor adherence, and economic pressures contribute to increased incidence of type 2 diabetes and nonattainment of treatment goals for patients afflicted with it.¹⁹ Interventions targeting the system of chronic disease management, health-care professionals along with patient-mediated quality improvement strategies should be an important component of interventions aimed at improving diabetes management.²⁰⁻²² The implementation of multidisciplinary health care team of diabetes, case coordinators, clinical reminders for diabetes care and enhanced patient education can help our diabetes patients to achieve more treatment targets

and proper diabetic complication assessments.

Foremost among the limitations of the present study is the retrospective reviews of medical record. It is possible that some information were absent. Moreover, the prevalence of diabetic complications may be understated because of unscreened cases. Further assessments should focus on the effect of our new diabetes care to microvascular and macrovascular outcomes in long term study.

In conclusion, this study demonstrates that proportion of attainment goals and proper diabetic complication assessments can be improved by our new diabetes care targeting the system of chronic disease management, clinical reminder, and enhanced patient education.

References

1. Aekplakorn W, Charialertsak S, Kessomboon P, et al. Prevalence and management of diabetes and metabolic risk factors in Thai adults: the Thai National Health Examination Survey IV, 2009. *Diabetes Care*. 2011;34(9):1980-5.
2. The effect of intensive treatment of diabetes on the development and progression of long-term complication in insulin-dependent diabetes mellitus. The Diabetes Control and Complications Trial Research Group. *N Engl J Med*. 1993;329: 977-86.
3. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. *Lancet* 1998;352:837-53.

4. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. UK Prospective Diabetes Study Group. *BMJ*. 1998;317:703-13.
5. Pyorala K, Padersen TR, Kjekshus J, et al. Cholesterol lowering with simvastatin improve prognosis of diabetic patients with coronary heart disease; a subgroup analysis of the Scandinavian Simvastatin Survival Study (4S). *Diabetes Care*. 1997; 20:614-20.
6. Gaede P, Vedel P, Larsen N, et al. Multifactorial intervention and cardiovascular disease in patient with type 2 diabetes. *N Engl J Med*. 2003;348: 383-93.
7. Resnick HE, Foster GL, Bardsley J, et al. Achievement of American Diabetes Association clinical practice recommendations among U.S. adults with diabetes, 1992-2002: the National Health and Nutrition Examination Survey. *Diabetes Care*. 2006;29:531-7.
8. Rawdaree P, Ngarmukos C, Deerochanawong C, et al. Thailand diabetes registry (TDR) project: clinical status and long term vascular complications in diabetic patients. *J Med Assoc Thai*. 2006;89 (suppl 1):S1-9.
9. American Diabetes Association. Standards of medical care in diabetes 2007. *Diabetes Care*. 2007;30 (suppl 1):S4-41.
10. Sriwijitkamol A, Mounngern Y, Vannaseang S. Attainment of American Diabetes association clinical practice recommendations in 722 Thai type 2 diabetes patients. *J Med Assoc Thai*. 2011;94 (suppl 1):S159-67.
11. Kong AP, Yang X, Ko GT, et al. Effects of treatment targets on subsequent cardiovascular events in Chinese patients with type 2 diabetes. *Diabetes Care*. 2007;30(4):953-9.
12. Sriwijitkamol A, Mounngern Y, Vannaseang S. Assessment and prevalences of diabetic complications in 722 Thai type 2 diabetes patients. *J Med Assoc Thai*. 2011;94 (suppl 1):S168-74.
13. Palmer AJ, Valentine WJ, Chen R, et al. A health economic analysis of screening and optimal treatment of nephropathy in patients with type 2 diabetes and hypertension in the USA. *Nephrol Dial Transplant*. 2008;23:1216-23.
14. Chow I, Lemos EV, Einarson TR. Management and prevention of diabetic foot ulcers and infections: a health economic review. *Pharmacoeconomics*. 2008;26:1019-35.
15. Javitt JC, Aiello LP. Cost-effectiveness of detecting and treating diabetic retinopathy. *Ann Intern Med*. 1996;124:164-9.
16. Maberley D, Walker H, Koushik A, et al. Screening for diabetic retinopathy in James Bay, Ontario: a cost-effectiveness analysis. *CMAJ*. 2003;168: 160-4.
17. McCabe CJ, Stevenson RC, Dolan AM. Evaluation of a diabetic foot screening and protection program. *Diabet Med*. 1998;15:80-4.
18. Gaede P, Anderson HL, Parving HH, et al. Effect of multifactorial intervention on mortality in type 2 diabetes. *N Engl J Med*. 2008;358:580-91.
19. Kogan AJ. Overcoming obstacles to effective care of type 2 diabetes. *Am J Manag Care*. 2009;15 (9 suppl); s255-62.
20. Tricco AC, Ivers NM, Grimshaw JM, et al.

- Effectiveness of quality improvement of diabetes: a systematic review and meta-analysis. *Lancet*. 2012;379:2252-61.
21. Vouri SM, Shaw RF, Waterbury NV, et al. Prevalence of achievement of A1c, blood pressure, and cholesterol (ABC) goal in veterans with diabetes. *J Manag Care Pharm*. 2011;17(4): 304-12.
22. de Belvis AG, Pelone F, Biasco A, et al. Can primary care professional's adherence to evidence based medicine tools improve quality of care in type 2 diabetes mellitus? A systematic review. *Diabetes Res Clin Pract*. 2009;85:119-31.