

Appendix 1. Diabetes Related Comorbidities among the T2D Humedica Population from 2008-2011 (N=7,235)

	%
Hypertension	61.30
Obesity	11.47
Dyslipidemia, Hyperlipidemia	53.50
Depression	9.43
Myocardial Infarction	5.21
Angina Pectoris	1.40
Heart Failure	7.88
Ischemic Stroke	2.17
Peripheral Vascular Disease	6.18
Neuropathy	20.55
Nephropathy, Nephrosis	13.37
Retinopathy and Other Eye Problems	8.62
Toe, Foot, or Leg Amputation	0.37
Cellulitis, Decubitus Ulcer Of Skin, Gangrene)	7.37
Dementia	1.02
Cerebrovascular Disease	5.40
Chronic Respiratory Conditions	6.80
Rheumatologic Disease	1.71
Ulcer Disease	0.57
Mild Liver Disease	2.87
Hemiplegia	2.58
Moderate or Severe Renal Disease	9.29
Any Non-Metastatic Solid Tumor	5.24
Leukemia	0.21
Lymphoma	0.51
Moderate or Severe Liver Disease	1.12
Metastatic Solid Tumor	0.48
Peripheral Circulatory Diseases	2.68
Abdominal Aortic Aneurysm	0.62

Appendix 2. Methods Used to Assign Costs to Encounter Data

Summary of Unit Cost Approach

As noted in the text of the manuscript, costs associated with health care resource utilization are not available in the Humedica database. To assess the costs we applied unit cost information from external sources to the health care services identified in the Humedica database. Costs associated with inpatient and outpatient resource utilization were estimated by assigning each type of service a unit cost or average cost derived from the Medicare fee schedule and the National Inpatient Sample from the Healthcare Cost and Utilization Project that is sponsored and run by the Agency for Healthcare Research and Quality (<http://www.ahrq.gov/research/data/hcup/index.html>).

Inpatient Hospitalizations

National Inpatient Sample

Average costs for inpatient hospitalizations were derived from the 2011 National Inpatient Sample (NIS). The NIS is part of the Healthcare Cost and Utilization Project (HCUP) that is sponsored and run by the Agency for Healthcare Research and Quality (AHRQ). The HCUP is the largest collection of longitudinal hospital care data in the US and provides encounter-level information data from 1988 to 2011. The NIS database represents approximately 8 million inpatient stays each year from 1,050 hospitals located in 44 states. Information for each hospitalization includes diagnosis-related group (DRG), principal and secondary ICD-9-CM diagnosis codes, ICD-9-CM procedure codes, length of stay, total charges, patient characteristics, such as age and sex, and hospital characteristics, such as bed size and geographic region). Each ICD-9-CM diagnosis code has been mapped to one of 289 diagnostic categories using the Clinical Classification Software (CCS) by AHRQ (<http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>).

We used a multivariable regression model to estimate the relationship between each hospitalization's total cost and the primary CCS category and geographic region (charges in the NIS data were converted to paid amounts using the cost-to-charge ratios and sample weights that are available at the hospital level). The average daily costs for each CCS category-region stratum were then estimated based on the regression results and each hospitalization's length of stay.

Humedica Data

Using SAS programs available from AHRQ (<http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>) we classified each ICD-9-CM diagnosis code in each Humedica hospitalization record into a CCS category. We mapped each average daily cost estimated from the NIS data to each Humedica hospitalization record by CCS category and region (because the Humedica data did not distinguish between primary and secondary diagnoses/reasons for hospitalization, we ultimately used the average of cost for all of the CCS categories based on all of the ICD-9-CM codes in each Humedica hospitalization record). The total cost for each Humedica inpatient record was finally calculated by multiplying the average daily cost by the length of stay in the Humedica record.

Outpatient Services

Medicare Fee Schedules

Costs of outpatient services were assigned using unit cost information in the Centers for Medicare and Medicaid Services (CMS) 2012 Medicare fee schedules (<http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/FeeScheduleGenInfo>). CMS pays physicians for services based on the submission of a claim using one or more Healthcare Common Procedure Coding System (HCPCS) codes. The physician fee schedule payment formulas differentiate between facility and non-facility services according to where services are provided. The facility pricing amount generally covers services to inpatient or hospital outpatient clinic settings (such as emergency room visits, ambulatory surgeries). The non-facility services are usually provided in a freestanding physician's office. Similarly, costs for ambulance services, clinical laboratory services, durable medical equipment, prosthetics, orthotics, and supplies are paid by CMS based on HCPCS code.

Humedica Data

All non-inpatient encounters and procedure codes were linked to the Medicare fee schedule (to avoid double-counting, we excluded services that occurred during the same dates as an inpatient hospitalization. We merged Humedica encounters to one of four specific fee schedules depending on the type of service (ambulatory services, clinical laboratory services, durable medical equipment, and physician services). About 99% of the patients in our study had at least one healthcare service or encounter that was linked to a record in the fee schedule files.

For ambulatory services, we used the average of each of the state-specific costs (because state identifiers are not available in the Humedica data), which are equal to the base rate multiplied by each service's number of relative value units (RVU). We also used the average of all state-specific unit costs to assign costs to the durable medical equipment services in the Humedica data.

We used the "national limit" amount published for each clinical laboratory service to determine the cost of each service (we ignored procedure codes that were duplicated due to the inclusion of a modifier because they did not change the cost estimates). If the national limit was equal to 0.00 for any laboratory service, we used the median cost across all states instead for that particular code.

Costs for physician services recorded in the Humedica database were assigned using the total transitioned non-facility unit costs for day surgery patient, emergency patient, inpatient, observation patient, and nursing home patient interaction types and total transitioned facility unit costs were used for office or clinic visit interaction types (interaction types not covered above would be defined as 'Unknown' and we estimated those costs using the average between facility interactions). We ignored procedure codes that were duplicated due to the inclusion of a modifier.