Strengthening management of diabetes and hypertension in primary health care in Tbilisi, Georgia

Baseline data on management of diabetes and hypertension in PHC in select clinics in Tbilisi, Kutaisi, Mtskheta and Batumi

In 2020 the Non-communicable Diseases (NCDs) Integrated Prevention and Control Program at the WHO Regional Office for Europe contracted the National Family Medicine Training Center to support data collection in the scope of an assessment to strengthen the management of diabetes and hypertension in primary health care in Georgia. The study assessed the feasibility of implementing an approach that relies on routine clinical data to assess essential NCD-related services provided in primary health care; specifically, for the management of diabetes and hypertension. A team of data collectors was trained for the audit review of individual patient records, extracting of pre-specified data and logging of extracted data into a standardized tool.

For this next phase of the project the WHO Country office in Georgia contracted the Family Medicine Training Center to build on its previous work and contribute technical advice and capacity building in use of tools, contribute to sub-regional meetings on new tools and exchange of country experience and disseminate the evaluation framework and support monitoring and evaluation. For this initial phase, English/Georgian bilingual and skilled data collection/auditors have been selected to ensure the timely completion of a quality extraction of data for further analysis.

At the initial stage has been developed the roadmap of those PHC providers who will be involved in the preparation phase for the PHC reform (in total 6 clinics). Other two PHC facilities expressed their willingness to participate in program and therefore one facility from Imereti region – Kutaisi Clinical and Diagnostic Center №4 and one from Tbilisi – Medical Center Holding 23 Gldani have been added to participants. Data was collected from 8 clinics of Georgia: four clinics in Tbilisi, two clinics in Kutaisi, one clinic in Batumi and one clinic in Mtskheta in order to assess essential NCD-related services provided in primary health care; specifically, for the management of diabetes. The primary health care facilities were: in Tbilisi: National Family Medicine Training Center (NFMTC), Krol Medical Corporation Vake District (KMC Vake), Krol Medical Corporation Nadzaladevi District (KMC Nadzaladevi), Holding 23, in Kutaisi: Nazarishvili Family Medicine Training Center and Clinical Diagnostic Center №4, in Mtskheta: PHC center "Healthy Generation" and in Batumi: Family Medicine Regional Centre.

The data collection tool has been tested in 2020 within the initiative funded by the Government of Denmark, in the context of the Danish Neighborhood Program-DANEP and allowed a structured collection of the data. For this data collection, the data collection tool was adapted and additional questions related to service restrictions due to COVID-19 pandemic were added (the type of visit for BP and blood glucose measurements: face to face or remote).

Primary care professionals from the selected facilities were trained in the use of adapted diabetes audit tool and applied it to the eight facilities. The data emerged during the review of the routine clinical records were analyzed by the Project IT consultant and jointly interpreted by involved audit advisory group members. A total of **766** clinical records were randomly reviewed, covering a 12-month period from 1st June 2020 to 31 May 2021, inclusive.

Sample size by specific PHC facility presented in table 1.

Table 1. Sample size of reviewed charts by specific PHC clinic.

Region	PHC Facility	Number of reviewed charts
Ajara – Guria	Family Medicine Regional Centre	106
Imereti	Nazarishvili Family Medicine Centre	100
	Kutaisi №4 Clinical Diagnostic Centre	49
Mtskheta	Mtskheta PHC center "Healthy Generation"	94
Tbilisi	National Family Medicine Training Centre	125
	Krol Medical Corporation Vake District	87
	Krol Medical Corporation Nadzaladevi District	105
	Holding 23 Gldani	100
Total	**8**	**766**
Sample size without Batumi	**7**	**660**

During the process of data analysis results from Batumi Family Medicine Regional Center were significantly deviated from the mean data from other PHC clinics. These findings resulted in need for double check of data. After checking the collected data, we found that Batumi FMC have not updated register of patients with diabetes and there were included the patients already withdrawn from the registration, also those who died during last year and additional contingent from the villages who were visiting only endocrinologist and not using family doctors' service. Therefore, we decided to exclude Batumi sample from the analysis to receive reliable results. Batumi FMC data collector team and the responsible audit adviser are continuing to clarify data and exact results will be analyzed and shared later. In this report we present results of analysis with and without Batumi FMC data.

Variables which were not recorded uniformly in the facilities could easily be transformed to the same unit due to the detailed documentation by the data collectors (e.g. noting if fasting glucose is recorded in mmol/l or mg/dl). Also, the documentation of dates worked well. There were a few measurements

which dated after 1.6.2021, or where the most recent and second most recent values had to be swapped, but those were minor issues.

Data collecting period

August 16, 2021 – August 31, 2021

Data collecting methodology

Collecting data through the manual review of individual patient records, extracting the specified data and logging data collected in standardized forms.

Data sources and chart selection process

20 data collectors attended a two-hour training by 4 audit advisers conducted at-distance and face to face on July 30 and August 16.

Data sources were patient records in selected medical facilities. For selection of medical charts were used the patient registers of each medical facility. These registers were presented in Excel format.

Patient charts were randomly selected from the register using Excel random sample generator. Once the chart was found, the data collectors checked it to make sure the patient meets the inclusion criteria. If they met the inclusion criteria, data collector continued to the next step; if they did not, the chart was put back and selected the next chart from the random chart selection list.

The first step was to create two list of patients:

1. Patients' register with the diagnosis of diabetes mellitus;

2. Adult patients aged 18 or older with diabetes type 2 who have visited clinic in the abovementioned period: from June 1, 2020 till June 1 2021.

The second step was the random selection in those clinics where number of patients were more than 150. As for those clinics, where number of patients with the diagnosis of type 2 diabetes, who visited medical facility during the study period were less than 150, have been selected all medical records without any exclusion.

Method that we used to randomly select rows of data in Excel:

1. Create a new column

2. In the new column, for every row, use the formula "= RAND ()". This gave us a random number between 0 and 1.

3. Then every row of data had a random number.

4. Sorted the data by the random numbers we generated from smallest to largest.

5. Once sorted by random number, we selected the first 150 patient IDs (the sample size was only 100 but we needed to provide the team with some extras).

Due to the difference of available medical charts in selected PHC facilities data collection has been conducted differently, e.g. in National Family Medicine Training Center Electronic Medical Records were available, therefore data mainly was collected from the EMR and Laboratory log, in other facilities were used paper based medical records. In Batumi Regional Family Medicine Center all data have been collected with paper-based audit tool and then entered in Excel file. Data collectors in other facilities were working in Offline Excel files which were sent to the responsible expert and then they were combined for the analytical purpose.

Definition of Diabetic Patient

Inclusion criteria: **patients with Type 2 diabetes** since those with Type 1 require specialist care.

Definition of visit

When patients consulted the doctor. They physically visit the facility and are visited by the doctor, or had remote consultation for their health reason. This means that the pick-up of a prescription should not be included in the sampling.

Patient age - for records with diagnosis of Diabetes 18 and over years' old

The patient should be 18 or over years old before June 1, 2020.

CVD Risk Scores

Any CVD risk score (e.g., ESC Score, WHO/ISH, Framingham) that is recorded in the patient record.

Sampling Timeframe

Sampling timeframe - from **June 1, 2020 to May 31, 2021 inclusive (12 months).**

During this timeframe Georgian PHC system faced COVID-19 pandemic and the number of visits due to chronic problems has been decreased. So, one of main interest was how the COVID-19 pandemic influenced utilization of PHC routine preventive services.

Data quality checking

Data quality was checked by audit advisory board members. During data collection process audit advisors were conducting regular supervision. Each advisor was assigned to the specific PHC facility. Number of medical charts checked by the data collectors at the target facility were selected randomly and checked by the audit advisor additionally to be sure that collected data quality met desired criteria. Audit advisers were continuously providing input and comments as well as additional explanations/clarifications to the data collectors.

Results of data analysis

At the initial stage data were analyzed for a total of 766 patients with diagnosis of type 2 diabetes after excluding patients who did not meet the age criteria or who died during the follow-up period. When

the data from the Batumi FMC were excluded from the analysis the sample size was 660 medical records. In both samples, about two thirds were women (table 1A). The Median age of the patients is 66.2, women are a bit older (66.5) than men (65.8). These demographic indicators are comparable with the demographic data received during recent DANEP project study. Regarding differences between the clinics, higher proportions of men were observed in Kutaisi Nazarishvili Family Medicine Center and a lower median age were observed in KMC Vake compared to the other clinics. Mtskheta "New Generation" and Kutaisi PHC centers had the highest median age with 77-77.6 (table 1B). During the study period patients' face to face visits to PHC providers were restricted due to COVID-19 pandemic. Therefore 127 patients (16.6%) were consulted by their healthcare provider remotely. The highest rate of remote consultations (112/90.3%) observed in NFMTC.

Table 1A: Demographic characteristic of patients in both samples (Diabetes sample) by gender (N=766 patients)			
Demographics	**Both**	**Women**	**Men**
Diabetes sample			
Female, % (n/N)	62.0 (475/766)	100 (475/475)	0.0 (0/291)
Male, % (n/N)	38.0 (291/766)	0.0 (0/475)	100 (291/291)
Age, median (IQR)	66.2(55-75)	66.5 (55-75)	65.8 (55-75)
18-39 years, % (n/N)	1.0(8/766)	0.6 (3/475)	1.7 (5/291)
40-49 years, % (n/N)	4.6 (35/766)	3.6 (17/475)	6.2 (18/291)
50-59 years, % (n/N)	14.9 (114/766)	13.7 (65/475)	16.8 (49/291)
60-69 years, % (n/N)	36.7 (281/766)	36.6 (174/475)	36.8 (107/291)
70-79 years, % (n/N)	31.3 (240/766)	32.4 (154/475)	29.6 (86/291)
80+ years, % (n/N)	11.5 (88 /766)	13.1 (62/475)	8.9 (26/291)
Abbreviations: IQR, inter quartile range.			

Table 1A shows the analysis of the diabetes dataset (n=766) for women (n=475, 62%) and men (n=291, 38%) separately.

Diabetic women, who accounted for almost two thirds of the sample, were a bit older than men with median age 66.5 years compared to 65.8 years, respectively (table 1A). Among all diabetic patients, 87.9% were also hypertensive and 47.1% had a history of CVD (table 2A).

Data from the clinics gives us information about prevalence, incidence and coverage of diabetic patients. This information presented in the table 2.

Table 2. Data on prevalence, incidence and coverage of type 2 DM in selected facilities

N	PHC Clinic	Total number of beneficiaries	Prevalence of Type 2 DM		Incidence of Type 2 DM		Coverage of Type 2 DM	
			N	%	N	%	N	%
1	KMC Vake	13937	87	0.62%	5	0.04%	87	100.00%
2	KMC Nadzaladevi	15973	265	1.66%	10	0.06%	106	40.00%
3	NFMTC	31523	1175	3.73%	173	0.55%	537	45.70%
4	Batumi PHC	43000	2176	5.06%	1246	2.90%	1246	57.26%
5	Mtskheta	7500	174	2.32%	17	0.23%	94	54.02%
6	Kutaisi N4	14400	49	0.34%	4	0.03%	49	100.00%
7	Kutaisi Nazarishvili	36724	375	1.02%	30	0.08%	337	89.87%
8	Holding 23	31500	575	1.83%	24	0.08%	427	74.26%
Grand Total		180620	4789	2.7%	1504	0.91%	2883	60.20%
Grand Total without Batumi)		137620	2613	1.9%	258	0.19%	1637	62.65%

Table 2 shows that the highest prevalence and incidence of type 2 DM observed in NFMTC and the lowest one in Kutaisi N4 polyclinic. Coverage is highest in Kutaisi N4 and KMC Vake and the lowest one – KMC Nadzaladevi. These findings show that the PHC professionals need to improve their efforts towards detection of diabetes to achieve the estimated prevalence of the disease.

Almost two thirds (525/79.5%) of the patients had a recorded smoking status. Among those with available information on smoking, 1.3% of women and 12% of men were smokers. Highest rate of current smokers observed in Kutaisi №4 polyclinic (12.2%) and the lowest one – in KMC Vake (3.4%). Smoking status was not recorded in all charts selected from Batumi Regional FMC (Table 2B). Rate of smoking status among men is almost twice less than in recent DANEP study (23%). When comparing those clinics which were participating in recent DANEP study, percentage of current smokers increased in NFMTC (8.9% vs 5.6%) and decreased in KMC Vake and Nadzaladevi (1.2% vs 3.4% and 4.5% vs 6.6% respectively). Considering the findings from population STEPS-2016 study, where almost half of the male population in Georgia is smoker, this fact from the data is doubtful and might be explained by improper and formal documentation of smoking status in medical charts.

Table 2A: Risk factors of patients in diabetes sample by gender

Risk factors	Results with Batumi sample N=766			Without Batumi N=660
	Both	**Women**	**Men**	**Both**
Current smoker*, % (n/N)	5.4 (41/766)	1.3(6/475)	12.0(35/291)	**5.4 (41/660)**
Current non-smoker % (n/N)	63.2(484/766)	71.4(339/475)	49.8(145/291)	**63.2(484/660)**
Hypertension, % (n/N)	87.9(673/766)	90.7 (431/475)	83.2(242/291)	**86.4 (570/660)**
Diabetes, % (n/N)	100.0 (766/766)	100 (475/475)	100.0 (291/291)	**100.0 (660/660)**
History of CVD, % (n/N)	47,1(361/766)	44,2 (210/475)	51,9(151/291)	**53.5 (353/660)**
SBP, mean ± SD most recent visit	138,3 ± 16,1	137,4 ± 16.1	139,7± 15,5	**138,8 ± 16,1**
DBP, mean ± SD most recent visit	81,9 ± 9,4	81,6 ± 9,3	82,4 ± 9,3	**82,0 ± 9,5**
SBP, mean ± SD second recent visit	137.8 ± 14,5	138,0 ± 14,5	137,4 ± 13,0	**138,5 ± 15,0**
DBP, mean ± SD second recent visit	83,4 ± 8,1	83,6 ± 8,1	83,0 ± 8,0	**82,6 ± 8,2**
FG, mean ± SD most recent visit	9.2± 3.7	9.5± 3.7	9.5 ± 3.5	**9.2± 3.7**
FG, mean ± SD second recent visit	9.4± 3.6	9.0± 3.6	10.6 ± 3.6	**8,9± 3.4**
TC, mean ± SD most recent visit	5.3 ± 1.4	5.5 ± 1.4	4.9 ± 1.4	**5.1 ± 1.3**
TC, mean ± SD second recent visit	6.07 ± 1.93	6.06 ± 1.98	6.12 ± 1.96	**5,5 ± 1.5**
calculated BMI, mean ± SD	30.8 ± 5.5	31.3 ± 5.5	30.1 ± 5.5	**30.7 ± 5,4**

Abbreviations: CVD, cardiovascular disease; SBP, systolic blood pressure; DBP, diastolic blood pressure; FG, fasting glucose; TC, total cholesterol; BMI, body mass index; SD, standard deviation.

**Batumi was excluded from data analysis due to inaccurate data from not updated registers (see above)

Table 2B: Risk factors of patients in the diabetes sample by clinic

Risk factors	All	KMC-VAKE	KMC-Nadzaladevi	NFMTC	Batumi**	Mtskheta	Kutaisi Nazarishvili FMC	Kutaisi N4	Holding 23
Current smoker*, % (n/N)	5.4 (41/766)	3.4 (3/87)	6.6 (7/106)	8.9(11/124)	0.0 (0/106)	6.4(6/94)	4.0 (4/100)	12.2(6/49)	4.0(4/100)
Current non-smoker % (n/N)	63.2(484/766)	95.4(83/87)	51.9(55/106)	73.4(91/124)	0.0 (0/106)	93.6 (88/94)	36.0(36/100)	71.4(35/49)	96.0 (96/100)
Hypertension, % (n/N)	87.9(673/766)	88.5(77/87)	67.9 (72/106)	81.5 (101/124)	97.2 (103/106)	93.6(88/94)	88.0(88/100)	93.9 (46/49)	98.0 (98/100)
History of CVD, % (n/N)	47,1(361/766)	31,0 (27/87)	44,3 (47/106)	31,5 (39/124)	7,5 (8/106)	68,1 (64/94)	68,0 (68/100)	75,5 (37/49)	71,0 (71/100)
SBP, mean ± SD most recent visit	138,3 ± 16,1	136.4 ± 11.0	132.4± 17.0	128.7 ± 11.0	135.2± 16,0	144.6 ± 16,0	145.3 ± 14.0	150.1± 17.8	139,3 ± 15.9
DBP, mean ± SD most recent visit	81,9 ± 9,4	80.3± 8.8	78.3 ± 7.7	76.9 ± 6.8	81,6 ± 8.6	85.4 ± 8.3	87.2 ± 8.4	88.9 ± 10.7	80.3 ± 10.0
SBP, mean ± SD second recent visit	137.8 ± 14,5	137.1 ± 10.0	135.8 ± 17.0	132.3 ± 14,0	134.8 ± 12.0	138.3± 15.0	141.1± 13.0	150.0 ± 20.7	137.6 ± 11.0

DBP, mean ± SD second recent visit	83,4 ± 8,1	83,2± 6.9	80.5± 8,7	79.7± 6.8	86.6 ± 6.7	83,5 ± 8,1	87.1± 7.7	85.3 ± 8,6	80.3± 8,3
FG, mean ± SD most recent visit	9.2± 3.7	8.5± 2.7	11.6± 4	8.9± 3.8	7.9± 2.5	7.8± 4.1	11.1± 4.0	9.2± 2.3	8.1± 2.8
FG, mean ± SD second recent visit	9.4± 3.6	9.1± 3.5	8.9± 1.4	8.2± 4.3	8.2± 2.8	8.2± 2.5	15.9± 4.8	9.6± 3.6	8.2± 2.3
TC, mean ± SD most recent visit	5.3 ± 1.4	5.0± 1.2	5.4 ± 1.4	5.3 ± 0.9	6.1 ± 1.5	5.0 ± 1.4	4.6± 1.3	4.9 ± 1.1	5.4 ± 1.4
TC, mean ± SD second recent visit	6.07 ± 1.93	4.3 ± 1.5	6.6 ± 2.3	5.1 ± 0.6	6.8 ± 2.3	5.3 ± 1.1	3.5 ±---	5.6 ± 2.1	5.9 ± 1.5
calculated BMI, mean ± SD	30.8 ± 5.5	30.9 ± 7.3	30.2± 4.8	29.1 ± 4.4	33.2± 5.2	28.4± 4.4	31.4 ± 4.6	31.2 ± 5.8	31.4 ± 5.3

* Patients with missing smoking status were excluded.

**Batumi was excluded from data analysis due to inaccurate data from not updated registers (see above)

Among diabetic patients, who had at least one blood pressure measurement during the last year (93.6%), only 37.9% met the treatment target of SBP/DBP < 130/80 mmHg, and the mean values for SBP and DBP were 138.5 and 82.0 mmHg, respectively with the highest rate 150.1± 17.8 mmHg (in Kutaisi №4 Polyclinic) and lowest 128.7 ± 11.0 mmHg (In NFMTC). Meeting target blood pressure is higher in this study compared with the DANEP (23%), but the mean values for SBP and DBP were lower last year (131 and 79 mmHg respectively). About two thirds (68.8%) had blood pressure measured twice during the last year. Comparing the results of three clinics: NFMTC, KMC Vake and KMC Nadzaladevi, control of blood pressure improved significantly from recent study (59.7% vs 23.4%; 41% vs 9.7% and 48% vs 40% respectively). These data are encouraging that family doctors are improving practice of management of high blood pressure.

HbA1c was tested for 25% of diabetic patients. About 65.6% of the patients had fasting glucose tested and 20% of those had fasting glucose controlled with a treatment target for diabetics of < 7 mmol/l (43% in DANEP study). However, it should be noted that in NFMTC achieving fasting glucose control was almost the same as in DANEP study - 41.5%. The mean fasting glucose level was at 9.2± 3.7mmol/l (8 mmol/l in DANEP study), showing that there were some quite high values, too (lowest 7.8± 4.1mmol/l in Mtskheta PHC and highest 11.6± 4mmol/l in KMC Nadzaladevi)., Testing rates for total cholesterol was 44.5%, and among those, 20.5% had total cholesterol < 5 mmol/l (44% in DANEP study that is significant decrease in achievement of TC target level). Testing rates for LDL cholesterol was lower with 12.4% (15% in DANEP study) of the patients having it tested. Rate of twice measurement were less: 9.1% for TC and 1.2% for LDL-C respectively. Total cholesterol mean value at the last visit was 5.1 ± 1.3mmol/l with a bit higher rate for women than men (5.5 ± 1.4 and 4.9 ± 1.4mmol/l respectively). It should be noted that in those patients where total cholesterol was measured twice there was the tendency to improvement: mean most recent TC was less than mean second recent TC (5.5 ± 1.5 and 5.1 ± 1.3mmol/l respectively).

More than 77% of the patients had information on BMI recorded (62% in DANEP study) and based on the information about weight and height recorded in the medical charts calculation of BMI was possible for the analysis in 5.1% of charts. Mean BMI value for the selected patients was 30.7 ± 5.4 with highest rate in Batumi Regional FMC (33.2± 5.2) and lowest in Mtskheta FMC (28.4± 4.4). Based on the recorded and calculated BMI, 55.3% of women and 48.8% of men were obese. Obesity rate increased slightly in women and almost twice in men from recent DANEP study where 46% of women and 24% of men were obese.

Also in the reviewed charts, none of the patients had a recorded risk score. This finding might be explained by the fact that based on the old National Protocol for CVD risk assessment and prevention, diabetes was considered a high risk for cardiovascular disease and risk calculation was not recommended for patients with diabetes.

More than third of the patients (37 %) was not referred to a diabetes specialist for diagnosis, and treatment and follow-up. But it should be noted that more than half of the patients (58.2%) were referred to diabetes specialist. This indicator worsened compared with the results from recent DANEP study. This might be explained by the fact that family doctors were too much overwhelmed in response of COVID-19 pandemic and therefore had less time for the patients with chronic conditions. In addition, in DANEP study diabetes' sample was tested only in NFMTC and in NFMTC referral rate to the endocrinologist is the lowest one also in current survey (only 8.9% of patients). Only 29.7% of diabetic patients were referred to the ophthalmologist for screening of retinopathy.

Almost all patients had medication for diabetes prescribed. Only 8% of patients had no prescription in medical charts. The majority of patients (69.7%) had tablets prescribed, insulin was prescribed to 19.8% of the patients, and both tablets and insulin to 2.3%. Prescription of tablets was more common among women and insulin more common among men. From tablets the majority of patients were prescribed Metformin (45%), 12.3% were prescribed sulfonylureas and 0.8% other classes of glucose lowering oral drugs. These findings are comparable with DANEP study results which indicates almost similar medication prescribing practices. The practice of medication prescription is mostly influenced by the State program of chronic medications where Metformin and Sulfonylureas are included.

Statin and aspirin were more frequently prescribed to men (in previous DANEP study there was opposite finding): Statin was prescribed to 33.7% of women and 41.9% of men, aspirin to 47.3% of women and 51.5% of men, anti-hypertensive medication prescription was slightly higher to men (67.3%) compared with women (65%). Triple therapy was prescribed to 33% of all diabetic patients (53.2% of patients with diabetes and comorbid CVD).

Statin prescribed if established CVD (CAD, stroke, PAD, angina, MI) and elevated Total cholesterol (TC≥5mmol/l at last visit) during the last year in 79.2% of patients and unnecessary duplication of tests (Repeated measurement of TC or LDL-C if no established CVD (CAD, stroke, PAD, angina, MI) and

TC<5mmol/l or LDL-C<2mmol/l) found in few cases which were not statistically significant but need attention from PHC personnel. Detailed information about process and outcome indicators see in table 3A.

Table 3A: Process and outcome indicators of patients in the total sample by gender

Process and outcome indicators	Sample with Batumi			Sample without Batumi*
	Both	**Women**	**Men**	
	% (n/N)	**% (n/N)**	**% (n/N)**	**% (n/N)**
Process indicators				
Last visit type face to face	83.4 (639/766)	82.1(390/475)	85.6(249/291)	**80,8 (533/660)**
Last visit type remote	16.6 (127/766)	17.9(85/475)	14.4(42/291)	**19,2 (127/660)**
Smoking status recorded	68.5 (525/766)	72.6 (345/475)	61.9 (180/291)	**79,5 (525/660)**
BP measured once during the last year	94.3 (722/766)	94.7(450/475)	93.5 (272/291)	**93.6 (618/660)**
BP measured twice during the last year	68.8 (527/766)	73.7 (350/475)	60.8 (177/291)	**63.9 (422/660)**
HbA1c tested	22.1 (169/766)	17.9 (85/475)	28.9 (84/291)	**25.2 (166/660)**
Fasting glucose tested	70.1(537/766)	72.8 (346/475)	65.6 (191/291)	**65.6 (433/660)**
Total cholesterol tested	49.0 (375/766)	50.9(242/475)	45.7 (133/291)	**44.5 (294/660)**
LDL cholesterol tested	2.1(16/766)	2.7(13/475)	1.0(3/291)	**1.2 (8/660)**
BMI recorded by health care professionals	77.8(593/766)	78.3(372/475)	75.9(221/291)	**77.3(510/660)**
BMI calculated for the analysis	5.1(39/766)	3.2(15/475)	8.2(24/291)	**5.9(39/660)**
Obese (BMI ≥ 30 kg/m2)	52.8 (334/632)	55.3 (214/387	48.8 (120/246)	**40,2 (265/660)**
Total cholesterol tested once during the last year	49.0(375/766)	50.9(242/475)	45.7 (133/291)	**44.5 (294/660)**
Total cholesterol tested twice during the last year	14.1 (108/766)	16.8(80/475)	9.6(28/291)	**9.1 (60/660)**
LDL cholesterol tested once during the last year	12.4 (95/568)	13.5 (64/475)	10.7(31/291)	**12.4 (82/660)**
LDL cholesterol tested twice during the last year	2.1(16/766)	2.7(13/475)	1.0 (3/291)	**1.2 (8/660)**
WHO/ISH risk score documented	0.0 (0/766)	0.0 (0/475)	0.0 (0/291)	**0.0 (0/660)**
Referred to DM specialist?				
No	31.9 (244/766)	32.2 (153/475)	31.3 (91/291)	**37.0 (244/660)**
Yes (for diagnosis)	0.4(3/766)	0.6 (3/475)	0.0 (0/291)	**0.5 (3/660)**
Yes (for treatment and follow-up)	64.0(490/766)	64.2 (305/475)	63.6(185/291)	**58.2 (384/660)**
Yes (for all)	0.7(5/766)	0.2 (1/475)	1.4 (4/291)	**0.8 (5/660)**
Referred to ophthalmologist for retinopathy screening	38,5 (295/766)	0.2 (1/475)	1.4 (4/291)	**29.7 (196/660)**
DM drug				

DM drug: No	7.0 (54/766)	7.4 (35/475)	6.5(19/291)	**8.0 (53/660)**
DM drug: tablets	71.3(546/766)	74.3 (353/475)	66.3(193/291)	**69.7 (460/660)**
Metformin	39.4(302/766)	40.4(192/475)	37.8(110/291)	**45.0 (297/660)**
Sulfonylurea	10.6(81/766)	8.4(40/475)	14.1(41/291)	**12.3 (81/660)**
Other	0.7(5/766)	0.6(3/475)	0.7(2/291)	**0.8 (5/660)**
DM drug: insulin	19.6(150/766)	16.8 (80/475)	24.170/291)	**19.8 (131/660)**
DM drug: tablets and insulin	2.0(15/766)	1.5 (7/475)	2.7(8/291)	**2.3 (15/660)**
Statin prescribed	37.2 (285/766)	34.3 (163/475)	41.9(122/291)	**42.7 (282/660)**
Aspirin prescribed	50.3(385/766)	49.1 (233/475)	52.2 (152/291)	**57.0 (376/660)**
Anti-hypertensive drug prescribed	70.1 (537/766)	70.5 (335/475)	69.4(202/291)	**76.4 (504/660)**
Triple therapy prescribed	28.7 (220/766)	26.7(127/475)	32.0 (93/291)	**33.0 (218/660)**
Statin prescribed if established CVD (CAD, stroke, PAD, angina, MI) and elevated LDL- cholesterol (LDL-C≥2mmol/l at last visit) during the last year	48.6(18/37)	67.6(25/37)	32.4(12/37)	**50.0 (15/30)**
Statin prescribed if established CVD (CAD, stroke, PAD, angina, MI) and elevated Total cholesterol (TC≥5mmol/l at last visit) during the last year	68,6 (59/86)	66,7(40/60)	73,1 (19/26)	**79.2 (19/24)**
Outcome indicators				
BP at normal range (SBP/DBP < 130/80 mmHg) last visit	38.1 (292/766)	40.0(190/475)	35.1(102/291)	**37.9 (250/660)**
BP at normal range (SBP/DBP < 130/80 mmHg) before last visit	24.5 (188/766)	24.6(117/475)	24.4(71/291)	**25.5 (168/660)**
Fasting glucose controlled (FG < 7 mmol/l) last visit	23.0 (176/766)	23.4(111/475)	22.3(65/291)	**20.0 (132/660)**
Fasting glucose controlled (FG < 7 mmol/l) before last visit	10.2 (78/766)	12.4(59/475)	6.5(19/291)	**6.2 (41/660)**
Total cholesterol controlled (TC < 5 mmol/l) last visit	19.5 (149/766)	16.6(79/475)	24.1(70/291)	**20.5 (135/660)**
Total cholesterol controlled (TC < 5 mmol/l) before last visit	4.0 (31/766)	5.0(24/475)	2.4(7/291)	**3.3 (22/660)**

*Batumi was excluded from data analysis due to inaccurate data from not updated registers (see above)

All diabetics – comparison by clinics

Table 3B: Process and outcome indicators of patients in general sample by clinic										
Process indicators	**All with Batumi**	**All without Batumi**	**KMC-Vake**	**KMC-Nadzaladevi**	**NFMTC**	**Batumi**	**Mtskheta**	**Kutaisi Nazarishvili**	**Kutaisi N4**	**Holding 23**
	% (n/N)	**% (n/N)**	**% (n/N)**	**% (n/N)**	**% (n/N)**	**% (n/N)**	**% (n/N)**	**% (n/N)**	**% (n/N)**	**% (n/N)**
Last visit type face to face	83.4 (639/766)	**80,8 (533/660)**	98.9 (86/87)	96.02 (102/106)	9.7(12/124)	100.0(106/106)	96.8(91/94)	99.0 (99/100)	91.8(45/49)	98.0(98/100)
Last visit type remote	16.6 (127/766)	**19,2 (127/660)**	1.1 (1/87)	3.8 (4/106)	90.3(112/124)	0.0(0/106)	3.2(3/94)	1.0 (1/100)	8.2(4/49)	2.0(2/100)
Smoking status recorded	68.5 (525/766)	**79,5 (525/660)**	98.9 (86/87)	58.5 (62/106)	82.3(102/124)	0.0(0/106)	100.0 (94/94)	40.0 (40/100)	83.7(41/49)	100.0(100/100)
BP measured once during the last year	94.3 (722/766)	**93.6 (618/660)**	98,9 (86/87)	87,7 (93/106)	79,8 (99/124)	98,1 (104/106)	98,9 (93/94)	100.0 (100/100)	98.0 (48/49)	99.0 (99/100)
BP measured twice during the last year	68.8 (527/766)	**63.9 (422/660)**	65,5(57/87)	31,1 (33/106)	55,6 (69/124)	99,1 (105/106)	80,9 (76/94)	57 (57/100)	91,8 (45/49)	85,0 (85/100)
HbA1c tested	22.1 (169/766)	**25.2 (166/660)**	19.5 (17/87)	23.6 (25/106)	17.7(22/124)	2.8 (3/106)	30.9 (29/94)	44.0 (44/100)	53.1(26/49)	3.0 (3/100)
Fasting glucose tested	70.1(537/766)	**65.6 (433/660)**	37.9 (33/87)	41.5 (44/106)	66.9(83/124)	98.1 (104/106)	86.2 (81/94)	66.0 (66/100)	98.0(48/49)	78.0 (78/100)
Total cholesterol tested	49.0 (375/766)	**44.5 (294/660)**	35.6 (31/87)	31.1 (33/106)	47.6(59/124)	76.4 (81/106)	55.3 (52/94)	44.0 (44/100)	65.3(32/49)	43.0 (43/100)
LDL cholesterol tested	12.4(95/766)	**1.2 (8/660)**	32.2 (28/87)	19.8 (21/106)	13.7(17/124)	12.3(13/106)	4.3 (4/94)	4.0 (4/100)	8.2(4/49)	1.0 (1/100)
BMI recorded by health care professionals	77.8(593/766)	**77.3(510/660)**	94.3 (82/87)	74.5 (79/106)	56.5(70/124)	78.3(83/106)	98.9 (93/94)	59.0 (59/100)	79.6(39/49)	88.0 (88/100)
BMI calculated for the analysis	5.1(39/766)	**5.9(39/660)**	0.0 (0/87)	0.0 (0/106)	0.0 (0/124)	0.0 (0/106)	0.0 (0/94)	39.0 (39/100)	0.0 (0/49)	0.0 (0/100)
Obese (BMI ≥ 30 kg/m2)	40.9 (313/766)	**40,2 (265/660)**	50.6 (44/87)	25.5 (27/106)	10.5 (13/124)	65.1 (69/106)	35.1 (33/94)	57.0 (57/100)	40.8 (20/49)	50.0 (50/100)
Total cholesterol tested once during the last year	49.0(375/766)	**44.5 (294/660)**	35,6 (31/87)	31,1 (33/106)	47,6 (59/124)	76,4 (81/106)	55,3 (52/94)	44.0 (44/100)	65,3 (32/49)	43.0 (43/100)

Process indicators	All with Batumi	All without Batumi	KMC-Vake	KMC-Nadzaladevi	NFMTC	Batumi	Mtskheta	Kutaisi Nazarishvili	Kutaisi N4	Holding 23
Table 3B: Process and outcome indicators of patients in general sample by clinic										
	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)
Total cholesterol tested twice during the last year	14.1 (108/766)	**9.1 (60/660)**	3,4 (3/87)	1,9 (2/106)	11,3 (14/124)	45,3 (48/106)	16.0 (15/94)	1.0 (1/100)	22,4 (11/49)	14.0 (14/100)
LDL cholesterol tested once during the last year	12.4 (95/568)	**12.4 (82/660)**	32,2 (28/87)	19,8 (21/106)	13,7 (17/124)	12,3 (13/106)	4,3 (4/94)	4.0 (4/100)	8,2 (4/49)	4.0 (4/100)
LDL cholesterol tested twice during the last year	2.1(16/766)	**1.2 (8/660)**	2,3 (2/87)	2,8 (3/106)	1,6 (2/124)	7,5 (8/106)	1,1 (1/94)	0.0 (0/100)	0.0 (0/49)	0.0 (0/100)
WHO/ISH risk score documented	0.0 (0/766)	**0.0 (0/660)**	0.0 (0/87)	0.0 (0/106)	0.0 (0/124)	0.0 (0/106)	0.0 (0/94)	0.0 (0/100)	0.0 (0/49)	0.0 (0/100)
Referred to DM specialist?										
No	31.9 (244/766)	**37.0 (244/660)**	65,5 (57/87)	38,7 (41/106)	72,6 (90/124)	0.0 (0/106)	13,8 (13/94)	12.0 (12/100)	8,2 (4/49)	27.0 (27/100)
Yes (for diagnosis)	0.4(3/766)	**0.5 (3/660)**	0.0 (0/87)	0.0 (0/106)	0.0 (0/124)	0.0 (0/106)	0.0 (0/94)	0.0 (0/100)	6,1 (3/49)	0.0 (0/100)
Yes (for treatment and follow-up)	64.0(490/766)	**58.2 (384/660)**	34,5 (30/87)	59,4 (63/106)	8,9 (11/124)	100.0 (106/106)	86,2 (81/94)	84.0 (84/100)	85,7 (42/49)	73.0 (73/100)
Yes (for all)	0.7(5/766)	**0.8 (5/660)**	0.0 (0/87)	0.9 (1/106)	3,2 (4/124)	0.0 (0/106)	0.0 (0/94)	0.0 (0/100)	0.0 (0/49)	0.0 (0/100)
Referred to ophthalmologist for retinopathy screening	38,5 (295/766)	**29.7 (196/660)**	4,6 (4/87)	14,2 (15/106)	16,1 (20/124)	93,4 (99/106)	50,0 (47/94)	39.0 (39/100)	69,4(34/49)	37.0 (37/100)
DM drug										
DM drug: No	7.0 (54/766)	**8.0 (53/660)**	3,4 (3/87)	15,1 (16/106)	16,1 (20/124)	0,9 (1/106)	3,2 (3/94)	1.0 (1/100)	0.0 (0/49)	10.0 (10/100)
DM drug: tablets	71.3(546/766)	**69.7 (460/660)**	73,6 (64/87)	61,3 (65/106)	70,2 (87/124)	81,1 (86/106)	89,4 (84/94)	40.0 (40/100)	93,9 (46/49)	74.0 (74/100)
Metformin	39.4(302/766)	**45.0 (297/660)**	55,2(48/87)	21,7 (23/106)	29,8 (37/124)	4,7 (5/106)	50.0 (47/94)	26.0 (26/100)	93,9 (46/49)	70.0 (70/100)
Sulfonylurea	10.6(81/766)	**12.3 (81/660)**	14,9 (13/87)	13,2 (14/106)	7,3 (9/124)	0.0 (0/106)	16,0 (15/94)	19.0 (19/100)	8,2 (4/49)	7.0 (7/100)
Other	0.7(5/766)	**0.8 (5/660)**	2,3 (2/87)	1,9 (2/106)	0.8 (1/124)	0.0 (0/106)	0.0 (0/94)	0.0 (0/100)	0.0 (0/49)	0.0 (0/100)

Process indicators	All with Batumi	All without Batumi	KMC-Vake	KMC-Nadzaladevi	NFMTC	Batumi	Mtskheta	Kutaisi Nazarishvili	Kutaisi N4	Holding 23
Table 3B: Process and outcome indicators of patients in general sample by clinic										
	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)	% (n/N)
DM drug: insulin	19.6(150/766)	**19.8 (131/660)**	23.0 (20/87)	18,9 (20/106)	11,3 (14/124)	17,9 (19/106)	3,2 (3/94)	57.0 (57/100)	6,1 (3/49)	14.0 (14/100)
DM drug: tablets and insulin	2.0(15/766)	**2.3 (15/660)**	0.0 (0/87)	4,7 (5/106)	2,4 (3/124)	0.0 (0/106)	4,3 (4/94)	2.0 (2/100)	0.0 (0/49)	1.0 (1/100)
Statin prescribed	37.2 (285/766)	**42.7 (282/660)**	35,6 (31/87)	35,8 (38/106)	32,3 (40/124)	2,8 (3/106)	61,7(58/94)	41.0 (41/100)	42,9 (21/49)	53.0 (53/100)
Aspirin prescribed	50.3(385/766)	**57.0 (376/660)**	57,5 (50/87)	43,4 (46/106)	46.0 (57/124)	8,5(9/106)	73,4(69/94)	58.0 (58/100)	65,3(32/49)	64.0 (64/100)
Anti-hypertensive drug prescribed	70.1 (537/766)	**76.4 (504/660)**	86,2 (75/87)	53,8 (57/106)	60,5 (75/124)	31,1 (33/106)	90,4 (85/94)	80.0 (80/100)	83,7 (41/49)	91.0 (91/100)
Triple therapy prescribed	28.7 (220/766)	**33.0 (218/660)**	18.4 (16/87)	53,8 (12/106)	11.3 (16/124)	1.9 (2/106)	33.0 (31/94)	8.0 (8/100)	18.4 (9/49)	33.0 (33/100)
Statin prescribed if established CVD (CAD, stroke, PAD, angina, MI) and elevated LDL- cholesterol (LDL-C≥2mmol/l at last visit) during the last year	48.6(18/37)	**50.0 (15/30)**	42.9(3/7)	50(5/10)	60(3/5)	42.9(3/7)	50(1/2)	50 (1/2)	50 (1/2)	50 (1/2)
Statin prescribed if established CVD (CAD, stroke, PAD, angina, MI) and elevated Total cholesterol (TC≥5mmol/l at last visit) during the last year	68,6 (59/86)	**79.2 (19/24)**	0.0 (4/6)	0.0 (7/11)	0.0 (4/6)	0.0 (3/6)	0.0 (15/20)	0.0 (2/4)	0.0 (4/6)	0.0 (20/27)
Outcome indicators										
BP at normal range (SBP/DBP < 130/80 mmHg) last visit	38.1 (292/766)	**37.9 (250/660)**	41,1 (36/87)	48,1(51/106)	59,7(74/124)	39,6(42/106)	24,5(23/94)	18.0 (18/100)	14,3 (7/49)	41.0 (41/100)
BP at normal range (SBP/DBP < 130/80 mmHg) before last visit	24.5 (188/766)	**25.5 (168/660)**	27,6 (24/87)	16,0 (17/106)	35,5 (44/124)	18,9 (20/106)	35,1 (33/94)	11.0(11/100)	12,2 (6/49)	33.0 (33/100)
Fasting glucose controlled (FG < 7 mmol/l) last visit	23.0 (176/766)	**20.0 (132/660)**	11.5 (10/87)	5.7(6/106)	25.8(32/124)	41.5(44/106)	45.7(43/94)	8.0 (8/100)	10.2 (5/49)	28.0 (28/100)

Table 3B: Process and outcome indicators of patients in general sample by clinic

Process indicators	All with Batumi % (n/N)	All without Batumi % (n/N)	KMC-Vake % (n/N)	KMC-Nadzaladevi % (n/N)	NFMTC % (n/N)	Batumi % (n/N)	Mtskheta % (n/N)	Kutaisi Nazarishvili % (n/N)	Kutaisi N4 % (n/N)	Holding 23 % (n/N)
Fasting glucose controlled (FG < 7 mmol/l) before last visit	10.2 (78/766)	**6.2 (41/660)**	2.3(2/87)	0.0 (0/106)	10.5(13/124)	34.9(37/106)	18.1(17/94)	0.0 (0/100)	6.1 (3/49)	6.0 (6/100)
Total cholesterol controlled (TC < 5 mmol/l) last visit	19.5 (149/766)	**20.5 (135/660)**	16.1 (14/87)	13.2 (14/106)	16.1(20/124)	13.2(14/106)	27.7(26/94)	35.0 (35/100)	32.7 (16/49)	10.0 (10/100)
Total cholesterol controlled (TC < 5 mmol/l) before last visit	4.0 (31/766)	**3.3 (22/660)**	2.3 (2/87)	0.0 (0/106)	4.8 (6/124)	8.5 (9/106)	6.4 (6/94)	1.0(1/100)	6.1 (3/49)	4.0 (4/100)

*Batumi was excluded from data analysis due to inaccurate data from not updated registers (see above)

Overall diabetic patients have higher rates of BP control in NFMTC, glucose control is higher in Mteskheta PHC center, higher control of total cholesterol is observed in Kutaisi Nazarishvili FMC, higher prescription of statin is in NFMTC and triple therapy more frequently prescribed in KMC Nadzaladevi. CVD risk score is not calculated in any chart and there is a room for improvement in this direction.

Key messages and lessons learnt

Key achievements:

1. The initiative shows how it is possible to building evidence by using current collected data to improve clinical practice and, from these, inform the ongoing health reforms.
2. Based on the experience with this exercise the team of expert auditors can move forward with using the audit tool in other healthcare facilities.
3. Study helped us to highlight the discrepancies between actual practice and standard of diabetes care in order to identify the changes needed to improve the quality of medical service for diabetic patients;
4. Study highlighted the need to establish local clinical pathways and routine data standards for ensuring collection of quality data;
5. Study highlighted the need for preparation (e.g., through training or introducing specific manuals) before introducing quality improvement tools and the importance of a visible relationship between audit activity and patient care;
6. QI leaders in selected facilities realized importance of systematic approach to design, test and implement change using real-time data for improvement, with the ultimate aim of delivering a tangible and evidence-based difference;
7. Individual family doctors realized the importance of participation in quality improvement activities, their involvement in discussing the conditions that contribute to successful improvement initiatives in PHC, and their role as physicians in those initiatives.
8. CVD risk calculation could be done having the data about age, gender, smoking status, systolic BP and total cholesterol level, but there was no record in medical charts. Therefore, this message was communicated to the healthcare providers from selected facilities and they were given task to calculate and enter CVD risk scores in relevant medical records.
9. The challenges related to the COVID-19 pandemic showed that there was disruption of the delivery chronic care to diabetic patients. So developing a practice organization plan to organize chronic care and use digital channels for support, especially to vulnerable patients might be very helpful.

Lessons learnt

1. Due to time constraints, we were not able to communicate importance of QI activities to all medical staff of selected PHC facilities, therefore single individuals in a team which were responsible for all audit might be limiting factor for chance to drive improvements;
2. We could not involve nurses in clinical audit process;

3. Discrepancies between the data from Batumi regional FMC and other clinics showed us how important is to have correct patient registers and how poor or missing recording of data in data sources may compromise data quality;
4. Retrieving data from electronic or paper health records for clinical audits was inherently more complex than clinicians were able imagine and this lesson was very useful for them for the future QI activities;
5. Conducting an audit was a time-consuming and demanding activity, and due to the period of the study when the majority of medical staff had vacation, the data collection process was performed in a pressured environment, leaving little time to develop, carry out and re-audit an action plan.
6. Primary care providers have substantially fewer resources to develop QI capacity on their own. Most PHC clinics have large numbers of patients, leading them to focus on the daily demands of patient care and they need external support to participate in these kinds of activities.