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Resource use associated with type 2 diabetes in Africa, the Middle East, South Asia, Eurasia and Turkey: results from the International Diabetes Management Practice Study (IDMPS)

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ABSTRACT

Objective: Type 2 diabetes (T2D) and its complications form a global healthcare burden but the exact impact in some geographical regions is still not well documented. We describe the healthcare resource usage (HRU) associated with T2D in Africa, the Middle East, South Asia, Eurasia and Turkey.

Research design and methods: In the fifth wave of the International Diabetes Management Practices Study (IDMPS; 2011–2012), we collected self-reported and physician-reported cross-sectional data from 8156 patients from 18 countries across 5 regions, including different types of HRU in the previous 3–6 months. Negative binomial regression was used to identify parameters associated with HRU, using incidence rate ratios (IRRs) to express associations.

Results: Patients in Africa (n=2220), the Middle East (n=2065), Eurasia (n=1843), South Asia (n=1195) and Turkey (n=842) experienced an annual hospitalization rate (mean±SD) of 0.6±1.9, 0.3±1.2, 1.7±4.1, 0.4±1.5 and 1.3±2.7, respectively. The annual number of diabetes-related inpatient days (mean±SD) was 4.7 ±22.7, 1.1±6.1, 16.0±30.0, 1.5±6.8 and 10.8±34.3, respectively. Despite some inter-regional heterogeneity, macrovascular complications (IRRs varying between 1.4 and 8.9), microvascular complications (IRRs varying between 3.4 and 4.3) and, to a large extent, inadequate glycemic control (IRRs varying between 1.89 and 10.1), were independent parameters associated with hospitalization in these respective regions.

Conclusions: In non-Western countries, macrovascular/microvascular complications and inadequate glycemic control were common and important parameters associated with increased HRU.

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Key messages

- Results from the International Diabetes Management Practice Study (IDMPS) wave 5 show high levels of healthcare resource use (HRU) associated with the presence of type 2 diabetes mellitus in non-Western countries.
- The presence of macrovascular/microvascular complications and insufficient glycemic control are the most consistent parameters associated with increased resource use.
- Our study re-emphasizes the importance of early diagnosis and intervention to reduce complications and HRU and highlights the need for more national-based surveys with precise separation of HRU for prevention and treatment of late complications in order to inform healthcare providers and policymakers on the socioeconomic burden of diabetes and its complications.

INTRODUCTION

Type 2 diabetes (T2D) and its chronic complications are recognized as a global healthcare burden both from a societal and personal perspective. Among the estimated 8.3% of people with diabetes, 90% have T2D and the number of affected people is expected to increase by 55% in 2035.[1] In recent decades, the largest increase in diabetes prevalence has been observed in low-income and middle-income countries (LMIC) where 80% of people with T2D aged 40–59 years are living in these countries.[2 3] This trend is expected to continue in the next 20 years due to changes in demographics, lifestyle and economic development.[1] According to the International Diabetes Federation (IDF) Atlas, 10% of adults from the Middle East and North Africa (MENA) and South East Asia are expected to have diabetes, however, with substantial between-country variation within the region.[1]

Diabetes causes microvascular and macrovascular complications, mainly driven by disease duration[3 4] with increased risk of premature mortality across all ages compared with the general population.[5] Diabetes and its associated complications worsen health-related quality of life (HRQoL)[6–8] with many patients experiencing problems with self-care, pain/discomfort and anxiety/depression.[6] Patients with comorbidities, and especially those with vascular diseases, have shown consistently lower HRQoL than those without.[6 7 9] Furthermore, prevalence of depression in T2D has been estimated to be twice higher than without.[8 10 11]

Growing evidence from LMIC shows the burden of diabetes care in terms of healthcare resource use (HRU) and costs.[12] At an individual level, this has been attributed largely to the presence of relatively high out-of-pocket (OOP) treatment costs.[12] Such costs have the potential for a catastrophic impact on incomes, pushing families below the poverty line.[13] In LMIC, people with diabetes have spent on average $157 per year more than those without the disease,[14] putting them at a higher risk of incurring catastrophic medical spending compared with those without diabetes. It has been reported that around 17.8% of patients with diabetes go below the poverty line due to medical OOP payments compared with 13.9% of patients without diabetes.[14] Previous reports from the International Diabetes Management Practice Study (IDMPS) showed the high resource consumption among patients with T2D from Asia, Latin America, the Middle East and Africa,[15] where the presence of microvascular/macrovascular complications and inadequate diabetes control were strong predictors for hospitalizations. These data highlighted the urgent need for health policy steps to address the increasing magnitude of this ongoing public health problem. In this cross-sectional analysis, we estimated levels of HRU and their predictors among patients with T2D recruited from 18 countries in Africa, the Middle East, South Asia, Eurasia and Turkey.

RESEARCH DESIGN AND METHODS

The IDMPS is an ongoing international multicenter observational study conducted annually for the past 10 years. Until now, we have collected six waves of data from non-Western countries to document the pattern of care in a real-world setting in order to inform practice and policy. The primary objective of the study is to assess the HRU of T2D in current medical practice. The secondary objective is to evaluate the initiation, characteristics and management of insulin therapy and to assess the overall health economic impact of T2D and its complications. Specific outcomes collected as part of wave 5 of the IDMPS included details of management of care, education and HRU.

Physicians involved in each wave of the IDMPS were randomly selected at a country level and requested to enroll the first 10 patients with T2D they had a consultation with over a 2-week period. Eligible physicians had to have experience with initiation and titration of insulin. Patients younger than 18 years, patients participating in a clinical study, or patients receiving temporary insulin treatment because of conditions such as gestational diabetes, pancreas cancer or surgery at the time of enrollment were excluded. Patients were also excluded if they had already participated in a previous wave of the IDMPS. The sample size was estimated on a country by country basis, and was calculated such that the expected relative precision around the proportion of patients receiving insulin reached 20%.

Each wave of the IDMPS consisted of a cross-sectional and a longitudinal part. The cross-sectional part was a 2-week survey during which data were collected by physicians through a standardized case report form. Patients enrolled in the cross-sectional study who were treated with insulin were eligible to enter a 9-month longitudinal study. Physician details and characteristics were also collected at study initiation.

Ethical approvals for the IDMPS study were obtained from the Ethics Committees in all participating countries and all patients provided written informed consent prior to enrollment. Study design and reporting format are in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[16]

Resource consumption data were collected within the cross-sectional part of the fifth wave of the IDMPS study (2011–2012). HRU was assessed based on the patient-reported frequency of visits to endocrinologists/diabetologists or other physicians (including general practitioners (GPs)), hospitalizations due to diabetes-related complications (including hypoglycemia), hospital inpatient days, and emergency room (ER) visits due to diabetes complications and work loss (unemployment, absenteeism and sick leave) in the past 3 months. Additionally, patients were asked to report the frequency of ER visits due to hypoglycemia in the past 6 months and number of laboratory tests (glycated hemoglobin, HbA1c), self-monitoring of blood glucose (SMBG) and screenings for complications in the past year. Details on antidiabetic treatment (eg, oral antihyperglycemic drugs (OADs) by class and agent, insulin by class and agent, or other) with the corresponding doses and frequencies of administration were recorded. Similar information on use of antihypertensive and lipid-lowering drugs was also recorded. Presence of complications was recorded by the physician using definitions included in the case report form.

Levels of HRU were estimated among the 18 countries stratified according to regions including South Asia, Eurasia, the Middle East and Africa with data for Turkey presented separately, due to its geographical location and demography. Reported 3-month and 6-month quantities for HRU items were converted to an annual estimate assuming a constant rate of use. For resources measured as a binary outcome (yes/no), no further adjustments were made.

Statistical analysis

Descriptive statistics were generated for population characteristics and levels of HRU. Data related to the number of visits to diabetologists/endocrinologists and other physicians (including GPs), diabetes-related hospitalizations, hospital inpatient days, ER visits and number of days off work due to diabetes were computed on a country and regional level and expressed as mean±SD or median (range), depending on distribution. For each variable, the analysis was performed only on cases with complete data, that is, cases with missing or unknown values were excluded.

A generalized linear model based on a negative binomial distribution was used to determine variables associated with hospitalizations, hospital inpatient days, ER visits and absenteeism. We selected these four key items of HRU because of their high costs. Regression models were developed separately for each region of interest with a separate analysis for Turkey.

The following covariates were included in the models: age (years); time since diagnosis (years); gender (male or female); body mass index (BMI) at inclusion (≤25, 25–30, 30–35, >35 kg/m^2; ≤18.5 was not included due to limited number of patients); locality (rural, urban and suburban); education level (illiterate, primary, secondary and university higher); health insurance (no, public and private); microvascular complications (present and absent); macrovascular complications (present and absent); blood pressure (systolic blood pressure (SBP)/diastolic blood pressure (DBP) ≤130/80 mm Hg, SBP/DBP≥130/80 mm Hg); low-density lipoprotein (LDL) cholesterol (≤100, ≥100 mg/dL); high-density lipoprotein (HDL) cholesterol (≤40, ≥40 mg/dL); glycemic control (HbA1c≤7%, ≥7%); fasting blood glucose (FBG≤100, ≥100 mg/dL); type of practice of the physician (public, private, mostly public and mostly private); specialty of the physician (diabetologist–endocrinologist and other, including GPs) and countries within the regions. Variables which were significant at a 20% threshold were included in the multivariate model.

A backward selection method was then applied, with the final model restricted to variables statistically significant at the 5% level as well as the country. Complete case analysis, which involves the discarding of cases where the dependent variable or any of the identified covariates are missing, was applied as the base-case.

Countries with a sample size lower than 50 were excluded from the HRU multivariate analysis and this concerned only one country (Senegal). Incidence rate ratios (IRRs) and corresponding 95% CIs were generated from the multivariate analysis for each categorical covariate included in the model. All statistical analyses were performed using SAS V.8.02 (SAS Institute, Cary, North Carolina, USA).

RESULTS

Patients

An initial total of 10 987 patients with T2D were recruited across Africa, the Middle East, South Asia, Eurasia and Turkey, among whom 8156 met the inclusion criteria of the IDMPS wave 5. Demographic, clinical and socioeconomic characteristics of the included patients are shown in tables 1–3. Gross domestic product per capita at a country level is also presented. At a regional level, the sample sizes were 2220 patients in Africa, 2065 in the Middle East, 1834 in Eurasia, 1195 in South Asia and 842 in Turkey. The age of the patients ranged from 53.7±10.6 years in South Asia to 55.8±11.5 years in Eurasia and the duration of disease ranged from 8.3±7.2 years in the Middle East to 9.0±6.7 years in South Asia. The prevalence of microvascular complications was similar across most regions (35–42%) except Eurasia (≈87%). Furthermore, the prevalence of macrovascular complications was similar across most regions (14–20%) except Eurasia (47%). The proportion of people employed full time or part time varied between 28% in Turkey and 47% in the Middle East, although a substantial proportion of patients were of working age. Proportions of patients treated with OADs, antihypertensive and lipid-lowering drugs were generally high across all regions (table 4).

Annual quantities of HRU

Table 3 summarizes the levels of diabetes-related HRU reported by category, country and region. The number of annual GP visits reported across the regions varied between 2.5±7.0 in South Asia and 6.5±7.6 in Eurasia. Patients in Turkey reported the lowest annual endocrinologist/diabetologist visits of 2.6±4.2 while in Eurasia it was 11.8±9.0. The annual number of hospitalizations did not exceed one except in Eurasia (1.7±4.1) and Turkey (1.3±2.7). Length of hospital stay in terms of inpatient days was significantly (p<0.05) higher in Eurasia and Turkey (16.0±29.6 and 10.8±34.3, respectively) than other regions (4.7±22.7 in Africa, 1.1±6.1 in the Middle East and 1.5±6.7 in South Asia). The number of diabetes-related ER visits was relatively low across all the regions with the lowest figures reported in the Middle East, Eurasia and South Asia (0.2±1.4) and the highest in Turkey (0.9±4.1). The number of days off work due to diabetes per year was highly variable across the regions with the lowest value recorded in the Middle East (1.4 ±6.8) and the highest in Eurasia (17.5±35.4; table 5).

Parameters associated with resource use

The multivariate analysis identified a number of parameters associated with increased numbers of hospitalizations, inpatient days, ER visits and absenteeism. Drivers of healthcare consumption in the four categories in the analysis included: the type of physician practice (public vs private), glycemic control (HbA1c≥7% vs ≤7%), gender (male vs female), HDL cholesterol (HDL≤40 vs ≥40 mg/dL), hypertension (SBP/DBP≤130/80 vs ≥130/80 mm Hg), BMI (≤25 vs (30; 35); (25; 30) vs (30; 35); (30;35) vs >35 kg/m^2), time since diagnosis (≤10 vs ≥10 years), locality (suburban vs urban), education level (university vs secondary), health insurance (yes vs no) as well as the presence of microvascular and macrovascular

Table 1 Demographic characteristics of patients with T2DM by country and region

	Mean SD, age years	Females (%)	Ethnicity						
			Caucasian n (%)	South Asian (%)	Black (%)	Oriental, Arab, Persian (%)	Japanese (%)	Other Asian (%)	Other (%)
Eurasia (n=1835)	58.8 (9.6)	60	64	0.4	0.0	0.1	0.1	20.8	14.9
Georgia (n=152)	59.6 (10.1)	47	99	0.0	0.0	0.0	0.0	0.0	0.7
Kazakhstan (n=413)	57.4 (10.4)	60	33	0.0	0.0	0.0	0.2	9.2	57.9
Russia (n=540)	61.7 (9.3)	71	98	0.0	0.0	0.0	0.0	1.7	0.2
Ukraine (n=354)	57.5 (9.1)	57	91	0.3	0.0	0.0	0.0	0.0	8.5
Uzbekistan (n=376)	57.2 (8.3)	52	8	1.9	0.0	0.5	0.0	88.8	0.8
Africa (n=2269)	57.4 (10.8)	57	46	0.0	25.2	28.9	0.0	0.0	0.0
Algeria (n=515)	59.4 (10.7)	59	96	0.0	0.2	3.7	0.0	0.0	0.0
Cameroon (n=525)	57.4 (11.0)	61	0	0.0	100.0	0.0	0.0	0.0	0.0
Egypt (n=371)	53.9 (10.6)	52	0	0.0	0.0	100.0	0.0	0.0	0.0
Morocco (n=499)	58.0 (10.5)	62	99	0.0	0.0	0.6	0.0	0.0	0.0
Senegal (n=46)	58.4 (8.5)	65	0	0.0	100.0	0.0	0.0	0.0	0.0
Tunisia (n=313)	57.5 (10.1)	42	16	0.0	0.0	84.0	0.0	0.0	0.0
Middle East (n=2067)	55.8 (11.5)	48	2	4.3	0.6	91.6	0.0	1.4	0.3
Jordan (n=296)	54.8 (10.7)	46	0	0.3	0.3	99.0	0.0	0.0	0.0
KSA (n=199)	52.4 (10.4)	40	10	8.0	1.0	79.9	0.0	1.5	0.0
Lebanon (n=1061)	58.2 (11.1)	49	0	0.0	0.0	99.6	0.0	0.0	0.1
UAE (n=511)	52.7 (11.9)	49	3	14.1	2.0	75.3	0.0	5.1	1.0
South Asia (n=1196)	53.7 (10.6)	44	0	94.8	0.0	0.1	0.0	4.3	0.8
India (n=994)	53.8 (10.6)	44	0	93.9	0.0	0.0	0.0	5.1	1.0
Pakistan (n=202)	53.3 (11.0)	44	0	99.5	0.0	0.5	0.0	0.0	0.0
Turkey (n=842)	56.9 (11.4)	55	98	0.1	0.0	0.4	0.0	0.0	1.4

KSA, Kingdom of Saudi Arabia; T2DM, type 2 diabetes mellitus; UAE,United Arab Emirates.

Table 2 Socioeconomic characteristics of patients with T2DM by country and region

	GDP/ capita (US$)*	Location			Education				Employed (full time or part time) (%)
		Urban area (%)	Rural area (%)	Suburban area (%)	Illiterate (%)	Primary (%)	Secondary (%)	Higher (%)	
Eurasia (n=1835)	–	82.5	15.1	2.4	0.1	1.9	49.2	48.8	38.0
Georgia (n=152)	3520	77.2	19.5	3.4	0.0	0.0	38.3	61.7	36.0
Kazakhstan (n=413)	11 983	85.0	14.5	0.5	0.0	0.7	53.4	45.9	41.0
Russia (n=540)	14 302	96.9	1.7	1.5	0.0	2.6	53.8	43.6	38.0
Ukraine (n=354)	3877	75.6	20.1	4.3	0.3	3.0	49.0	47.8	43.0
Uzbekistan (n=376)	1736	67.5	28.8	3.7	0.3	2.0	42.1	55.7	33.0
Africa (n=2269)	–	84.5	10.1	5.4	21.4	28.9	31.7	18.1	35.0
Algeria (n=515)	5583	87.2	7.8	5.1	26.4	36.5	30.4	6.7	24.0
Cameroon (n=525)	1181	78.7	12.3	9.0	10.2	31.8	39.7	18.3	35.0
Egypt (n=371)	3112	83.3	14.0	2.7	12.4	20.5	24.8	42.3	48.0
Morocco (n=499)	2956	88.2	8.4	3.4	36.8	28.7	25.1	9.5	32.0
Senegal (n=46)	1074	65.2	13.0	21.7	50.0	13.6	22.7	13.6	32.0
Tunisia (n=313)	4213	87.8	8.0	4.2	13.3	24.2	40.8	21.8	43.0
Middle East (n=2067)	–	76.5	15.7	7.8	10.3	29.9	34.0	25.9	47.0
Jordan (n=296)	4879	89.9	6.1	4.1	1.7	15.7	37.9	44.7	45.0
KSA (n=199)	24 524	92.5	5.0	2.5	15.2	25.8	23.7	35.4	52.0
Lebanon (n=1061)	10 311	59.2	27.5	13.3	6.0	40.8	34.7	18.5	48.0
UAE (n=511)	43 774	98.4	1.0	0.6	22.2	17.1	34.3	26.5	45.0
South Asia (n=1196)	–	73.5	15.9	10.7	8.1	17.8	30.7	43.4	45.0
India (n=994)	1501	73.9	13.9	12.2	4.8	15.5	32.4	47.3	46.0
Pakistan (n=202)	1261	71.1	25.9	3.0	24.5	29.2	22.4	24.0	40.0
Turkey (n=842)	10 527	80.6	14.5	4.9	15.4	46.3	26.7	11.7	28.0

*IMF estimates for 2012.
GDP, gross domestic product; IMF, International Monetary Fund; KSA, Kingdom of Saudi Arabia; T2DM, type 2 diabetes mellitus; UAE,United Arab Emirates.

Table 3 Clinical characteristics of patients with type 2 diabetes analyzed in the IDMPS wave 5 by region and country

Country/region	Current smoker (%)	Mean (SD) diabetes duration (years)	Screened for diabetes-related complications (%)*	With microvascular complications (%)*	With macrovascular complications (%)*	With HbA1c<7% (%)	Familial history of T2DM (%)
Eurasia (n=1834)	9.8	8.7 (7.1)	99	87	47	21	37.9
Georgia (n=152)	13.2	10.7 (8.6)	99	91	74	4	42.8
Kazakhstan (n=413)	11.1	8.1 (7.3)	100	89	40	21	27.4
Russia (n=540)	9.3	9.5 (7.4)	99	81	42	29	40.9
Ukraine (n=353)	8.5	9.2 (6.3)	97	89	53	15	41.8
Uzbekistan (n=376)	8.8	6.8 (5.7)	100	89	47	23	39.6
Africa (n=2220)†	8.1	8.6 (7.2)	93	41	14	31	52.3
Algeria (n=514)	4.5	8.8 (7.1)	97	41	15	44	51.3
Cameroon (n=524)	2.7	6.6 (6.9)	90	48	6	28	44.5
Egypt (n=371)	17.8	9.4 (7.7)	93	47	20	22	58.2
Morocco (n=498)	5.0	9.0 (7.0)	91	30	15	27	53.7
Tunisia (n=313)	16.9	10.0 (6.7)	98	39	15	23	58.5
Middle East (n=2065)	22.9	8.3 (7.2)	96	35	15	37	59.5
Jordan (n=296)	28.7	6.6 (5.9)	93	30	15	34	55.4
KSA (n=199)	18.6	10.2 (8.2)	94	48	19	31	63.3
Lebanon (n=1059)	28.0	8.1 (7.2)	95	35	17	36	60.4
UAE (n=511)	10.6	9.1 (7.0)	99	30	10	42	58.3
South Asia (n=1195)	8.8	9.0 (6.7)	91	41	14	25	43.2
India (n=994)	7.7	9.1 (6.5)	91	37	11	26	43.0
Pakistan (n=201)	14.4	8.2 (7.2)	92	62	27	22	44.6
Turkey (n=842)	14.5	8.7 (6.8)	94	42	20	28	55.5

*Missing data are considered for percentage calculations.
†Owing to the small sample size (N=50), Senegal was not included in Africa results in this table.
HbA1c, glycated hemoglobin; KSA, Kingdom of Saudi Arabia; T2DM, type 2 diabetes mellitus; UAE,United Arab Emirates.

complications. The significance of each parameter varied between the different healthcare consumption items and also between the different regions. Glycemic control and presence of complications were the most consistent parameters associated with high HRU across the different regions. The effects of the most common drivers are presented in figure 1A–C.

The presence of diabetes-related complications (macrovascular and microvascular) was the most common driver of resource use with the largest effect size. Patients with macrovascular complications had increased annual rates of hospitalizations across all regions with IRRs (CI 95%) between 1.4 (1.1 to 1.8; Eurasia) and 8.6 (4.6 to 15.7; the Middle East) compared with patients with no complications. Similar results were observed with regard to rates of inpatient days and ER visits with IRR (CI 95%) ranges of 1.58 (1.2 to 2.1; Eurasia) and 13.4 (4.9 to 36.9; the Middle East) as well as 2.9 (2.2 to 3.9; Eurasia) and 7.7 (1.8 to 33.8; South Asia), respectively. The effect of macrovascular complications was significant on rates of absenteeism for Africa, Eurasia and the Middle East with IRRs (CI 95%) of 5.2 (1.5 to 18.3), 2.3 (1.5 to 3.6) and 8.3 (2.3 to 29.0).

Similarly, microvascular complications were associated with increased risk of hospitalizations in all regions with IRRs (CI 95%) of between 3.5 (2.0 to 6.2; Eurasia) and 4.3 (2.6 to 7.2; Africa). Furthermore, such complications were also associated with a higher rate of inpatient days with IRRs (CI 95%) of between 2.3 (1.2 to 4.4; Turkey) and 7.1 (4.1 to 12.1; Africa). Microvascular complications were associated with an increased rate of ER visits in the Middle East, South Asia and Turkey with IRRs (CI 95%) of 2.4 (1.7 to 3.4), 6.2 (2.4 to 15.8) and 6.1 (3.1 to 12.2), respectively. Absenteeism was also higher in patients with microvascular complications in Africa, Eurasia and South Asia with IRRs (CI 95%) of 5.9 (2.7 to 12.6), 4.0 (2.3 to 7.2) and 6.5 (2.7 to 15.8), respectively.

DISCUSSION

Despite the wealth of information on the economic impact of T2D and its complications in Western countries, the magnitude of this burden in non-Western countries is relatively unknown. In this first-ever multinational report on healthcare resource consumption including 18 countries across Africa, the Middle East, South Asia, Eurasia and Turkey and comprising 8156 patients with T2D, we have identified large inter-regional variations in the different HRU items. Despite this heterogeneity which may be attributed to differences in the healthcare system as well as clinical practices, the presence of macrovascular/microvascular complications and poor glycemic control were the most significant and

Table 4 Medical treatment received by recruited patients with type 2 diabetes by region/country

Country/region	On OAD treatment (%)	On insulin treatment (%)	With hypertension (%)	On antihypertensive treatment (%)*	With dyslipidemia (%)	On lipid-lowering treatment (%)†
Eurasia (n=1834)	76	50	84	98	75	83
Georgia (n=152)	41	100	80	100	73	99
Kazakhstan (n=413)	84	40	83	98	71	89
Russia (n=540)	76	53	88	99	69	78
Ukraine (n=353)	83	42	81	98	77	72
Uzbekistan (n=376)	76	47	82	98	84	86
Africa (n=2220)‡	83	38	57	98	47	84
Algeria (n=514)	92	42	69	99	56	92
Cameroon (n=524)	71	35	53	96	36	60
Egypt (n=371)	83	37	55	100	44	95
Morocco (n=498)	84	36	53	97	46	87
Senegal (n=50)	82	20	52	92	46	46
Tunisia (n=313)	85	43	56	99	53	90
Middle East (n=2065)	94	23	62	99	74	95
Jordan (n=296)	96	19	65	99	71	93
KSA (n=199)	93	32	54	100	68	99
Lebanon (n=1059)	93	23	61	98	72	94
UAE (n=511)	95	23	64	100	83	98
South Asia (n=1195)	93	33	61	98	54	94
India (n=994)	94	33	60	98	56	95
Pakistan (n=201)	89	31	61	98	45	89
Turkey (n=842)	81	46	63	98	56	86

*Among patients with hypertension.
†Among patients with dyslipidemia.
‡Owing to the small sample size (N=50), Senegal was not be included in Africa results in this table.
KSA, Kingdom of Saudi Arabia; OAD, oral antihyperglycemic drug; UAE,United Arab Emirates.

consistent drivers for HRU. In this light, disease duration is the most important driver for complications which is particularly relevant to patients with young onset of disease. Of note, the majority of patients were in the working age with a mean age of 50 years and disease duration of over 5 years. In Asia, 20% of adult patients have young onset T2D, that is, diagnosed before the age of 40. Compared with their peers with late onset disease, these patients have worse control of risk factors and are at 1.5 times higher risk for developing cardiovascular–renal events and related death at any age.[17 18] These findings highlighted the burden of late complications calling for timely management of diabetes to reduce complications and HRU.[15]

Several systematic literature reviews have highlighted the economic burden of diabetes in Asia, notably India where the presence of complications increased the cost by three times compared with those without complications.[19–21] A large proportion of this cost is related to hospitalization rates, which if reduced can sharply reduce the personal and socioeconomic burden due to diabetes.[22] Similarly, in Turkey, management of diabetes-related complications accounted for more than half of the total cost associated with T2D.[23] In this multinational survey, patients from Eurasia had a much higher prevalence of macrovascular and microvascular complications than other regions (47% and 87%, respectively). However, among different countries in this region (Georgia, Russia, Kazakhstan, Ukraine and Uzbekistan), the data were relatively consistent. Similarly, a high prevalence of macrovascular and microvascular comorbidities has also been reported in Russia compared with China, Asia, MENA and Latin American regions.[24] These high prevalence rates, which may be due to a number of population-specific and system-specific factors including low levels of awareness, overdiagnosis, late presentation and/or suboptimal care, need further investigation to inform practice and policy within these countries. The organization of healthcare delivery in the Eurasian region can also be taken into account when trying to explain some of the HRU variability observed in the IDMPS wave 5. The free nature of the system at the point of delivery as well as prescribing practices could explain higher levels of hospitalizations as well as outpatient visits seen in the study compared with other geographies.[25]

In the MENA region, the IDF estimates that ~US$13.6 billion have been spent on treatment of diabetes in 2013[1] with large regional variations ranging from US $1605 per person in the United Arab Emirates to US $175 in Sudan. Despite these differences, spending and resource usage have been consistently shown to be tightly associated with the presence of diabetes-related comorbidities.[26 27] Despite the large body of evidence

Table 5 Annual quantities of diabetes-related resource use for patients with type 2 diabetes by region/country

Country/region	Number of other physician visits including GP visits	Number of endocrinologist/ diabetologist visits	Number of hospitalizations due to diabetes	Number of days of inpatient care	Number of emergency room visits	Number (%) unemployed because of diabetes*	Number of sick leave days
Eurasia (n=1834)	6.5 (7.6)	11.8 (9.0)	1.7 (4.1)	16.0 (29.6)	0.2 (0.9)	184 (10.0)	17.5 (35.4)
Georgia (n=152)	1.8 (3.7)	11.8 (5.6)	0.4 (1.4)	1.8 (7.6)	0.0 (0.3)	11 (7.2)	5.0 (20.5)
Kazakhstan (n=413)	7.0 (6.1)	11.3 (6.9)	1.9 (2.9)	19.4 (30.1)	0.3 (1.1)	34 (8.2)	23.6 (40.6)
Russia (n=540)	7.0 (9.0)	9.6 (7.6)	0.7 (1.6)	9.5 (26.9)	0.2 (0.9)	47 (8.7)	8.2 (21.8)
Ukraine (n=353)	5.4 (6.4)	11.7 (9.3)	2.9 (7.6)	20.3 (34.3)	0.3 (1.2)	38 (10.8)	23.4 (42.3)
Uzbekistan (n=376)	7.9 (7.8)	15.4 (12.1)	2.3 (3.2)	23.6 (29.9)	0.1 (0.6)	54 (14.4)	22.9 (37.5)
Africa (n=2220)†	3.8 (5.8)	4.3 (5.2)	0.6 (1.9)	4.7 (22.7)	0.4 (1.7)	47 (2.1)	11.6 (44.4)
Algeria (n=514)	3.7 (4.4)	2.3 (3.9)	0.24 (1.0)	2.9 (18.3)	0.2 (0.8)	7 (1.4)	4.1 (25.3)
Cameroon (n=524)	6.9 (8.2)	5.7 (6.2)	0.9 (2.2)	9.9 (36.0)	0.6 (1.7)	23 (4.4)	29.5 (75.1)
Egypt (n=371)	3.2 (6.1)	7.4 (7.2)	0.7 (2.7)	3.8 (20.7)	0.4 (1.5)	6 (1.6)	10.3 (35.7)
Morocco (n=498)	2.0 (3.9)	3.6 (3.2)	0.6 (1.8)	3.3 (12.2)	0.6 (2.5)	7 (1.4)	4.3 (14.4)
Tunisia (n=313)	2.7 (3.7)	3.9 (3.6)	0.4 (1.4)	2.1 (9.3)	0.3 (1.5)	4 (1.3)	4.5 (23.1)
Middle East (n=2065)	4.4 (6.7)	3.8 (4.7)	0.3 (1.2)	1.1 (6.1)	0.2 (1.0)	19 (0.9)	1.4 (6.8)
Jordan (n=296)	5.2 (4.9)	2.3 (3.6)	0.3 (1.4)	1.4 (7.7)	0.2 (0.9)	4 (1.4)	3.4 (12.0)
KSA (n=199)	6.1 (8.4)	4.6 (5.8)	0.4 (1.4)	2.0 (8.3)	0.4 (1.5)	3 (1.5)	2.1 (6.7)
Lebanon (n=1059)	2.0 (3.8)	4.4 (4.1)	0.3 (1.2)	1.1 (5.3)	0.1 (0.8)	8 (0.8)	0.7 (4.1)
UAE (n=511)	8.1 (9.0)	3.2 (5.6)	0.2 (1.0)	0.6 (5.3)	0.2 (1.2)	4 (0.8)	1.6 (7.6)
South Asia (n=1195)	2.5 (7.0)	8.8 (7.6)	0.4 (1.5)	1.5 (6.7)	0.2 (1.4)	26 (2.2)	4.6 (19.7)
India (n=994)	1.0 (3.3)	9.5 (7.6)	0.3 (1.2)	1.2 (5.8)	0.1 (0.9)	20 (2.0)	3.9 (18.9)
Pakistan (n=201)	11.6 (13.7)	4.2 (6.5)	0.8 (2.6)	3.0 (10.4)	0.8 (2.8)	6 (3.0)	8.8 (23.4)
Turkey (n=842)	5.3 (6.0)	2.6 (4.2)	1.3 (2.7)	10.8 (34.3)	0.9 (4.1)	43 (5.1)	8.0 (34.4)

*The whole population is considered for percentage calculations.
†Owingto the small sample size (N=50), data from Senegal were not included in this table.
GP, general practitioner; KSA, Kingdom of Saudi Arabia; UAE, United Arab Emirates.

confirming the preventable nature of these complications through optimal control of cardiometabolic risk factors using various strategies including diabetes education, self-care, team-based management and use of medicines,[28 29] globally, most of the diabetes-related expenditures were on expensive interventions and technologies rather than on building capacity, developing infrastructures and implementing community-based prevention programs. In the MENA region, up to 70% of the healthcare budget is allocated to secondary care with considerably less being spent on health promotion and primary care services.[30–33]

In addition to HRU, we have also reported the impact of diabetes on absenteeism in regions outside Europe and North America where data are scarce. In 2013, a systematic review reported the burden of diabetes on the ability to work but did not identify any high-quality studies from countries and regions covered by the current IDMPS.[34] These absenteeism data have major implications on the person, family and society due to loss of productivity, especially in those still in employment.[35] In the wave 2 of IDMPS including 24 countries in Asia, Latin America, the Middle East and Africa, we also found associations between chronic complications and absenteeism (14). In the current analysis, there were relatively high rates of unemployment with marked inter-regional and intercountry variations in the reporting of absenteeism, which could explain the negative association. In Eurasia, the high absenteeism rate was driven by data from Kazakhstan, Ukraine and Uzbekistan while the reporting rates from Russia and Georgia were more in line with the other regions.

Although our study focuses on non-Western countries, conclusions from the analysis support findings from studies conducted in other parts of the world. Associations between glycemic control and presence of complications and increased HRU have been reported in the USA as well as countries from Western Europe.[36–40] An analysis of nearly 10 000 patients treated in a managed care organization revealed that those with uncontrolled glycemia (HbA1c≥10%) were more than twice as likely to be hospitalized due to diabetes than those with normal HbA1c (<7%).[36] Additionally, the cost of management of patients with microvascular and macrovascular complications has been estimated to be up to three times higher than that of complication-free patients owing to the higher HRU among them.[38 40]

Despite the increased HRU and costs associated with diabetes, certain care items are considered beneficial. For example, increases in screening for complications, HbA1c testing, SMBG, diabetes education and medication use are linked to positive long-term health benefits

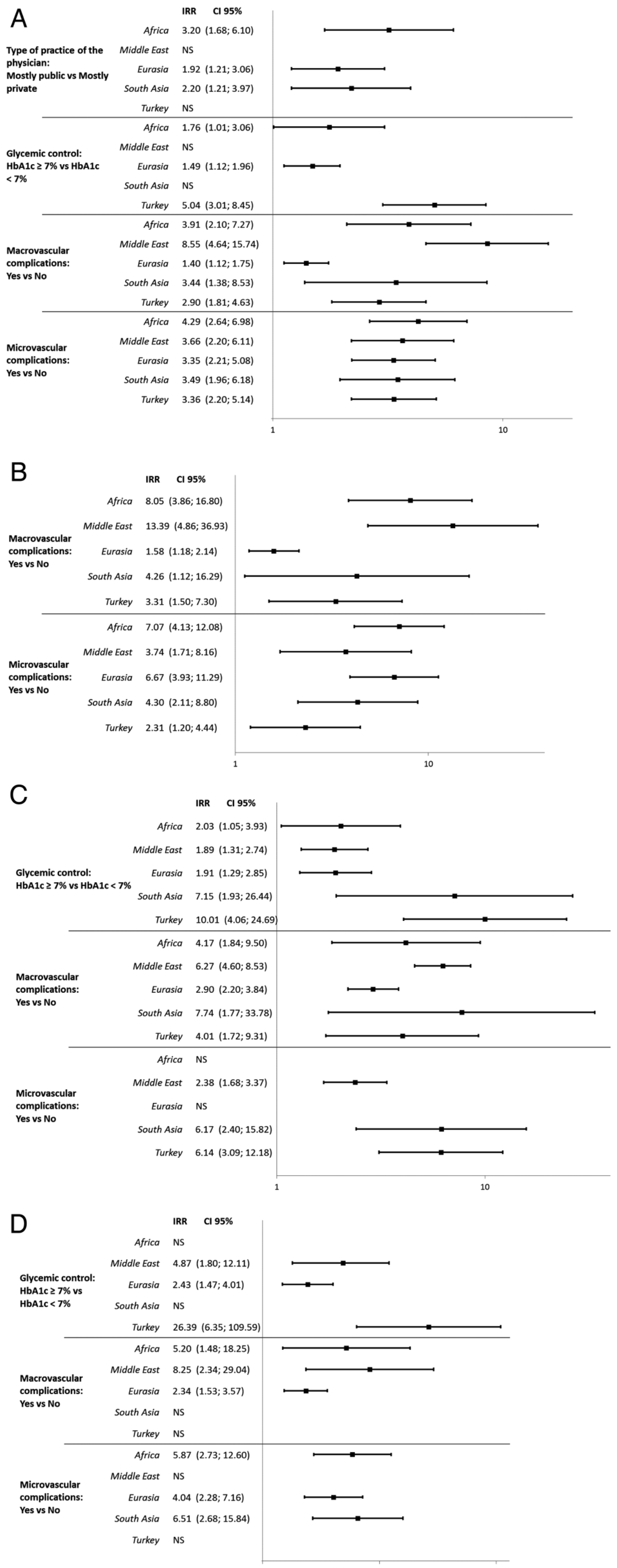

Figure 1 Parameters associated with increased HRU in T2D by region. (A) Association between hospitalizations and HRU. (B) Association between hospital inpatient stay and HRU. (C) Association between ER visits and HRU. (D) Association between absenteeism and HRU. ER, emergency room; HbA1c, glycated hemoglobin; HRU, healthcare resource use; IRR, incidence rate ratio; NS, not significant; T2D, type 2 diabetes.

and can lead to cost savings.[41 42] In a recent analysis of a large clinical laboratory database, patients who had three-monthly measurements of HbA1c were found to have the best glycemic control.[42] In a 7-year prospective survey of Chinese patients with T2D, lack of monitoring of HbA1c and/or lipids was associated with a 15-fold increased risk of death compared with those who had at least one measurement.[43] In wave 1 of the IDMPS, a high level of general education was associated with increased likelihood of attaining the HbA1c goal (<7%).[44] In wave 2, better educated patients consumed more healthcare resources in terms of specialist visits, insulin use and SMBG, with the latter being independently associated with improved glycemic control.[45] In the current analysis, patients receiving public care were more likely to be hospitalized than those receiving private care, although the significance requires further exploration.

Our study has several limitations. Despite the relatively large number of patients recruited from 18 countries with fairly consistent results across countries, extrapolation of these multinational data on HRU might not be applicable to individual countries due to potential selection bias. Further, physicians participating in the IDMPS had to have experience in insulin initiation which might not be representative of the majority of care providers for people with diabetes. Since these patients were managed by experienced physicians, they might also be referral biases since patients with poor risk factor control or complications were more likely to receive specialist care. The latter was further influenced by availability of medical cover or insurance. While these factors might increase the HRU rate, owing to the volunteer nature of the survey, the representation of the countries does not fully reflect its demographic weight in the region with only India and Pakistan representing South Asia.

CONCLUSION

In the IDMPS wave 5, T2D was associated with high levels of HRU among patients in Africa, the Middle East, South Asia and Eurasia. Macrovascular/microvascular complications and insufficient glycemic control were the most consistent parameters associated with such HRU. These findings are consistent with previously reported IDMPS data collected between 2006 and 2007 indicating a persistent need for change on a healthcare system level. While these data re-emphasize the importance of early diagnosis and intervention to reduce complications and HRU, more national-based surveys with precise separation of HRU for prevention and treatment of late complications will be needed to inform healthcare providers and policymakers regarding the socioeconomic burden of diabetes and its complications.

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