RESEARCH

Prescribing Trends for the Outpatient Treatment of Adolescents and Young Adults with Type 2 Diabetes Mellitus

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ABSTRACT

BACKGROUND: Little is known about U.S. outpatient prescribing trends for type 2 diabetes (T2DM) in adolescents and young adults.

OBJECTIVES: To determine (a) trends in the outpatient prescribing of pharmacological and nonpharmacological therapies and (b) factors influencing prescribing trends for adolescents and young adults with T2DM.

METHODS: A retrospective, cross-sectional analysis was conducted on office visits of adolescents (12-17 years) and young adults (18-39 years) with T2DM or impaired glucose tolerance (IGT), using the National Ambulatory Medical Care Survey (NAMCS) from 1996-2005. Logistic regression was used to test for prescribing trends over time.

RESULTS: There were an estimated 1.6 million (93.7% T2DM; 4.4% T2DM + IGT; 1.9% IGT) and 22.2 million (88.1% T2DM; 11.9% IGT) office visits for adolescents (0.4% of all adolescent visits) and young adults (1.2% of all young adult visits) associated with T2DM based on ICD-9-CM codes, respectively. In young adults, diabetes drug mentions increased significantly from 39% of visits with T2DM to 61% in 2004-2005 ($P=0.04$). Oral diabetes medication mentions increased from 20% to 49% ($P=0.001$). However, reports of nonpharmacological therapy decreased from 53% in 1996-1997 to 37% in 2004-2005 ($P=0.14$).

CONCLUSIONS: The prescribing of pharmacological treatment for T2DM increased with emphasis on oral agents, while reports of nonpharmacological therapy for T2DM decreased over the 9-year study period with increased use of oral medications in both adolescents and young adults. Health care providers should consistently consider both treatment approaches when prescribing patient care as recommended by treatment guidelines.

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What is already known about this subject

- Type 2 diabetes mellitus (T2DM), once thought of as an illness common to older adults, is now increasing in prevalence among young adults and adolescents.
- Previous studies have examined prescribing trends using private insurance databases for children and adolescents and national ambulatory care databases for adults. From these studies, an increasing trend in use of pharmacological treatment for T2DM has been noted, which is possibly reflective of an increasing incidence of risk factors for T2DM, such as obesity, in the United States.
- Off-label medication use is practiced in the treatment of T2DM in adolescents. A variety of treatment approaches are utilized in young adults and adolescents with T2DM.

What this study adds

- This study provides data for prescribing trends of pharmacological and nonpharmacological (e.g., lifestyle changes) therapies in the treatment of T2DM for young adults and adolescents.

Type 2 diabetes mellitus (T2DM), once thought of as an illness common in older adults, is now increasing in prevalence among young adults and adolescents.[1,2] According to the Centers for Disease Control and Prevention (CDC), T2DM comprises 90%-95% of all diagnosed cases of diabetes. In 2010, diabetes was diagnosed in approximately 18 million people in the United States, with over 200,000 people younger than 20 years of age.[1] Up to 46% of all new cases of diabetes among children and adolescents are T2DM.[2] Although T2DM affects all ethnic groups, it is more commonly diagnosed in nonwhite groups, including American Indian and African American youth.[2] Among individuals younger than 20 years of age, the overall prevalence of T2DM was 22 per 100,000 or 24.6 per 100,000 person-years.[3,4] The overall incidence of diabetes has increased over the past decade; this may be attributed in part to an increase in overweight and obese young adults and adolescents in the United States.[1-6]

Diagnosis and treatment of diabetes has evolved over the years. It has been noted that medical nutrition therapy alone in adults with T2DM has not been sufficient for most patients, especially in the first year of diagnosis, resulting in possible need for combination medical nutrition therapy and initial medication therapy.[7-10] As a result, initial treatment using pharmacological therapy, such as metformin, and medical nutrition therapy, such as lifestyle changes in diet and exercise, in adult patients with T2DM is recommended.[8,10] However, there is a noteworthy difference in the treatment approach for T2DM in adolescents. The American Diabetes Association (ADA) and American Academy of Pediatrics (AAP) suggest that children and adolescents who are not acutely ill at diagnosis can be managed initially using lifestyle changes or nonpharmacological therapy, such as self-management education, diet and nutrition counseling by a dietitian, and exercise or fitness programs. However, when nonpharmacological therapy ceases to meet treatment goals, medication therapy (i.e., metformin) should be initiated.[7,11,12] Similar to many medications used in the pediatric population, drug therapy approved for treatment of T2DM

in adolescents is limited. Metformin is currently the only oral diabetes agent approved for children and adolescents aged 10 years and older. Insulin, including long-acting insulins, are also approved for use in management of diabetes, both type 1 and 2, in children and adolescents.[11-13]

Limited data about the trends of pharmacologic treatment of T2DM in young adults and adolescents have been described.[13-18] However, updates in prescribing trends of medication therapy for T2DM related to payment source (e.g., insurance), prescriber type or specialty, ethnicity, and race are lacking, especially for adolscents.[13-15] The influence of such factors as insurance and prescriber type can affect treatment modalities used by providers and thus influence prescribing trends. The introduction of newer drug therapies and changes in treatment guidelines may affect prescribing trends in these patient populations. A study examining prescribing trends for pharmacological and nonpharmacological therapies may stimulate further research to improve medication use and health outcomes in young adults and adolescents with T2DM.

The objectives of this study were to determine prescribing trends of pharmacological and nonpharmalogical therapies for the management of T2DM in adolescents (12-17 years) and young adults (18-39 years) and factors influencing those prescribing trends in U.S. outpatient settings from 1996-2005.

Methods

This was a retrospective, cross-sectional study utilizing the National Ambulatory Medical Care Survey (NAMCS) database from 1996 to 2005 and was approved by the Ohio State University Institutional Review Board. This study examined trends in physician prescribing of medications and nonpharmacological therapies for T2DM in adolescents and young adults. NAMCS is a national probability sample survey conducted by the Division of Health Care Statistics of the National Center for Health Statistics (NCHS) and the CDC. The basic sampling unit for NAMCS is the physician-patient encounter or office visit, defined as a visit to a nonfederally employed office-based, direct patient care physician (excluding those in the specialties of radiology, anesthesiology, and pathology). Data collected from the medical records of each sampled office visit included patient sociodemographics, physician specialty, reason(s) for the visit, source of payment, diagnoses, medication records, nonspharmacological treatments or interventions (NAMCS variables DIETNUTR and EXERCISE), and type of insurance coverage. Based on the multistage sampling design, each office visit is assigned a statistical sampling weight. The target estimation population is all ambulatory office visits in the United States. Additional description of the methods used in NAMCS sampling, weighing, data processing, and quality control is available for public review.[19]

Office visits with adolescents (12-17 years) and young adults (18-39 years) having a diagnosis of T2DM were identified using *International Classification of Disease, Ninth Revision, Clinical Modification* (ICD-9-CM) codes from the visit record of the NAMCS dataset (Appendix A and B). An indicator variable for T2DM in patients aged 12 to 39 years was created and given the value of 1 when such a visit was identified. Not included in this identification were office visits of patients aged less than 12 years, those patients who presented with hyperglycemia without an ICD-9-CM code for T2DM or impaired glucose tolerance (IGT), or those patients who had type 1 diabetes mellitus. In addition, the presence of associated comorbidities, such as obesity, nephropathy, neuropathy, peripheral vascular disorders, hypertension, and hyperlipidemia were identified by ICD-9-CM code. Specific drug therapy was also identified using the NAMCS coding system and was grouped in therapeutic categories (Appendix C).

Statistical Analysis

All analyses were conducted using STATA statistical software version 10.1. Estimation and analysis procedures followed the guidelines provided by the CDC in the document "Using Ultimate Cluster Models with NAMCS and NHAMCS Public Use Files."[19] For data files prior to 2002, the CSTRATM and CPSUM variables were created to allow for variance estimation, assuming ultimate cluster design in STATA (CSTRATM and CPSUM were included starting in 2002). STATA survey set properties were set to pweight = PATWT, strata = CSTRATM, and psu = CPSUM. The sampling weights were designed to be nationally representative of all office visits. Estimates with a relative standard error greater than 30% were considered unreliable and not reported per NAMCS standards.

Separate analyses were performed for adolescents (aged 12-17 years) and young adults (aged 18-39 years) with T2DM. All data presented were weighted. Descriptive statistics for patient and physician characteristics were calculated as percentages of visits for the entire 1996-2005 cohort and also separately for each major treatment category: medication alone, nonpharmacological therapy alone (diet and/or exercise therapy), combination therapy (medication plus nonpharmacological), and no treatment. The number of visits with drug mentions from Appendix C and nonpharmacological therapy mentions were estimated for each age group. For the aged 18-39 cohort, drug mention estimates were also made separately for oral medications and insulin or insulin analogues. In the aged 12-17 cohort, 5-year periods were required to obtain reliable estimates. Chi-square tests were performed to test for differences between 1996-2000 and 2001-2005. For the aged 18-39 cohort, estimates were obtained for 2-year periods; linear trends were tested using logistic regression with time as the independent variable for each outcome. Sampling weights were divided by the number of years in each period to account for combining results across survey years.

Results

Overall Patterns of Ambulatory Care Visits Associated with T2DM

Between 1996 and 2005, the estimated total number of office visits in the United States was 426 million for adolescents (12-17 years) and 1.95 billion for young adults (18-39 years). The estimated number of visits by patients with diagnoses of T2DM or IGT was 1.6 million for adolescents and 22.2 million for young adults during this time period. Among adolescents, 93.7% of the 1.6 million visits were classified as T2DM without IGT; estimates of visits involving IGT were not reliable. For young adults, 88.1% of the 22.2 million visits were classified as T2DM alone, and 11.9% were IGT alone.

A majority of adolescent patients were non-Hispanic (75%), white (81%), and from the southern U.S. geographic region (49%). There were an equal percentage of male and female patients. Most of the adolescent patients were reported to have used private insurance (64%). Pediatricians (38%) and general/family medicine (32%) specialties were the most common physicians among adolescent office visits reported. Other demographic estimates did not meet NAMCS reliability criteria.

Among the young adults patient group, most patients were white (73%), and 85% of patients with a declared ethnicity were non-Hispanic. Female patients represented the majority (61%), and two-thirds of the total population was between 31-39 years of age (68%). The most represented geographic region was the southern region of the United States (39%). Hypertension was the most commonly reported comorbidity (13%), followed by obesity (8%). Private insurance (66%) was the most common payment source, followed by Medicare/Medicaid (19%). Other unlisted specialties (35%) were the most common specialty reported in this patient group, followed by general/family medicine (33%) and internal medicine (26%).

Trends for Pharmacological and Nonpharmacological Treatment of T2DM

Proportions of patient visits associated with T2DM or IGT that did not report either prescribed medication or nonpharmacological intervention (e.g., diet and exercise) were similar between adolescents and young adults, 33% and 31.5%, respectively. Use of combination pharmacological and nonpharmacological therapy was slightly higher for adolescents (31%) compared with young adults (25.7%), whereas use of either treatment modality alone was more common in young adults (Table 1).

Of visits from adolescents with T2DM from 1996-2000, 43% (confidence interval [CI] = 24%-65%) had a mention of at least 1 diabetes medication, and 58% (CI = 37%-77%) reported nonpharmacological intervention. From 2001-2005, 59% (CI = 26%-86%) had drug mentions, and 32% (CI = 12%-68%) reported nonpharmacological intervention. Neither change was statistically significant.

For the young adult group, the percentage of visits for T2DM with a drug mention increased significantly from 39% in 1996-1997 to 61% in 2004-2005 ($P = 0.04$; Table 2). Specifically, the percentage of visits with oral medication mentions increased from 20% to 49% ($P = 0.001$). Reports of nonpharmacological therapy decreased from 53% in 1996-1997 to 37% in 2004-2005 ($P = 0.14$).

Discussion

Much of the adult data regarding U.S. prescribing trends for the outpatient treatment of T2DM are for older adults, so there are limited data for young adults.[16,17] Skaer et al. (2006) examined payment sources from 1990-2001 and found that access to drug therapy was associated with source of insurance coverage.[16] Since this study, there has remained a lack of data describing prescribing trends based on such factors as payment source, health care provider, and geographic location in both the young adult and adolescent populations. In a study covering a 3-year period (1997-2000), Cohen et al. (2003) found an increasing prescribing trend of combination oral agents versus monotherapy, including insulin.[17] In our study, we found a significant trend of increased oral medication use; however, we did not find a change in use of insulin therapy. The Cohen et al. study, which examined data from privately insured U.S. patients, lacked data regarding those patients with different coverage such as Medicaid.[17]

There are limited studies describing T2DM therapy trends in adolescents.[14,15] Liberman et al. (2009) examined trends in use of medications for antihypertensive, antidiabetic, and dyslipidemic in children and adolescents and found an increased use of oral diabetes therapy by approximately 15% over a 3-year time period.[14] Similarly, Cox et al. (2008), in a study of chronic medication use trends, found doubled use of diabetes medications over a 3-year period.[15] However, these studies utilized private insurance databases, which lacked representation from other populations, including Medicaid and self-pay patients.[14,15] Off-label medication use is also a distinct characteristic in the treatment of adolescents given the limited availability of approved agents. Compared with the years 1996-2000, off-label medication use may be a part of the increased trend seen in the years 2001-2005, as newer agents became available on the market. However, there are various factors that may have affected change in therapy use over the years, including those related to prescribers (e.g., familiarity with agents) and patients (e.g., severity of disease).

Examination of the trends in the use of nonpharmacological therapy for T2DM was limited in previous studies.[14-17] Our study identified changes in prescribing trends of outpatient medications and nonpharmacological therapy, such as diet and/or exercise. Interestingly, during the study period, drug therapy utilization use increased and use of nonpharmacological therapy decreased. However, combination of

TABLE 1 Descriptive Statistics Overall and By Therapy Category for Young Adults (18-39 Years) with Type 2 Diabetes, 1996-2005

Characteristic	Weighted Percentage of Visits (95% CI)[a]									
	All Visits		Medication Alone		Med + Nonpharm[b]		Nonpharm Alone[c]		No Treatment	
Weighted number of visits (1,000,000s)	22.5	(19.7-25.3)	5.1	(3.9-6.3)	5.8	(4.5-7.1)	4.5	(3.3-5.6)	7.1	(5.7-8.6)
Age										
18-25	13	(10-16)	12	(6-21)	8	(4-14)	12	(7-21)	18	(12-26)
25-30	20	(13-30)	19	(12-27)	19	(13-28)	23	(15-34)	16	(10-25)
31-39	68	(63-73)	68	(57-77)	73	(64-81)	64	(52-75)	66	(56-74)
Gender										
Female	61	(56-67)	50	(38-62)	64	(53-74)	63	(51-73)	67	(57-75)
Race										
White	73	(67-78)	76	(62-86)	70	(58-80)	73	(61-83)	73	(63-81)
Black	20	(16-26)	16	(9-27)	22	(14-34)	20	(12-31)	21	(14-30)
Asian/Pacific Islander	7	(4-11)	NR		NR		NR		NR	
Other/Unknown	NR		NR		NR		NR		NR	
Ethnicity										
Hispanic	11	(7-15)	NR		NR		17	(10-28)	NR	
Non-Hispanic	63	(57-68)	64	(52-74)	71	(61-80)	53	(41-64)	61	(51-71)
Undeclared	27	(22-32)	26	(17-38)	22	(14-32)	30	(20-43)	29	(20-39)
Comorbidities										
Obesity/overweight	8	(5-11)	NR		14	(9-23)	NR		NR	
Hypertension	13	(10-17)	19	(11-31)	20	(13-30)	NR		NR	
Hyperlipidemia	5	(3-7)	NR		NR		NR		NR	
Nephropathy	NR		NR		NR		NR		NR	
Retinopathy	3	(2-5)	NR		NR		NR		9	(6-15)
Diabetic neuropathy	NR		NR		NR		NR		NR	
Peripheral vascular disorder	NR		NR		NR		NR		NR	
Payment source										
Private insurance	66	(60-71)	67	(57-77)	70	(59-79)	63	(51-74)	63	(54-72)
Medicare/Medicaid/WC	19	(16-23)	15	(9-23)	15	(10-23)	23	(14-35)	23	(17-32)
Self-pay	7	(5-10)	NR		NR		NR		NR	
Other/unknown	8	(6-12)	NR		NR		NR		NR	
Physician specialty										
Endocrinologist	NR		NR		NR		NR		NR	
General/family medicine	33	(28-39)	37	(26-49)	46	(36-57)	34	(24-46)	18	(12-27)
Internal medicine	26	(20-31)	36	(24-49)	25	(17-36)	22	(13-35)	21	(13-31)
Other specialties	35	(30-41)	19	(12-28)	23	(16-32)	40	(29-52)	54	(44-64)
Region										
Northeast	14	(10-18)	NR		9	(5-15)	17	(10-28)	16	(10-24)
Midwest	24	(19-30)	29	(19-41)	28	(19-39)	26	(17-37)	17	(11-25)
South	39	(33-46)	38	(27-51)	38	(28-50)	41	(29-54)	40	(31-51)
West	23	(18-29)	21	(13-31)	25	(16-36)	NR		27	(19-3)

[a]*Except first row, which is weighted frequency.*
[b]*Medication plus nonpharmacological therapy.*
[c]*Nonpharmacological therapy.*
CI = confidence interval; NR = Not reliable, relative standard error > 30%; WC = worker's compensation.

pharmacological and nonpharamcological therapy was found to be greater among adolescents compared with young adults. This may reflect practices emphasizing medical intervention, such as an oral diabetes medications as per adult guidelines, compared with pediatric guidelines in which nutritional medical therapy is considered first line, initial treatment.[7,8,11,12] The greater use of nonpharmacological therapy among adolescents may also be a result of limited approved agents for this age population. Lack of reported nonpharmacological therapy in both groups may also be attributed to under-reporting, as such approaches may not have been considered traditional medical treatment for T2DM, compared with drug therapies, by survey data providers.

Patient factors such as race and ethnicity, provider type,

TABLE 2 Medication Trends in Young Adults (18-39 Years) with Type 2 Diabetes, 1996-2005

Treatment	Percentage of Visits with Patient Taking the Indicated Medication (95% CI)[a]				
	1996-1997	1998-1999	2000-2001	2002-2003	2004-2005
Any diabetes medication[b]	0.8 (0.6-1.0) 39 (28-51)	0.9 (0.6-1.2) 50 (38-62)	1.2 (0.9-1.6) 44 (32-57)	1.2 (0.9-1.7) 49 (36-61)	1.3 (1.0-1.8) 61 (46-74)
Oral diabetes medication[c]	0.3 (0.2-0.5) 20 (12-32)	0.4 (0.3-0.6) 32 (22-43)	0.6 (0.5-0.9) 32 (21-44)	0.7 (0.5-0.9) 38 (26-52)	0.9 (0.7-1.3) 49 (35-63)
Insulin/insulin analogs	0.5 (0.3-0.7) 19 (13-28)	0.5 (0.3-0.7) 20 (11-34)	0.7 (0.4-1.1) 18 (11-28)	0.7 (0.4-1.0) 18 (11-28)	0.5 (0.3-0.7) 16 (9-27)
Nonpharmacological therapy	16 (15-18)[d] 53 (42-64)	16 (14-18)[d] 41 (30-54)	14 (12-16)[d] 51 (39-63)	17 (15-19)[d] 45 (34-57)	15 (13-17)[d] 37 (25-51)

[a]*Data in top row across the columns equals percentage of all U.S. office visits for patients 18-39 years; data in bottom row across the columns equals percentage of type 2 diabetes visits.*

[b]*Significant trend: P < 0.05.*

[c]*Significant trend: P < 0.001.*

[d]*Lifestyle change in diet and/or exercise recommended but not specifically because of diabetes.*

CI = confidence interval.

and geographic location of subjects were also examined in this study. In our study, race and ethnicity were similar to previous studies with mostly white, non-Hispanic patients. Health care provider and geographic location were factors lacking in previous studies among both age populations.[14,15,17] From a health care provider perspective, general pediatricians and family medicine providers were most common for adolescents in this group, which may indicate the treatment of T2DM occurred in general practices versus managed by specialists. Conversely, unlisted specialists were the majority of providers for young adults. Most of the young adult and adolescent populations used in this study were from the southern U.S. geographic region. Information regarding the most common providers, geographic location, and the prescribing trend of increased pharmacological and decreased nonpharmacological therapy use can help guide education for providers for appropriate utilization of both modalities in the management of T2DM in young adults and adolescents.

Limitations

Although this study has provided useful information regarding patient- and prescriber-specific trends in a once-overlooked population of T2DM patients, limitations should be considered. Since the basic unit of measure in the NAMCS database is a single office visit, therapeutic outcomes, such as hemoglobin A1c values, were not available. Also, this database does not provide information about patient follow-up, interventions, and medication adherence. The database is limited to 6 medications per visit; this may lead to possible missed observations in reported drug therapy, although the vast majority of patients are not likely to receive more than 6 medications. The database revealed a limited patient sample of adolescents with T2DM, which may be attributed to under-reporting of data in this patient population. Also noteworthy is the limitations in data span through 2005; patterns do not reflect more recent prescribing trends such as the use of incretins. Although the study period ended in 2005, vast majorities of data are still valid as there are limited data that describe prescribing trends of T2DM therapies in younger populations. Although some new medications have come on the market, none have been labeled for pediatric (and thus adolescent) use since 2005.

Conclusions

Over the study period, it was found that patients were prescribed a variety of diabetes medications, including oral and insulin therapies, as well as nonpharmacologial therapy, with trends changing as a result of evolving treatment guidelines and marketing of newer agents. This study expands the knowledge of prescribing trends of T2DM medications and nonpharmacological therapy and patient-specific factors such as health care providers prescribing therapies, geographic location, and payment provider. With our findings of an increased trend of pharmacological therapy paired with a decreased trend of nonpharmacological therapy, interventions such as additional education to providers should be considered. Such education may encourage optimal and consistent use of both treatment types in the care of young adults and adolescents as recommended by treatment guidelines. Future studies on prescribing trends, especially among younger populations (e.g., adolescents), are needed with the continued introduction of newer oral and injectable diabetes agents for the treatment of T2DM where approved medications are limited.

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DISCLOSURES

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APPENDIX A List of ICD-9-CM Codes for Patients with Type 2 Diabetes Mellitus and Impaired Glucose Tolerance and Possible Comorbidities

ICD-9-CM Code	Diagnoses
790.21	Impaired fasting glucose
790.22	Impaired glucose tolerance test (oral); elevated glucose tolerance test
790.29	Other abnormal glucose
250.00	Type II diabetes mellitus without mention of complication, or unspecified type, not stated as uncontrolled
250.02	Type II diabetes mellitus without mention of complication, uncontrolled or unspecified type
250.40	Type II diabetes mellitus with renal manifestations, or unspecified type, not stated as uncontrolled
250.42	Type II diabetes mellitus with renal manifestations, uncontrolled
250.50	Type II diabetes mellitus with ophthalmic manifestations, or unspecified type, not stated as uncontrolled
250.52	Type II diabetes mellitus with ophthalmic manifestations, uncontrolled
250.60	Type II diabetes mellitus with neurological manifestations, or unspecified type, not stated as uncontrolled
250.62	Type II diabetes mellitus with neurological manifestations, uncontrolled
250.70	Type II diabetes mellitus with peripheral circulatory disorders, or unspecified type, not stated as uncontrolled
250.72	Type II diabetes mellitus with peripheral circulatory disorders, uncontrolled
250.80	Type II diabetes mellitus with other specified manifestations, or unspecified type, not stated as uncontrolled; diabetic hypoglycemia; hypoglycemic shock
250.82	Type II diabetes mellitus with other specified manifestations, uncontrolled; diabetic hypoglycemia; hypoglycemic shock
250.90	Type II diabetes mellitus with unspecified complication, or unspecified type, not stated as uncontrolled
250.92	Type II diabetes mellitus with unspecified complication, uncontrolled

ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification.

APPENDIX B List of ICD-9-CM Codes for Possible Comorbidities

ICD-9-CM Code	Diagnoses
272.4	Other and unspecified hyperlipidemia
401.9	Unspecified essential hypertension
278.00	Obesity, unspecified
278.01	Morbid obesity; severe obesity
278.02	Overweight

ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification.

APPENDIX C Medications Used for Type 2 Diabetes Mellitus and NAMCS Medication Codes

Medications	Therapeutic Category	NAMCS Medication Codes
Metformin	Metformin	95111, 95133, 02189, 02286, 02302, 04113, 04175
Pioglitazone	Thiazolidinedione	02311, 99090
Rosiglitazone	Thiazolidinedione	00107, 99030
Chlorpropamide	Sulfonylurea	06625, 09250
Glipizide	Sulfonylurea	01037, 13553, 91081, 05106
Glyburide	Sulfonylurea	03016, 40580, 50035, 93069, 93305
Glimepride	Sulfonylurea	96138, 99056
Unspecified sulfonylurea	Sulfonylurea	93150
Repaglinide	Meglitinide	01042, 98101
Nateglinide	Meglitinide	01076, 04674, 20380, 06152
Acarbose	Alpha-glucosidase inhibitors	96058, 20232
Miglitol	Alpha-glucosidase inhibitors	00038
Glyburide + metformin	Fixed dose combination oral agent	00209
Glipizide + metformin	Fixed dose combination oral agent	03181
Pioglitazone + metformin	Fixed dose combination oral agent	06061
Rosiglitazone + metformin	Fixed dose combination oral agent	03105
Insulin, insulin analogs	Injectable	00487, 03273, 14412, 14727, 15475, 15678, 15680, 16003, 17303, 17304, 19568, 19648, 25598, 27748, 33073, 33078, 33808, 35575, 35576, 40815, 41380, 41855, 41895, 42515, 60725, 60730, 61045, 92045, 92046, 92101, 92102, 94116, 95010, 95053, 95075, 97017, 00253, 01267, 02209, 06164, 01214, 01266, 03306
Pramlintide	Injectable	06019
Exenatide	Injectable	05162

NAMCS = National Ambulatory Medical Care Survey.