

# Diabetes Mellitus Quality Care and Control Program at Primary Healthcare Facilities of Dubai Health Authority

Moulham Saleh Ashtar<sup>1, \*</sup>, Hanan Ali Obaid<sup>1, \*</sup>, Ayesha Sultan Alolama<sup>1</sup>,  
Fawzia Ahmed Abdouli<sup>2</sup>, Laila Abdulla Al Kaabi<sup>2</sup>,  
Mai Haider Mohammad Zain<sup>1</sup>, Salah Ahmed Elbadawi<sup>3</sup>,  
Nahed AbdulKhaleq Monsef<sup>1</sup>, Amel Ibrahim Buharoun<sup>2</sup>,  
Manal Mohammad Omran Taryam<sup>3</sup>

<sup>1</sup>Health Affairs Department, Primary Health Care Services Sector, Dubai Health Authority, Dubai, United Arab Emirates

<sup>2</sup>Health Centres Department, Primary Health Care Services Sector, Dubai Health Authority, Dubai, United Arab Emirates

<sup>3</sup>Primary Health Care Services Sector, Dubai Health Authority, Dubai, United Arab Emirates

## Abstract

**Introduction:** The prevalence of Diabetes Mellitus in United Arab Emirates is estimated to be around 19%. Diabetes Mellitus Quality Care and Control program started in 2012 in all Primary Health Care Centers in Dubai in order to improve diabetes care services and clinical outcomes. The program adopted a multidisciplinary team approach to patients care to ensure proper implementation of diabetes management guidelines. Health care providers training and patients education supported this approach. During the period of program implementation, annual audits were conducted to monitor changes and gaps in the provided diabetes care services. **Objectives:** To assess the current Primary Health Care Diabetes Mellitus Quality Care and Control program, identify gaps in management, and other factors contributing to the improvement of diabetes care. **Methods:** A retrospective records review of 8642 registered diabetic patients was performed in all 13 primary health care centers of Dubai Health Authority during the period from 2012-2016. Annual convenience samples were taken. They were consisting of all diabetic patients who attended PHC health centers in the month of December in every year. An initial situational audit was conducted in 2012 before program implementation. The patient's data was retrieved from Primary Health Care Electronic Medical Record. The sample was composed of 1578 in 2012; 1654 in 2013; 2139 in 2014; 1707 in 2015 and 1564 in 2016. Patients with Diabetes mellitus managed in PHC facilities were included and those receiving diabetic health care management from other health care facilities were excluded. **Results:** The results showed improvements in care of patients reflected in rates of recorded key clinical indicators outcomes. The percentage of diabetic patients with HBA1C <7% increased from 46.05% to 56.25%. The percentage of patients with LDL < 100 mg/dL increased from 54.40% to 63.20%, those with controlled blood pressure increased from 56.50% to 80.60%. Those on Statins increased from 76.70% to 85.00% and those on (ACEi / ARBs) increased from 73.50% to 80.20%. The percentage of patients who had pneumococcal vaccine increased from 55.30% to 71.21%. About 36.90% were overweight and 47.60% were obese. **Conclusion:** Managing Diabetes in a quality improvement setting produced outcomes that are more positive in terms of control compared to diabetes management prior program implementation. **Recommendations:** Continuous professional training of physicians and nurses on the standard DM guidelines, re-enforcing patients' health education and diet control are essential for continuous improvement.

## Keywords

Non-Communicable Diseases (NCDs), Diabetes Mellitus (DM), Primary Health Care (PHC), Dubai Health Authority (DHA), Clinical Audit

\* Corresponding author

E-mail address: [msashtar@dha.gov.ae](mailto:msashtar@dha.gov.ae) (M. S. Ashtar), [haobaid@dha.gov.ae](mailto:haobaid@dha.gov.ae) (H. A. Obaid)

Received: October 29, 2017 / Accepted: November 25, 2017 / Published online: December 13, 2017

@ 2017 The Authors. Published by American Institute of Science. This Open Access article is under the CC BY license.

<http://creativecommons.org/licenses/by/4.0/>

## 1. Introduction

Non-communicable diseases (NCDs) has attracted considerable worldwide attention in recent years as it has negative effect on the quality of life of patients and families, in addition to the high financial costs on health care system [1] [2]. Diabetes Mellitus is one of the NCDs whose prevalence is on the continuous rise [1] [2]. In addition to the estimated 415 million adults who currently have diabetes, there are 318 million adults with impaired glucose tolerance, which puts them at high risk of developing the disease in the future. By 2040, this will rise to 642 million. [3] One in 11 adults has diabetes in 2015 and One in 10 adults will have diabetes in 2040 [3]. Diabetes is one of the largest global health emergencies of the 21st century resulting in life-changing complications [3] placing a large financial burden on individuals and their families and imposing a substantial economic impact on countries and national health systems [3]. Diabetes is no longer a disease of predominantly rich nations, the prevalence of diabetes is steadily increasing everywhere, most markedly in the world's middle-income countries [4]. According to the International Diabetes Federation, the prevalence in United Arab Emirates is >19 % [5]. People with Diabetes in United Arab Emirate are estimated to be between 1.086.300 and 1.270.500 in 2015 and in 2040, it is expected to reach 2.204.600 [4]. Poorly managed diabetes results in uncontrolled patients; and will lead to consequences on health and well-being, in addition to complications developments that affect directly the finances of individuals and their families, and the economies of nations [1] [2]. Diabetes death is due to relative complications especially cardiovascular [1] [6], usually against a background of poorly controlled diabetes. Studies on effective implementation of local DM guidelines in primary healthcare setting showed it helps improving management of DM [7]. Primary Health Care Diabetes Mellitus Quality Care and Control program is introduced in all primary health care Centers in Dubai since 2012. The program was implemented through phases, which included:

- a. Conducting a situational analysis of the current situation on type 2 Diabetes Mellitus care and control among diabetic patients registered in primary health care facilities in 2012; in order to obtain baseline information before program implementation.
- b. Conducting a focused and continuous training programs and medical professional education on standard clinical

guidelines [8] to all family physicians, nurses dieticians and health educators in primary health care facilities and participating in continuous professional development courses organized by reputable international universities;

- c. Implementing clinical guidelines based on American Diabetes Association Guidelines (Standards of Medical Care in Diabetes) [8] and providing information systems incorporated in patients' electronic medical records to support health care workers proper implementation of the guideline;
- d. Implementing team approach through a well-trained multidisciplinary health care teams composed of family physicians with special interest in diabetes mellitus, Diabetic nurse case managers, health educators and dieticians;
- e. Conducting annual clinical audits from 2013 until 2016 to track gaps and improvement in the PHC DM services.

The clinical audit was carried out to assess critically the quality of medical care given to patients with diabetes mellitus in primary health care settings of to Dubai health authority. The aim was to determine whether current patient management is up to the standard recommended guidelines [8]. In this way, if we do find deficiencies in the management compared to the accepted standard then we could implement changes and suggest recommendations. This would serve to improve the delivery of care to DM patients.

## 2. Objectives

This study is carried out with the objective of assessing the current Primary Health Care Diabetes Mellitus Quality Care and Control program, identifying gaps in management, and other factors contributing to the improvement of diabetes care.

## 3. Methodology

Program implementation started in 2012 by conducting an initial situational audit to produce basic data for comparison with data collected in the annual consecutive audits after program implementation. Specific clinical indicators were audited yearly from 2012 until 2016 and new other indicators were added in 2016 audit in order to detect more practice gaps for improvement, as well as to cover newly introduced services like Retinal Camera Screening, which started in

PHC in April 2015. Clinical outcome indicators were based on the standard recommended guidelines [8] used for the comparisons.

### 3.1. Data Collection Source & Method

Annual retrospective medical records reviews of PHC/DHA registered diabetic patients were performed for the period of 2012-2016. Patients' data were retrieved from Primary Health Care Electronic Medical Record Registry System. The

assessment of initial situation, before program implementation, was conducted in 2012. Annual cyclic audits followed, from 2013 until 2016, to monitor progress in quality of care with regard to a specific set of defined criteria and standards (clinical indicators) (Table 1). Every year, in December 31st, patients medical records were reviewed retrospectively against the indicators for a twelve months period.

**Table 1.** Clinical Indicators Best Practices.

HBA1C Indicators:			
% of diabetic patients with HBA1C < 7%		40% [14]	56.7 [9]
The mean Haemoglobin A1C of diabetic patients in PHC		<7% [8]	<7.6 [9]
% of Diabetic patients who performed a minimum of 2 HBA1C (and not more than 4)		80.7% [10]	77.9% [13]
Retinal Screening Indicators:			
% of Diabetic patients who have been screened for retinopathy by retinal camera			82% [11]
% of Diabetic patients who have abnormal retinal camera image			25.7% [22]
% of diabetic patients who had ophthalmology referral for dilated fundoscopic examination in past 12 month	79% [12]	64% [10]	47.9% [13]
Lipids/Blood pressure Control Indicators:			
% of diabetic patients with LDL cholesterol < 100 mg/dL			62% [13]
% of diabetic patients with controlled blood pressure (< 140/90 mmhg)	87.3% [13]	74% [12]	65% [14]
Smoking cessation Indicators:			
% of diabetic patients with smoking status documented		80% [14]	73.2 [20]
% of diabetic patients who are currently smokers			13.9% [15]
% of diabetic patients referred to smoking cessation clinic			30%
Prescribing Indicators:			
% of diabetic patients on Statins		70% [12]	60% [21]
% of diabetic patients on ACEi / ARBs			90% [12]
% of diabetic patients on Metformin			90%
% of diabetic patients on Aspirin			55.1% [13]
Renal Function Tests Indicators:			
% of diabetic patients with Urine Micro-albumin tested in past 12 months	Once Yearly [21]	90% [12]	83.4% [13]
% of diabetic patients with eGFR tested in past 12 months			>90% [12]
Immunization Indicators:			
% of diabetic patients who had pneumococcal vaccine			70% [16]
% of diabetic patients who had influenza vaccine		90% [16]	62% [10]
Dental Care Indicator:			
% of diabetic patients who had dental care			61.2% [17]
Foot Care Indicator:			
% of diabetic patients who had foot examination	80% [14]	73% [10]	62.3 % [13]
Waist Circumference Indicators:			
% of diabetic patients who had waist circumference checked every visit			Once Yearly [11]
% of male diabetic patients who had waist circumference <102cm			20%
% of female diabetic patients who had waist circumference < 88cm			46.8% [18]
BMI Indicators:			
% of diabetic patients who had BMI checked every visit		Every Visit [21]	61.5% [13]
% of diabetic patients who had Normal BMI (18.5-24.9)			48% [23]
% of diabetic patients who are overweight (BMI 25-29.9)			39% [23]
% of diabetic patients who are obese (BMI ≥30)		17.4% % [13]	13% [23]
Health and Diet Education Indicators:			
% of diabetic patients referred to health education and dietician education		>94% [10]	64.3% [13]
% of diabetic patients attended health education and dietician appointment		>94% [10]	64.3% [13]
% of diabetic patients who have a self-management plan			95%

### 3.2. Audit Sample

A retrospective records review of 8642 registered diabetic patients was performed in all 13 primary health care centers of Dubai Health Authority during the period from 2012-2016. Annual convenience samples were taken. They were consisting of all diabetic patients who attended PHC health

centers in the month of December in every year. Samples were as follow: 1578 in 2012; 1654 in 2013; 2139 in 2014; 1707 in 2015 and 1564 in 2016.

### 3.3. Audit Population

Patients with Diabetes Mellitus registered in PHC health centers and followed up by the family physicians.

### 3.4. Audit Criteria and Standards (Clinical Indicators)

Criteria were selected based on the standard recommended guidelines [8]. Targets were set on annual basis and benchmarked to the available local, regional or international best practices when available, otherwise to the results of initial situational audit and field practice observation (Table 1).

### 3.5. Audit Inclusion Criteria

Patient with Diabetes mellitus managed and followed up for one year and more in PHC facilities.

### 3.6. Audit Exclusion Criteria

Patients with Diabetes Mellitus receiving diabetic health care management from health care facilities out of PHC facilities, and those who did not complete one year of follow up within PHC facilities. DM patients who have contraindications to metformin, Angiotensin Converting Enzymes Inhibitors (ACEi), Angiotensin Receptors Blockers (ARBs), Aspirin, Pneumococcal vaccine and Influenza vaccine were also excluded in the corresponding clinical indicator.

### 3.7. Audit Tool

Structured excel audit tool included domains of socio-demographic data, quality of care & Diabetes Mellitus control measurements, referred to standard recommended guidelines [8].

### 3.8. Data Analysis

Microsoft excel and SPSS software program version 19 were used. Z test was used for comparison of two proportions. Student "t" test was used for comparison of means of two independent samples. "p" value < 0.05 was the cut-off level of significance.

## 4. Results

### 4.1. Clinical Indicators Related to HBA1C (Table 2, Figure 1)

The percentage of DM patients with HBA1C<7% increased from 46.05 % in 2012 to 56.25% in 2016. The Mean Haemoglobin A1C improved from 7.40% to 7.20 %. Both results were statistically significant (p value<0.0001). The percentage of those who performed two HBA1C increased from 83.20% to 85.20 %. This result was not statistically significant.

### 4.2. Clinical Indicators Related to Eye Care (Table 2, Figure 2)

The percentage of DM patients screened for retinopathy by

retinal camera increased from 30% in 2015 to 46.91% in 2016. 36.50% of them had abnormal retinal image. The percentage of DM patients who had a routine ophthalmology referral for dilated fundoscopic examination in the past 12 months decreased from 83.9% in 2012 to 82% in 2016.

### 4.3. Clinical Indicators Related to Cardiovascular Care (Table 2, Figure3)

The percentage of DM patients with LDL < 100 mg/dL increased from 54.40% in 2012 to 63.20% in 2016. The percentage of those with controlled blood pressure (<140/90 mmhg) increased from 56.50% in 2012 to 80.60% in 2016. Both results were statistically significant (p value<0.0001).

### 4.4. Clinical Indicators Related to Smoking Habits (Table 2, Figure 4)

Smoking status in patients' medical records was well documented since 2012, and continue to improve from 90.30% in 2012 to 99.40% in 2016. This result was statistically significant (p value<0.0001). The percentage of DM patients who are currently smokers decreased from 9.30% in 2012 to 7.97% in 2016. This result was not statistically significant. The percentage of smokers referred to smoking cessation clinic was 10.50 % in 2016.

### 4.5. Clinical Indicators Related to Appropriate Prescribing (Table 2, Figure 5)

The percentage of DM patients on Statins increased from 76.70% in 2012 to 85.00% in 2016; on ACEi / ARBs increased from 73.50% to 80.20%; both results were statistically significant (p value<0.0001). The percentage of DM patients on Metformin was 94.40 in 2016; and on Aspirin was 60.10% in 2016.

### 4.6. Clinical Indicators Related to Renal Functions (Table 2, Figure 6)

The percentage of DM patients who had a Urine Micro albumin test in past 12 months was 87.70 % and those who had a eGFR test in past 12 months was 97.87 % in 2016.

### 4.7. Clinical Indicators Related to Immunization (Table 2, Figure 7)

The percentage of DM patients who had pneumococcal vaccine increased from 55.30% in 2012 to 71.21% in 2016 and those who had influenza vaccine increased from 22.80% to 44.70%. Both results were statistically significant (p value<0.0001).

### 4.8. Clinical Indicators Related to Dental and Foot Care (Table 2, Figure 8, 9)

The percentage of DM patients who had dental care

decreased from 82.70% in 2012 to 75.10% in 2016. This result was statistically significant (p value<0.0001).

The percentage of diabetic patients who had foot examination every visit decreased from 86.80% in 2012 to 78.60% in 2016. This result was statistically significant (p value<0.0001).

#### 4.9. Clinical Indicators Related to Weight Assessment (Table 2, Figures 10, 11)

The percentage of DM patients who had waist circumference checked every visit was 77.10% in 2016. 29.80% of males had waist circumference >102cm and 58.80% female had waist circumference >88cm. BMI indicators in 2016 showed

the percentage of DM patients who had BMI checked every visit was 97.00%; only 12.90% of them had Normal BMI (18.5-24.9), 36.90% were overweight and 47.60% were obese (BMI ≥30)

#### 4.10. Clinical Indicators Related to Health and Diet Education (Table 2, Figure 12)

The percentage of DM patients referred to health and diet education in 2016 was 64.50 % but only 43.30% of them attended their appointment.

**Table 2.** Audit Results (X= audit did not include this indicator in this year).

	2012		2013		2014		2015		2016	
	Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
<b>HBA1C Indicators:</b>										
% HBA1C < 7%	>45%	46.05%	>45%	49.80%	>45%	50.00%	>45%	48.21%	>46%	56.25%
Mean Haemoglobin A1C	<7.5%	7.40%	<7.5%	7.30%	<7.5%	7.40%	<7.5%	7.39%	<7.5%	7.20%
% of 2-4 HBA1C in a year	>80%	83.20%	>85%	88.50%	>90%	84.10%	>85%	83.50%	>95%	85.20%
<b>Retinal Screening Indicators:</b>										
% Retinal camera screening	X	X	X	X	X	X	>35%	30.00%	>35%	46.91%
% Abnormal retinal camera image	X	X	X	X	X	X	X	X	X	36.50%
% of ophthalmology referral	>80%	83.90%	>80%	74.00%	>80%	81.20%	>80%	61.30%	>90%	82.00%
<b>Lipids/Blood pressure Control Indicators:</b>										
% LDL cholesterol < 100 mg/dL	>60%	54.40%	>60%	74.30%	>60%	59.70%	>60%	58.30%	>60%	63.20%
% of controlled blood pressure (< 140/90 mmhg)	>60%	56.50%	>60%	86.60%	>60%	64.40%	>60%	81.50%	>60%	80.60%
<b>Smoking cessation Indicators:</b>										
% of smoking status documented	>95%	90.30%	>95%	98.50%	>95%	94.80%	>95%	92.40%	>95%	99.40%
% of smokers	<10%	9.30%	<10%	9.50%	<10%	8.60%	<10%	11.80%	<5%	7.97%
% of referred to smoking cessation clinic	x	x	x	x	x	x	x	x	>30%	10.50%
<b>Prescribing Indicators:</b>										
% on Statins	>80%	76.70%	>80%	99.20%	>80%	81.50%	>80%	81.50%	>80%	85.00%
% on ACEi / ARBs	>80%	73.50%	>80%	96.80%	>80%	71.70%	>80%	60.70%	>80%	80.20%
% on Metformin	x	x	x	x	x	x	x	x	>90%	94.40%
% on Aspirin	x	x	x	x	x	x	x	x	>80%	60.10%
<b>Renal Function Tests Indicators:</b>										
% of Urine Micro-albumin tested in past 12 months	x	x	x	x	x	x	x	x	>95%	87.70%
% of eGFR tested in past 12 months	x	x	x	x	x	x	x	x	>95%	97.87%
<b>Immunization Indicators:</b>										
% of pneumococcal vaccine	>50%	55.30%	>60%	78.80%	>70%	55.80%	>70%	65.10%	>80%	71.21%
% of influenza vaccine	>50%	22.80%	>50%	25.20%	>50%	26.40%	>50%	31.60%	>95%	44.70%
<b>Dental Care Indicator:</b>										
% dental care	>80%	82.70%	>80%	63.10%	>80%	78.00%	>80%	73.10%	>95%	75.10%
<b>Foot Care Indicator:</b>										
% of foot examination	>80%	86.80%	>90%	98.50%	>95%	83.80%	>95%	84.60%	>95%	78.60%
<b>Waist Circumference Indicators:</b>										
% of waist circumference checked every visit	x	x	x	x	x	x	x	x	>80%	77.10%
% of male waist circumference <102cm	x	x	x	x	x	x	x	x	<20%	29.80%
% of female waist circumference < 88cm	x	x	x	x	x	x	x	x	<20%	58.80%
<b>BMI Indicators:</b>										
% of BMI checked every visit	x	x	x	x	x	x	x	x	>95%	97.00%
% of Normal BMI (18.5-24.9)	x	x	x	x	x	x	x	x	>60%	12.90%
% of overweight (BMI 25-29.9)	x	x	x	x	x	x	x	x	<20%	36.90%
% of obese (BMI ≥30)	x	x	x	x	x	x	x	x	<20%	47.60%
<b>Health and Diet Education Indicators:</b>										
% referred to health and diet education	x	x	x	x	x	x	x	x	>60%	64.50%
% attended health and diet appointment	x	x	x	x	x	x	x	x	1	43.30%
% of self-management plan	x	x	x	x	x	x	x	x	>95%	96.90%



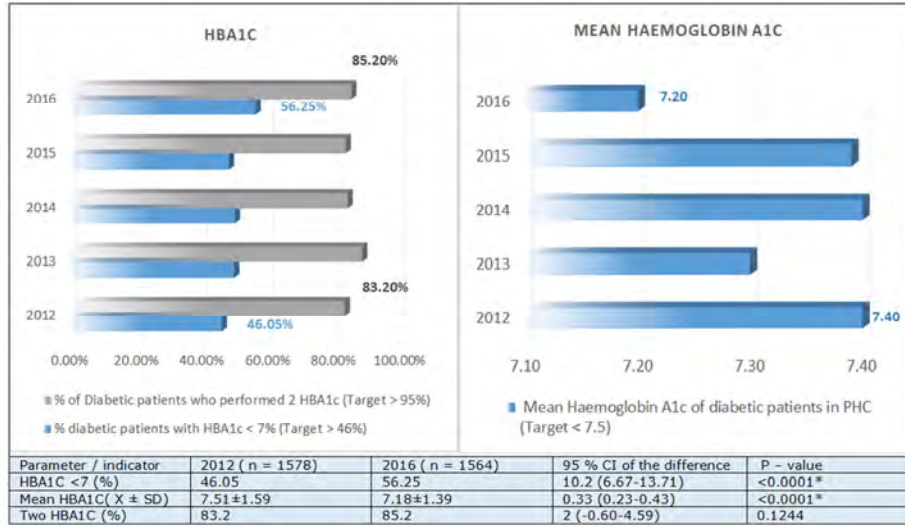


Figure 1. HBA1C Indicators.

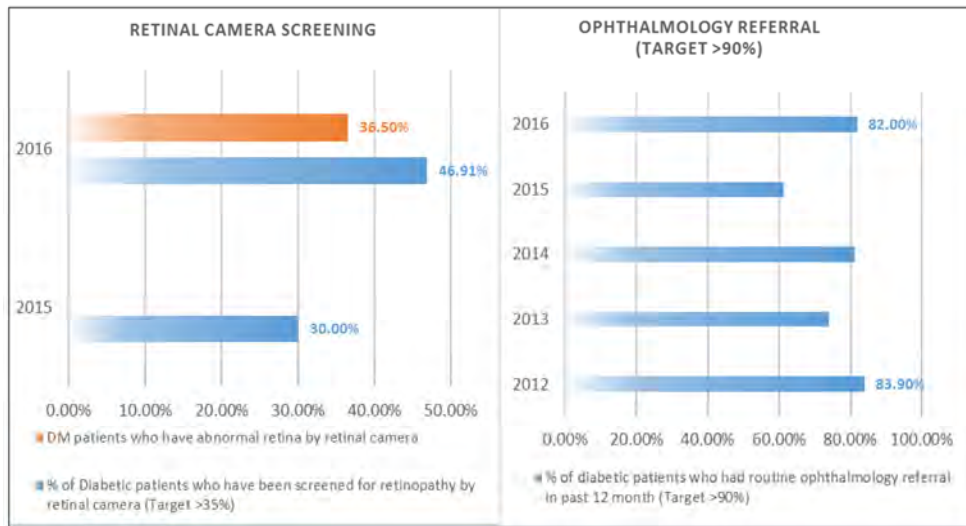


Figure 2. Retinal Screening Indicators.

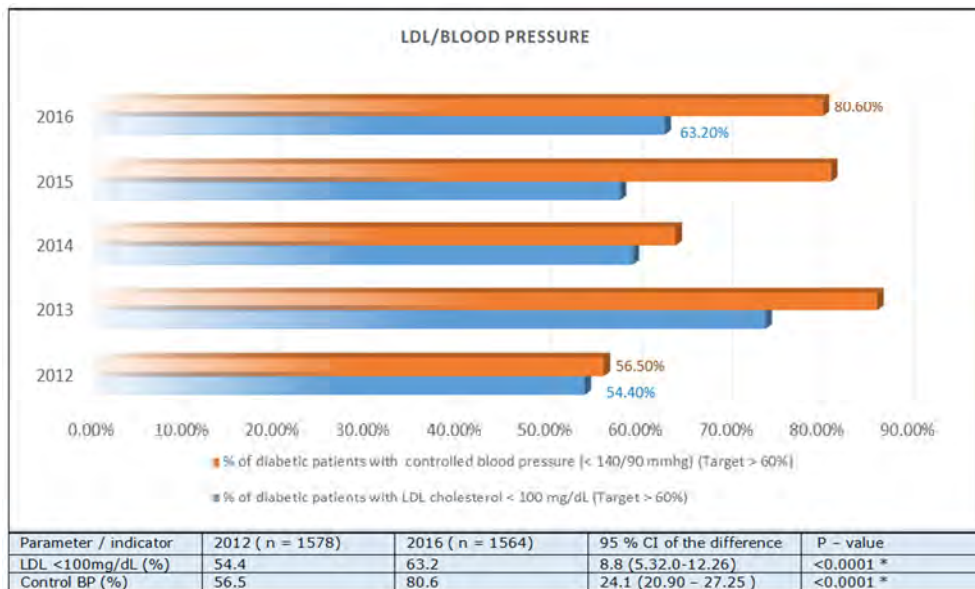


Figure 3. Lipids/Blood pressure Control Indicators.

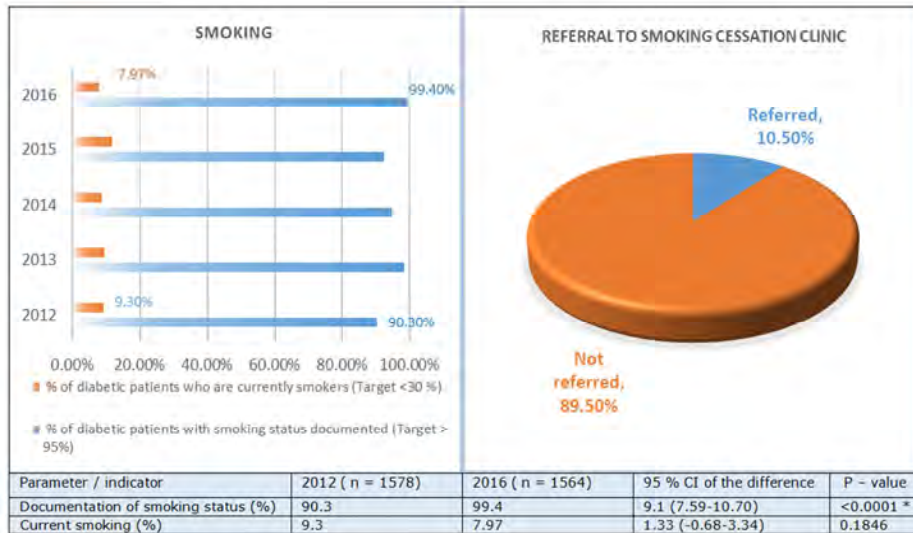


Figure 4. Smoking cessation Indicators.

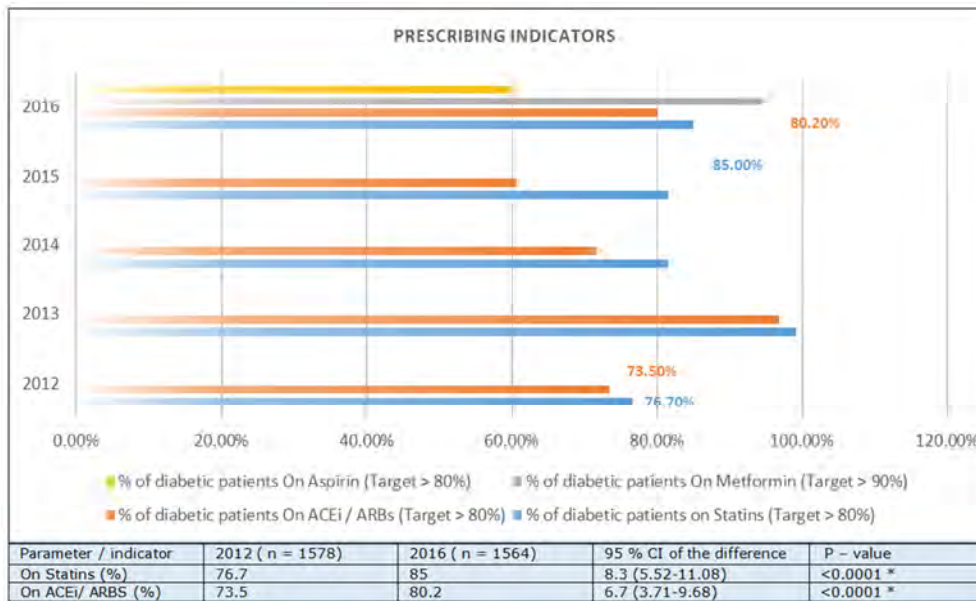


Figure 5. Prescribing Indicators.

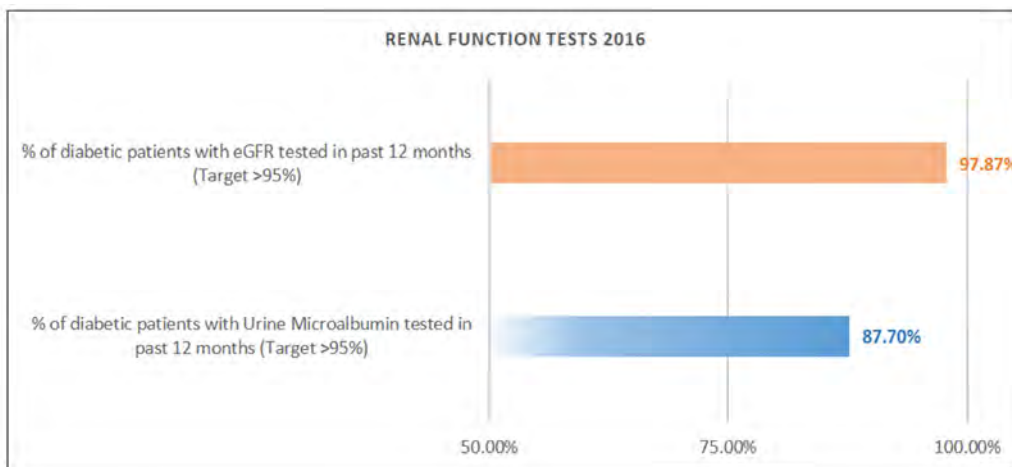


Figure 6. Renal Function Tests Indicators.

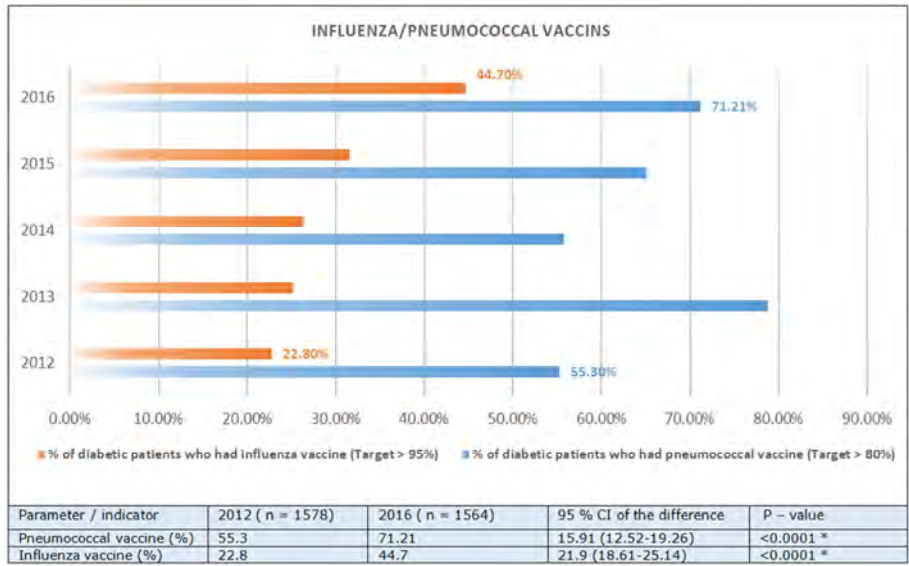


Figure 7. Immunization Indicators.

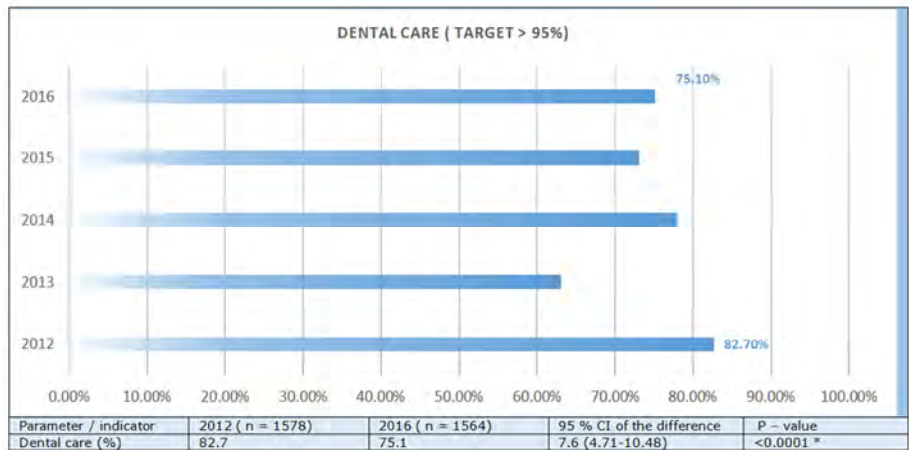


Figure 8. Dental Care Indicator.

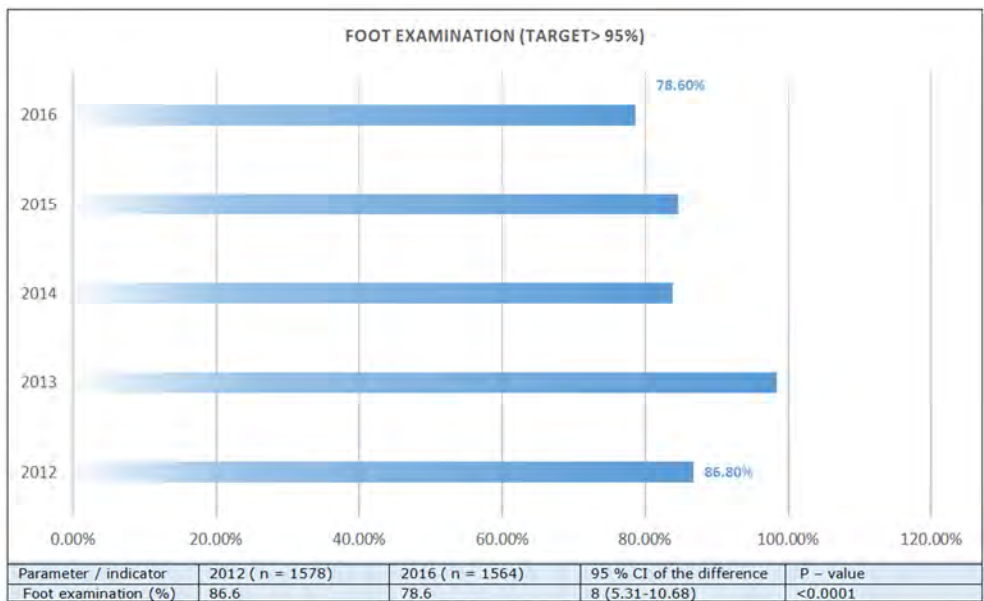


Figure 9. Foot Care Indicator.



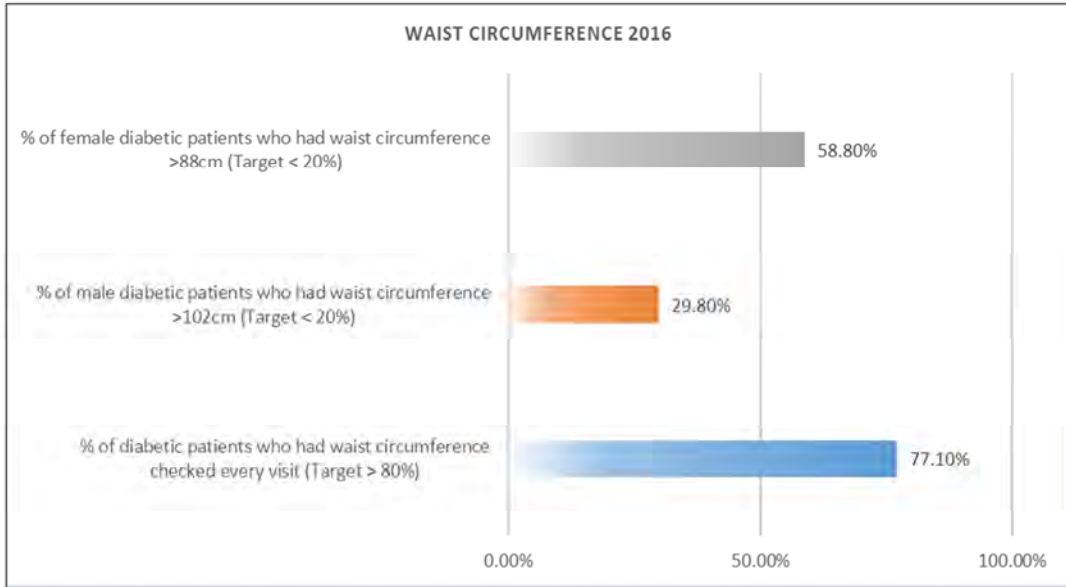


Figure 10. Waist Circumference Indicators.

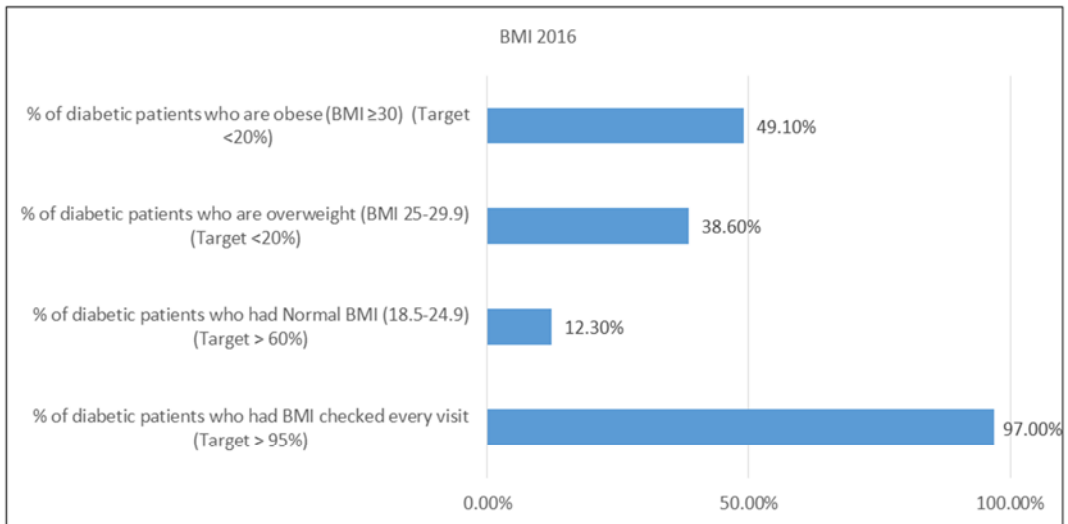


Figure 11. BMI Indicators.

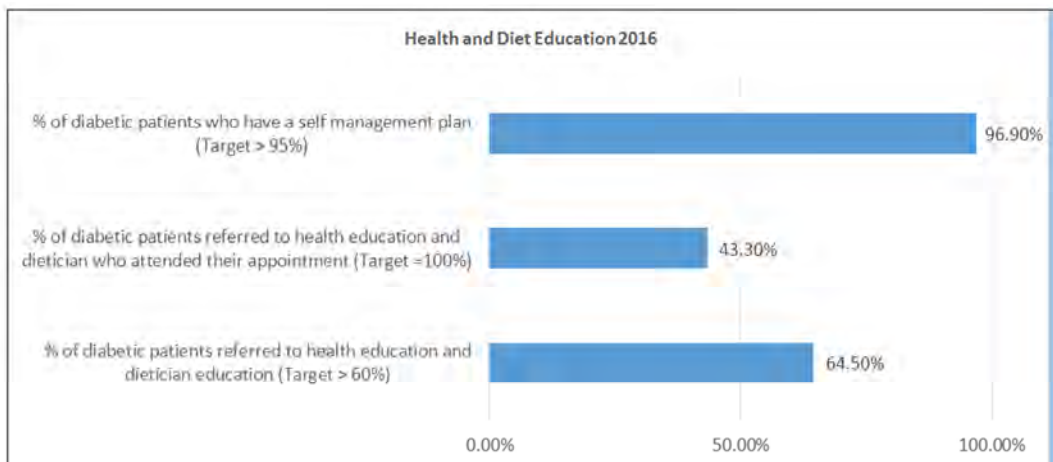


Figure 12. Health and Diet Education Indicators.

## 5. Discussion

A comparison with other studies shows the audit results of PHC in Dubai is reaching or exceeding the results of several best practices elsewhere. A study published in 2006 by Arch *et al* [9] showed HBA1C<7% was 48.9% in USA and 56.7% in England, while the mean HBA1C was in the USA 7.7% and in England 7.6%. Additionally, the national healthcare quality and disparities reports shows that DM patient's performing 2 or more hemoglobin A1C measurements was 75.10% in 2014 [10]. Kaiser Permanente group Health Foundation in Washington had 79.9% ophthalmology referral for dilated funduscopy, 74% had controlled blood pressure, 70% were on statins, 90% had eGFR tested in 2016 [12]. A study conducted in Qatar PHC showed in 2010 the percentage of diabetic patients with LDL < 100 mg/dL at 62% and level of patients on aspirin at 55.1%, [13].

The above indicators results in PHC / DHA 2016 were better probably due to the concentrated and continuous training of health care providers on the standard guidelines. The annual cyclic audits helped as well in annually addressing gaps in management. The Physician Alliance report of 2016, Michigan USA, stated that the national benchmark for retinal screening in diabetics is 82% and the result reached was only 55% [11]. In PHC / DHA 2016, result was lower because the retinal screening camera was implemented in April 2015 and result needs more time to improve.

In USA, the national healthcare quality and disparities reports of the agency of healthcare research and quality, shows that diabetic patients who had health and diet education in 2014 is 94% [10]. In PHC / DHA 2016, result were lower because not all patients who had referral to health and diet education attended their appointment. American Association of Diabetic Educators recommend targets of 70% for influenza vaccine and 90% for pneumococcal vaccine [16]. In PHC / DHA 2016, results were still below the recommended targets most probably because immunization was not sufficiently addressed in patients' health education. Centers for Diseases Control and Prevention recommend as an objective in 2020 to increase the proportion of persons with diagnosed diabetes who have at least an annual dental examination to 61.2% as their actual percentage in 55.6% [17]. In PHC / DHA 2016, result was better. A study conducted in 2011 in UAE showed the percentage of female diabetic patients who had waist circumference >88cm is 46.8% [18]. In PHC / DHA 2016, result was higher which reflect the problem of obesity in UAE is increasing.

## 6. Conclusion

Implementation of Diabetes Mellitus Quality Care and Control Program in Dubai primary health care centers showed

remarkable and significant improvements in health care provided to diabetic patients. Based on different outcomes indicators, it was clear that managing Diabetes in a quality improvement setting produced outcomes that are more positive in terms of control compared to diabetes management prior program implementation. Provision of continuous professional development training of physicians and nurses on the standard DM guidelines, ensured continuous improvement in DM program clinical outcomes, and had an effective role in improving the decline in the some clinical indicators in 2014. Most improved clinical indicators were those related to HBA1C, Retinal Camera Screening, LDL and Blood Pressure control, Prescribing Statins, ACEi/ARBs, Metformin and Aspirin, and Percentage of immunization.

## Recommendations

It is recommended to continue professional training of physicians and nurses on the standard DM guidelines, as well as to consolidate the training content by adding new topics such as management guidelines of dyslipidemia, Hypertension, smoking cessation, and diabetic foot examination to ensure continuous improvement in DM program clinical outcomes. It is also recommended to re-enforce patients' health education, diet control and lifestyle modifications in addressing the problem of overweight and obesity. Additional necessary recommendation include reminders notifications in the electronic medical record on the due time for foot examination, immunization, important laboratory tests including HBA1C and Urine Micro albumin, referrals to ophthalmology for dilated funduscopy examination, to smoking cessation clinic, to dental clinic and to health and diet educators. It is also recommended to improve the two ways communication with patients through reminders notifications.

## Conflict of Interest

The authors declare that they do not have any conflict of interest.

## References

- [1] Global report on diabetes, 2016, World Health Organization [http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257_eng.pdf) <http://who.int/diabetes/global-report/en/>
- [2] Global Status Report on Non-Communicable Diseases-2014-World Health Organization [http://apps.who.int/iris/bitstream/10665/148114/1/9789241564854\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/148114/1/9789241564854_eng.pdf?ua=1)
- [3] IDF Diabetes Atlas, Seventh Edition, 2015, International Diabetes Federation, <http://www.diabetesatlas.org/resources/2015-atlas.html>, <http://www.diabetesatlas.org/>

- [4] International Diabetes Federation, Across the Globe, Diabetes Estimates, People with Diabetes (20-79) in 1000, 2015 <http://www.diabetesatlas.org/across-the-globe.html>
- [5] Sarah W, Gojka R, Anders G, Richard S, Hilary K: Global Prevalence of Diabetes; Estimates for the year 2000 and projections for 2030, WHO, Diabetes Care, Volume 27, Number 5, MAY 2004:1047-1053, <http://www.who.int/diabetes/facts/en/diabcare0504.pdf>
- [6] Jose MBD, Judit P, Isaac S, Rafel R, Roberto E, Alejandro MI, María JG, Fernando R, María J TD, Conchi MI, Joan JC, Antonio S, Manel GL, Agustín GC, José L, Miquel Q, Jaume M, Maria J M, Jesús B, Guiem F, Diana G, Aurelio B, Josep B, Jose MG, Natalia CP, David LP, Eduardo M, Josep F, Manel M, Conxa C, Albert F, María G: Risk of Cause-Specific Death in Individuals with Diabetes: A Competing Risks Analysis, American Diabetes Association-Diabetes Care 2016 Nov; 39(11):1987-1995. <https://doi.org/10.2337/dc16-0614>
- [7] Gene F, Chris G, Clare H, Sandra E, Matthew S, Lesley S: Do clinical guidelines introduced with practice based education improve care of asthmatic and diabetic patients? A randomized controlled trial in general practices in east London, BMJ Volume 311 2 December 1995:1473-1478 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2543702/pdf/bmj00621-0031.pdf>
- [8] American Diabetes Association; Standards of Medical Care in Diabetes—2016, Diabetes Care, the Journal of Clinical and applied research and education, Volume 39, Supplement 1, January, 2016, [http://care.diabetesjournals.org/content/suppl/2015/12/21/39.Supplement\\_1.DC2/2016-Standards-of-Care.pdf](http://care.diabetesjournals.org/content/suppl/2015/12/21/39.Supplement_1.DC2/2016-Standards-of-Care.pdf)
- [9] Arch G M, Vanessa A. D, Sonia S, Richard B, Charles J.E, Richelle J. K, Azeem M: Diabetes management in the USA and England: comparative analysis of national surveys; Journal of the Royal Society of Medicine; Volume 99 September 2006:463-469 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1557885/> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1557885/pdf/0463.pdf>
- [10] Agency of Healthcare Research and Quality, AHRQ, Advancing Excellence in Healthcare, National Healthcare Quality and Disparities Reports, <https://nhqrmet.ahrq.gov/inhqrdr/data/query?stateName=National&subjectAreaId=3218206&topicId=3218529&subMeasureId=60401071>
- [11] HOW TO IMPROVE YOUR DIABETIC EYE EXAM SCREENING SCORE; the Physician Alliance, Saint Clair Shores, Michigan USA; [http://thephysicianalliance.org/images/FilesDocuments/2016\\_dm\\_eyexam\\_FINAL\\_20161207.pdf](http://thephysicianalliance.org/images/FilesDocuments/2016_dm_eyexam_FINAL_20161207.pdf)
- [12] National Committee for Quality Assurance, NCQA, 2016 HEDIS and CAHPS Measures and Performance (2016 Healthcare Effectiveness Data and Information Set and Consumer Assessment of Healthcare Providers and Systems Measures and Performance) in Kaiser Permanente Health Foundation in Washington USA <https://www.ghc.org/static/pdf/public/about/hedis.pdf>
- [13] Mohamed H: How Effective is Systematic Care of Diabetic Patients. A study of four Primary Healthcare Centers in Qatar; Primary Healthcare Center, Doha, Qatar; QATAR MEDICAL JOURNAL; VOL. 19 / NO. 2 / DECEMBER 2010 <http://www.qscience.com/doi/pdf/10.5339/qmj.2010.2.7>
- [14] Chinnapongse S: The Benchmark between the NCQA Diabetes Recognition Program (DRP) and the JCI Condition-Specific Certification for DM Type 2 at the Bangkok Hospital Medical Center, Diabetes Mellitus and Endocrinology Center, Bangkok Hospital, Bangkok Hospital group, Bangkok, Thailand, The Bangkok Medical Journal Vol. 7; February 2014 [http://www.bangkokmedjournal.com/sites/default/files/fullpapers/TBMJ%207\\_20.pdf](http://www.bangkokmedjournal.com/sites/default/files/fullpapers/TBMJ%207_20.pdf)
- [15] Leif I. S, Jay R. D, Patrick J. O, Donald B. B, Heather M. D: Diabetic Patients Who Smoke: Are They Different? Annals of Family Medicine, v. 2 (1); 2004 Jan; 2(1): 26–32. PMC1466617 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1466617/>
- [16] AADE, American Association of Diabetic Educators; Vaccination Practices for People with Diabetes; AADE Practice Synopsis; October 7, 2015 <https://www.diabeteseducator.org/docs/default-source/practice/practice-resources/synopsis/vaccination-practices-for-people-with-diabetes.pdf?sfvrsn=0>
- [17] U.S. Department of Health and Human Services, Centers for Diseases Control and Prevention, Diabetes, Oral Health and Diabetes; <https://www.cdc.gov/diabetes/ndep/pdfs/ppod-guide-dental-professionals.pdf>
- [18] Shu WN, Sahar Zaghoul, Habiba A, Gail H, Karin Y, Mohamed E, Barry M.P: Nutrition Transition in the United Arab Emirates (UAE); Published online 2011 Jul 20; PMID: PMC3304306 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3304306/>
- [19] David L. L, Wayne C, Steven T: Longitudinal Assessment of a Diabetes Care Management System in an Integrated Health Network, Intermountain Health Care, Utah, USA; Journal of Managed Care and Specialty Pharmacy; Volume 92003 Nov; 9(6):552-558. <https://doi.org/10.18553/jmcp.2003.9.6.552>
- [20] [David b, Tyler W, Suzanne B, Karen H. B, Danyal M, Lorne K, Rachael M: Data discipline in electronic medical records, Improving smoking status documentation with a standardized intake tool and process, Canadian Family Physician. 2015 Dec; 61(12): e570–e576. PMID: PMC4677960 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4677960/>
- [21] American Diabetes Association, Diabetes Forecast, the Healthy Living Magazine; Health Targets: Tests for Adults with Diabetes 2014; <http://www.diabetesforecast.org/2014/apr/images/apr14-tests-for-adults-1.pdf>
- [22] Dora J. E, Dora J. S, Greg R, Phil K, Edit P, Laszlo N, Andrea F, Morten C. M, Beata E. P: Diabetic Retinopathy Screening Using Telemedicine Tools: Pilot Study in Hungary, Published online 2016 Dec 19, Journal of Diabetes Research, Volume 2016, Article ID 4529824, 9 pages <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5204085/pdf/JDR2016-4529824.pdf> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5204085/>
- [23] World Health Organization, Obesity and overweight, Fact sheet, Updated June 2016 <http://www.who.int/mediacentre/factsheets/fs311/en/>