Ukraine faces a triple health challenge from non-communicable diseases (NCDs), infectious diseases, and the demographic situation with low fertility, out-migration, and excess adult male mortality. It also has the challenge of re-focusing its health systems from a vertical hospital-based model with high hospitalization rates and length of stay to a community-based patient-centred model, emphasizing primary health care, out-patient care and health promotion. In short, it must move a system designed for injury and infectious diseases to one designed for better management of chronic care, prevention and promotion.

KEY MESSAGES

1. Diabetes mellitus has become one of the most serious public health problems due to its increasing incidence, devastating complications if undiagnosed or untreated, and costs of patient care.

2. A cascade analysis was conducted to systematically identify the breakpoints along the type-2 diabetes care delivery chain in two regions of Ukraine. The continuum of diabetes care included the registration of diagnosed cases, linkage to care and treatment, glucose monitoring and the attainment of sustained glucose control while on treatment. The analysis found significant breakpoints across the diabetes cascade.

3. Screening and diagnosis: Diabetic cases are identified at health facilities and in some outreach activities, but up to 50% of cases are undiagnosed. People may avoid diagnosis due to recurrent costs of care and low risk perception of undiagnosed, untreated diabetes. Screening campaigns are poorly evaluated and not strategically targeted, and endocrinologists’ patient data are not flowing back to the PHC level. Also, the PHC level has insufficient capacity to confidently address the diabetes epidemic.

4. Linkage to appropriate care: Health care providers lacked fit-for-purpose data system to flag people who are diagnosed but not in care, or on treatment but failing targets.

5. Treatment monitoring: HbA1C testing is integrated in Poltava’s diabetes program but not Lviv’s where 42% of diabetics on medication have no record of HbA1C monitoring. Self-monitoring and treatment adherence are not sufficiently supported by the public sector providers and non-pharmacological interventions on weight loss and physical activity not well tracked and evaluated.

6. Disease control: Attainment of the glycated haemoglobin target was the largest breakpoint. In Lviv Region, 80% of HbA1C monitored cases didn’t achieve the target, according to the 2016 routine statistics, and in Poltava, 73% didn’t achieve the target in 2016. Patients experience economic (drug/monitoring costs), cognitive (knowledge, risk perception), psychological (fears, stigma), behavioural (nutrition habits) and medical barriers to sustained treatment adherence and long-term glucose control.

7. This analysis presents important lessons and policy implications for diabetes care in Ukraine: (i) Diabetes screening needs to be strengthened for better targeting, follow-up...
and evaluation; (ii) The **PHC level** needs to have the confidence and capacity as well as resources to manage diabetes patients as tasks are shifted from specialists to family doctors; (iii) The new **electronic medical record system** can become the backbone for identifying patient-level gaps in prevention and care, and inform quality improvement; (iv) There are opportunities for **better diabetes patients’ education and empowerment** towards assisted self-monitoring; and (v) The **cascade framework** offers an analysis approach to track change in the continuum of diabetes care as the PHC reform takes effect, and emphasizes the **importance of evaluating the final outcome** (glucose control among the entire diabetic population).

**INTRODUCTION**

Type-2 diabetes mellitus (T2DM) is one of the leading causes of poor health and high health care expenditure in Ukraine. There are close to 3 million adults with diabetes and T2DM prevalence is at 8.4%,\(^{ii,iii}\) This puts Ukraine into an average position across Eastern and Central European countries for T2DM prevalence (Figure 1).

According to best estimates across countries by the International Diabetes Federation (IDF), Ukraine’s level of undiagnosed diabetes at about 40% of all diabetes is on a par with several countries in the region (Figure 2). However, due to the size of Ukraine’s population, this translates into **over 1 million undiagnosed cases**\(^iv\). Expenditure to finance diabetes treatment is high and growing, a recent costing study of the Ukrainian pharmaceutical market reported for **oral antidiabetic medications** alone annual expenditure of 22.6 million USD in 2014 and 56.1 million USD in 2016.\(^v\) The annual expenditure for diabetes in Ukraine is about **US$460 million**.\(^vi\)

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**Figure 1** Diabetes prevalence in adults 18+ years, 2016

**Figure 2** Undiagnosed diabetes in adults 18+ years, 2016

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*Source: IDF 2017, estimates for year 2016 for Eastern and Central European countries, as per IDF 8th Diabetes Atlas*

Diabetes has become the 7th most important cause of Years Lived with Disability in Ukraine.\(^vii\) The occurrence of T2DM is according to the WHO a result of rising overweight and obesity rates, lifestyle and dietary changes, and an aging population.\(^viii\) The 2016 International Diabetes Management Practices Study reports very high hospital admission rates for diabetes cases in Ukraine.\(^ix\) Seventy-seven percent of T2DM patients (and 85% of T1DM cases) reported at least one hospital stay over the last 12 month. The same study
reports high levels of vascular complications with 38% of T2DM and 18% of T1DM patients suffering from macrovascular complications (and over 9 out of 10 from microvascular complications). While diabetes is a major driver of disability and impaired quality of life, it is also directly responsible for over 40,000 deaths annually.\(^a\)

Several reports have highlighted the charges Ukrainian diabetics face for diabetes medication, self-monitoring equipment and routine laboratory tests.\(^a\) Given patients’ challenges to afford diabetes care, the Ukraine Government has embarked on reimbursement schemes. An electronic register of diabetic patients was also introduced, forming the backbone to better patient monitoring, data on health service performance, and medical statistics. Much of the ongoing difficulties in gathering reliable data comes from how diabetes care has been organised, with patients managed by endocrinologists employed by the government in a parallel system to the patient care provided by family doctors.\(^{xii}\) Disparate data systems lead to poor information about burden, diagnosis rates, treatment, as well as disease control in known diabetes cases.

**The World Bank, with support from the Swiss Development cooperation, implements the technical assistance program “Support to Reforms and Governance in the Health Sector in Ukraine”.** In 2017, an analysis was conducted on the continuum of care for T2DM in two Ukrainian Regions, Lviv and Poltava.

The “cascade” framework was used for the analysis, asking four questions about a patient’s pathway:

- **First**, is a patient diagnosed if he/she has a health condition?
- **Second**, is the patient linked to appropriate care and treatment?
- **Third**, is the patient monitored on the care regimen? and
- **Fourth**, does the patient achieve disease control?

Failure at each stage of the cascade precludes success at the next, which means the cascade of care may tumble rapidly. The diabetes cascades were developed for the Regions of Lviv (2,534,174 inhabitants) and Poltava (1,431,110 inhabitants) to appraise the breakpoints in the care cascade and consider priority setting for the diabetes program. The analysis also provided a 2016 baseline prior to the introduction of an affordable medicines, patient reimbursement and health sector strengthening program in these regions.

**FINDINGS**

**Diabetes burden:** The total burden was estimated by combining estimates of diagnosed and undiagnosed diabetes and data triangulation. The data sources were:

- For diagnosed diabetes: Health Index report 2016 providing prevalence of self-reported diabetes for regions and national in adults 18+ years,\(^{xiii}\) Annual regional endocrinology reports 2016 (number of diabetics registered), and Ukraine data in the IDF database.
- For undiagnosed diabetes: Reports of 2016 screening campaigns in both regions, using the positive yield among people reporting no pre-existing diabetes,\(^{xiv}\) expert opinion and Ukraine data in the IDF database.

It was estimated that total diabetes prevalence in adults was 3.7%-6.3% in Lviv Region (74,000 – 129,000 diabetics) and 5.9%–6.3% in Poltava Region (70,000-75,000 diabetics).
The rates of registered diabetes per 10,000 adults were 315 for Lviv and 398 for Poltava Regions.

**CARE CASCADES: ALL AVAILABLE ROUTINE DATA DESCRIBING THE T2DM CONTINUUM OF CARE WERE BROUGHT TOGETHER:**

1. Registered T2DM: Total number of registered cases based on the endocrinology reports
2. T2DM linked to care: Diabetics who are reported as under dispensary supervision, either for non-pharmacological treatment (lifestyle advice, diet, exercise), or for pharmacological treatment (medication), using annual form #12 data from regional medical statistics units
3. T2DM on medication: Total number of T2DM reported as on medication by the endocrinology reports
4. HbA1C monitored: Applying reported HbA1C test coverage from endocrinology reports
5. Two levels of reported HbA1C test data were interpreted: HbA1C ≤ 8.0% as an indicator for reasonable disease control (Diabetes UK, 2017), and HbA1C ≤ 7.0% as an indicator of sustained glucose control through effective management of the glucose metabolism.
6. Data on chronic morbidity and mortality were also consulted: Morbidity data came from endocrinology reports. Mortality in diabetes cases or deaths from diabetes-related causes came from diabetes register data and regional 2015 mortality statistics (the two regions reported diabetes mortality slightly differently)
7. In addition, there were patient-level data available from a specially implemented patient card survey in Poltava. The results of this survey are reported after the main cascades.

**Figure 3 Type 2 diabetes care cascades and breakpoints for adults in Lviv Region (2016)**

Sources: Lviv Region Endocrinology report 2016 and annual form #12 statistics, Lviv Endocrinology Centre 2016 campaign summary, and demographic statistics.

In Lviv Region, there were several important breakpoints along the cascade (Figure 3). We estimated that 32-50% of T2DM were not detected and registered. Among those who had been registered at diagnosis, about 5,000 cases were not known to be under supervision and potentially lost to follow-up. Fifty-four percent of patients linked to care (and 42% of
Among those who had been registered at diagnosis, about 5,000 cases were not known to be under supervision and potentially lost to follow-up.

patients on diabetes medication) did not get HbA1C monitored based on public sector statistics. Four out of five patients with HbA1C monitoring data did not attain the glycated hemoglobin target level. Therefore, only 9% of T2DM cases recorded as linked to care (and 12% of cases on medication) had evidence of sustained glucose control (HbA1C<7%). About 8% of registered Lviv cases were reported to suffer from chronic morbidity. Deaths in people on the diabetes register made up 5.5% of all reported deaths (using 2015 mortality statistics reporting 32,869 deaths in total in the region).

In Poltava Region, disease detection was also a major breakpoint in the cascade with about a third of estimated cases missing from the diabetes register due to lack of detection (Figure 4). About 8% were not linked to care.

In contrast to Lviv, HbA1C monitoring was implemented at higher coverage in Poltava’s public sector once or twice annually for cases on both non-pharmacological and pharmacological treatment (a HbA1C test result is a condition for medicine prescription). Nevertheless, patients’ glucose control was again a large breakpoint with over seven out of ten HbA1C-monitored cases failing to achieve the glycated haemoglobin target level of ≤7,0%. Overall, only 25% of all T2DM cases linked to care (and about 63% of cases on medication) achieve the HbA1C target level. Of all diabetics registered in Poltava Region, 47% were reported to have complications. Known diabetes deaths among registered patients made up 0.2% of all deaths (using 2015 mortality statistics reporting 24,498 deaths).

Figure 4 Type 2 diabetes care cascades and breakpoints for adults in Poltava Region (2016)

Sources: Poltava Region Diabetes statistics 2016 and annual form #12 statistics, Poltava 2016 diabetes campaign summary, Demographic statistics

DIABETES PATIENT CARD SURVEY POLTAVA: ANONYMISED PATIENT DATA WERE EVALUATED TO BETTER UNDERSTAND TREATMENT MONITORING AND GLUCOSE CONTROL.

The following results were obtained from 398 of randomly selected ambulatory cards of Poltava diabetes cases:

- **Demographics:** 61% were female and 71% were 60 years old or younger
- **Risk factors:** 85% were overweight or obese, and 77% were also known hypertensives at diabetes diagnosis (“co-morbid patients”)
Timing of treatment initiation: 93% of cases were initiated on the day of diagnosis, 96% within a month and 98% had evidence of treatment initiation within 12 months.

Current treatment: Most patients were on oral treatment (Figure 5), 29% were on insulin either alone or in combination, and 8% of patients were on non-pharmacological treatment (diet and exercise advice).

Treatment monitoring: the penultimate and last monitoring visit was analysed for test data (Table 1). Coverage of fasting plasma glucose (FPG) monitoring was high at 97%, with a median interval between FPG checks of 83 days (79% of diabetic patients had FPG re-checked within 6 months, other random glucose checks not taken into account). Weight and blood pressure were recorded at all patients visits. Cholesterol test coverage was slightly higher among co-morbid patients. HbA1C results were not well reflected in the patient cards (and possibly not available at point of care), despite HbA1C monitoring being implemented according to the Endocrinology report (see Fig 4). However, it could be concluded that while male and female patients had similar HbA1C test coverage (one in 6), male patients had significantly better glycemic control (42%) compared to female patients (20%) using ≤7.0% cut-off.

Using each patient’s penultimate and last FPG test results, we evaluated patterns of elevated FPG while on anti-diabetic treatment.

Young diabetes patients and those on treatment combinations for T2DM and HTN had poorest glucose control (Figure 6). Best FPG results were seen in patients provided with advice but no medication, but these patients were mainly pre-diabetics. The other group with relatively better success in glucose control were co-morbid patients on mono-treatment for hypertension compared to receiving multiple hypertension drugs.

In order to better understand the underlying reasons for the breakpoints in care, the study team reviewed available information on barriers to diabetes care (Table 2). Patient cost for medication and monitoring tests seemed to be responsible for losses at each stage of the cascade. In Ukraine’s decentralised health system, the barriers on the health provider side may vary across regional health administrations, for instance, providers in Lviv Region were not able to offer free HbA1C monitoring whereas Poltava providers had budget allocations for offering the test.
Figure 6  Prevalence of elevated fasting plasma glucose in Poltava patient groups (2017)

Table 2  Patient and provider barriers in diabetes cascades as of 2016

<table>
<thead>
<tr>
<th>Barriers to...</th>
<th>Patient side</th>
<th>Provider side</th>
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| **Screening/ diagnosis** | • Cost of diagnosis (e.g., test strips)\(^1,^3\)  
• Awareness of future treatment costs\(^2\)  
• Health seeking and disease prevention behaviours\(^2\)  
• Lack of risk perception\(^2\)  
• Scepticism about treatment\(^2\) | • Weak integration of diabetes in primary care, low confidence to deal with diabetes at PHC\(^3,^6\)  
• Lack of statistics at PHC level e.g., glucose tolerance test\(^6\)  
• Poor information flow endocrinologist—family doctor\(^5\)  
• Lack of health policies in companies\(^2\)  
• Pre-diabetics not in register leading to initial losses\(^2\)  
• Non-compliance with screening guidelines at PHC level |
| **Treatment initiation** | • Cost of oral anti-diabetes drugs\(^1,^3,^4\)  
• Cost of insulin analogs\(^3,^4\)  
• Poor knowledge of disease\(^6\)  
• Non-adherence to lifestyle changes\(^2\) | • Poor patient support for linkage to treatment  
• Consultations too short for proper patient engagement\(^2\) |
| **Treatment monitoring** | • Need to pay private laboratory for routine HbA1C testing (costing US$ 4–US$ 5)\(^6\)  
• Need to purchase self-monitoring equipment\(^3\) | • Low availability of HbA1C test in public sector |
| **Treatment adherence/ disease control** | • Fear of hypoglycemia\(^1\)  
• Episodes of hypoglycemia\(^1\)  
• Long-term cost of drugs (low income)\(^4\)  
• Poor access to free insulin pumps\(^3\) | • Insufficient insulin titration\(^1\)  
• Lack of routine system to track ABC control  
• Lack of PHC test capacity to detect vascular flow problems\(^6\) |

Sources: 1 = International Diabetes Management Practices Study (Ukraine data from 53 physicians and 795 patients); 2 = Lviv endocrinologist interviews; 3 = Doničová et al. 2011; 4 = Manoxa et al. 2016; 5 = Key informant ambulatory care level; 6 = Lviv programme costing and coverage assessment.
IMPLICATIONS FOR ACTION

The study, conducted in collaboration with the regional Endocrinology, Cardiology and Primary Care Teams, demonstrated the value of analyzing routine medical record data as well as triangulating data across multiple data sources. The analysis coincided with the early roll-out of the PHC reform which aims to bring a guaranteed service basket to patients and re-imbursement of diabetes medication costs, as well as an electronic medical record system (EMR). These changes have the potential to significantly improve diabetes prevention and care. The Ministry of Health, Ukrainian Public Health Centers, Regional Department of Health, care providers and technical agencies should collaborate to strengthen diabetes care and chronic care models in general, with focus on the following issues:

► Information should be disseminated on the diabetes cascade and the identified breakpoints in care, and on the performance of the services regarding diabetes screening, linkage to care, treatment and its monitoring, and patient outcomes, which can all guide quality improvements.

► Diabetes is a complex, prevalent and costly disease, providers at PHC level should therefore be equipped with knowledge, tools and aids to provide effective diabetes prevention and patient care to prevent diabetes-related vascular damage and clinical complications.

► The recently published National Guidance on Screening needs to be translated into systems of regular screening of all eligible individuals and systematic follow up of identified cases. The Guidance recommends annual diabetes screening for persons aged 45 years and above and for younger persons with excessive body weight, abdominal obesity, gestational diabetes or a family history of diabetes.

► Screening campaigns to find the “missing cases” are important, but must be targeted to age and BMI/risk categories and tracked on the EMRs for efficiency (with implementation of ICPC-2 coding). Staff must be oriented on eligibility criteria and screening frequency, and automated electronic reminders should be generated by the system to facilitate patient follow-up.

► Treatment must continue to have a strong component of patient monitoring and targeted support to patient who struggle with adherence. Patient education and motivational counselling should be ensured to strengthen treatment adherence and improve overall outcomes given the link between patients’ risk factors and diabetes/CVDs complications (48% of patients were obese at diabetes diagnosis with a BMI of 30 or above).

► The capacity of the PHC level to manage diabetes and hypertension needs to be a focus as the management of uncomplicated cases is transitioning from endocrinologists to family doctors. This requires continuous education on good prescription practices and the effective use of diagnostic equipment. Coordination of care between levels of care, and follow-up especially of severe hypertension and CVD cases need strengthening.

► There should be continued analysis of the diabetes care cascade to monitor the breakpoints and determine the impact on patient outcomes of drug reimbursement, PHC strengthening and EMR-facilitated patient monitoring. Measures of success should include screening coverage, patient monitoring as per norm, and test results (levels of
glucose, BMI, cholesterol). Population-level data on undiagnosed, untreated and uncontrolled diabetes and hypertension should be collected regularly at both national and local levels, for evaluation and target-setting purposes. International evidence on the importance of patient education, assisted self-monitoring and incentive schemes should be consulted for the further development of the diabetes program.

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ENDNOTES


iii International Diabetes Foundation, Ukraine country report 2017
https://reports.instantatlas.com/report/view/704ee0e6475b4af885051bcec15f0e2c/UKR

iv Best IDF estimate was 1.153 million (0.785 - 1.923 million) for 2017, Ukraine country report 2017


vi Based on International Diabetes Foundation mean expenditure/case=US$259 and 1.8 m diagnosed cases

vii IHM global burden of disease estimations https://vizhub.healthdata.org/gbd-compare/


x Best IDF estimate 41,500 (29,400 – 70,200) for 2017, Ukraine country report 2017


xiv Lviv 2016 diabetes screening campaign on 38,175 non-pregnant adults 18+ without pre-existing diabetes diagnosis, diagnostic yield=1.4% (confirmed cases), and Poltava 2016 diabetes screening campaign on 400 adults without pre-existing diabetes diagnosis, screening yield 7.5% and diagnostic yield=1.9%


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