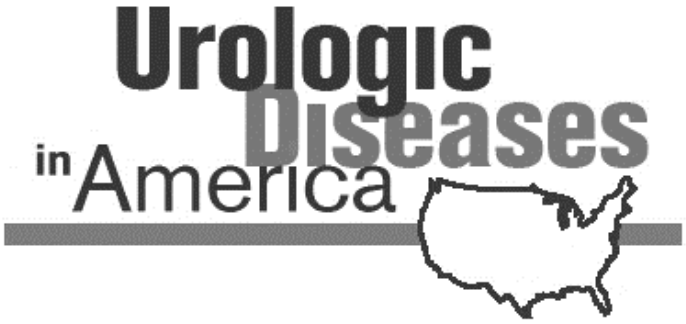

Urinary Tract Infection

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1.0 Introduction

Urinary tract infection (UTI) is a common medical condition. Although most UTI can be effectively managed in an outpatient setting, in other cases it may require more intensive therapy. In 2005, the Urologic Diseases in America (UDA) project first undertook efforts to quantify the burden of UTI on the United States population. In this initial effort, UDA investigators utilized datasets that included the National Health and Nutrition Examination Survey III, National Hospital Ambulatory Medical Care Survey, National Ambulatory Medical Care Survey, Centers for Medicare & Medicaid Services, National Nursing Home Survey, Ingenix Health Alliance, and the Medical Expenditure Panel Survey.[1-3] From these data, the investigators estimated that overall lifetime UTI prevalence from 1988 to 1994 was over 53% in women and 14% in men.[1, 2] The initial UDA project also undertook efforts to better define the costs associated with UTI, utilizing a composite expenditure approach that merged data from the National Ambulatory Medical Care Survey, National Hospital Ambulatory Medical Care Survey, Healthcare Cost and Utilization Project, and Medical Expenditure Panel Survey. They found that the total expenditures on UTI in 2000 for both men and women, including inpatient, physician office, hospital outpatient, and emergency room care were greater than $3.4 billion.[3]

Claims-based datasets may be one of the most comprehensive data sources available to further improve our understanding of the epidemiology of UTI and its associated costs. Although not without limitations, administrative claims capture healthcare utilization in all settings, including inpatient, outpatient, and emergency, and also permit longitudinal assessments. The occurrence and management of UTI has likely evolved since prior analyses, some of which are over two decades old. Therefore, our study utilized two large administrative claims-based datasets to more comprehensively assess prevalence, treatment, and insurer costs of UTI from 2007 to 2016.

2.0 Methods

2.1 Data Sources

Two insurance claims databases were used to investigate UTI over the 2007-2016 study period: the Centers for Medicare & Medicaid Services Medicare (CMS) 5% Sample and the Optum© de-identified Clinformatics® Data Mart Database (CDM). CMS data were used to describe Medicare beneficiaries at least 65 years of age, and CDM data were used to describe enrollees aged 18–64 years.

2.1.1 Centers for Medicare & Medicaid Services Medicare (CMS) 5% Sample

The CMS 5% Sample was created by CMS to establish a sample of Medicare beneficiaries that is representative of the full Medicare population and is followed over time to allow for representative longitudinal analysis.[4]

a. Enrollment (Denominator) Data

The enrollment files contain detailed demographic, geographic, Medicare entitlement, monthly enrollment status by program (Part A [Hospital Insurance], Part B [Supplemental Medical Insurance], and Part D [Prescription Drug Benefit]), and eligibility period information (enrollment date, death year, and death month) on all Medicare beneficiaries. Records in the files are at the individual level, and are linkable to claims and other Medicare data by the beneficiary unique identifier.

b. Institutional Claims

Institutional claims files contain records summarizing final action on fee-for-service claims submitted by health care institutions for facility cost reimbursement. A separate dataset exists for each of several types of institutional claims:

- Hospital inpatient stays (IP)
- Hospital outpatient services (OP)
- Skilled nursing facilities (SN)
- Home health agencies (HH)
- Hospice care organizations (HS)

Each of these institutional claims sources have three related files:

- The "base claims" file contains one record per instance of institutional service. For example, there is one record for a given hospital stay, one record for a stay at a skilled nursing facility, and one record for an outpatient encounter at a hospital. A record in this file contains basic summary information on the medical encounter, including beneficiary unique identifier, beneficiary demographics, type of claim involved, principal diagnostic code, date(s) of service, and total payments for services covered by Medicare.
- The "code detail" file contains medical diagnostic and procedural codes detailing medical conditions and/or medical procedures related to a particular encounter. There may be multiple code records per service instance, which include at least one record specifying at least one medical diagnostic code, and any number of additional records specifying surgical or other medical procedures applied and the number of supplies used. Each record in this file can be uniquely linked to a base claims file record through a Claim Number field. Diagnostic and procedure codes are from International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM).
- The "revenue detail" file contains line-item-level details of charge-related information connected to a claim. There may be multiple records related to each service instance, depending on the number of specific items for which there were associated charges, such as a diagnostic procedure, a surgical or other treatment procedure, etc. As such, this file provides medical procedure information coded according to the Healthcare Common Procedure Coding System (HCPCS) administrative codes, which may be complementary to or redundant with medical procedure information provided in the code detail file.

As discussed in Section 2.2.1, our analysis was limited to uncomplicated UTI episodes. From the institutional claims, we therefore employed hospital outpatient claim files only.

c. Non-Institutional Claims

Non-institutional claims (also known as Physician/Supplier or PB claims) cover requests for reimbursement from health care professionals (e.g., physicians, clinical social workers, nurse practitioners) for patient encounters and for supplies and services provided in support of these encounters (e.g., laboratory tests, radiology services, medical supplies).

For each such claim, two related files were used for the UTI analysis:

- The "base claim" file contains one record per claim. Base claim file records provide summary information such as beneficiary unique identifier, beneficiary demographics, date(s) of service, ICD-9-CM and ICD-10-CM medical diagnostic codes, and total payments for service.
- The "line-level detail" file provides details on specific services provided or supplies used in support of services. There is generally one record per chargeable service or supply, so the file typically contains several records per claim. Contents of a record in this file include a claim number to link unique records to beneficiary data in the base claim file, provider type, type of service or supply provided, and HCPCS medical procedure codes for records detailing a charge for a medical procedure.

d. The Part D Events (PDE) File

The PDE file contains all final action claims for prescription drugs submitted by pharmacies. The files contain information such as drug name, days and quantity of supply, drug dose and strength, etc.

2.1.2 Clinformatics® Data Mart Database (CDM)

The CDM database consists of de-identified, adjudicated administrative health claims for approximately 15-18 million lives covered annually by

commercial insurance in all 50 US states. We purchased the CDM data from Optum© for the UTI analysis. The population is comprised of national participants with geographic diversity. All members were covered for both medical services and prescription drugs.

a. Member Eligibility Files

The member eligibility files in the CDM dataset contain year of birth, gender, race/ethnicity, state of residence, household income, and eligibility period (eligibility and effective dates) information on each member. Records in the files are at the individual level and are linkable to claims by the enrollee unique identifier.

b. Inpatient Confinement Files

Inpatient confinement files contain records summarizing each inpatient episode serviced in an acute care hospital or skilled nursing facility. A record in this file contains basic summary information on the hospitalization, including enrollee unique identifier, admission and discharge dates, up to 25 ICD-9-CM or ICD-10-CM diagnostic codes, up to 25 ICD-9-CM or ICD-10-CM procedure codes, place of service, and standardized cost.

c. Medical Claims Files

The Medical claims files include requests for reimbursement from health care professional services provided in all places of services (e.g., inpatient hospital, outpatient facilities, physician office, and laboratory). Medical claims files contain "line-level detail" information, i.e., each claim may include multiple records for services rendered on one claim. Contents of a record in these files include enrollee unique identifier, a claim number, service date, up to 25 ICD-9-CM or ICD-10-CM diagnostic codes, up to 25 ICD-9-CM or ICD-10-CM procedure codes, one Current Procedural Terminology/Healthcare Common Procedure Coding System (CPT/HCPCS) medical procedure code, type of service, place of service, and standardized cost.

d. Pharmacy Claims Files

Pharmacy claims files contain all final action claims submitted by pharmacies for prescription drugs filled in an outpatient setting. The files contain information on the drug name, National Drug Code, days and quantity of supply, drug dose and strength, etc.

2.2 General Methods for Claims Data Files

In this section, we described how the following were defined in the UTI analysis: 1) UTI episodes; 2) UTI patients; 3) birth date; 4) race/ethnicity; 5) geographic region; and 6) socioeconomic status.

2.2.1 UTI Episodes

This analysis was limited to evaluation of uncomplicated UTI episodes, which were identified from outpatient claims only. We restricted to outpatient claims because (1) few patients with UTI require hospitalization, and (2) hospitalized patients commonly have multiple antimicrobial regimen changes or multiple documented or suspected infections, confounding assessment of therapy.[1, 2, 5] In the CMS 5% Sample data, outpatient claims were defined as all those located in institutional outpatient claim files and those located in non-institutional claim files that did not have a place of service of hospice or a claim type of durable medical equipment. In the CDM data, outpatient claims were defined as medical file claims without an associated confinement identifier, without a place of service of hospice, and without a type of service of durable medical equipment.

An uncomplicated UTI episode was defined as an outpatient claim with a qualifying UTI ICD-9-CM or ICD-10-CM diagnosis code (Appendix A), that was followed within 72 hours by a prescription filled for at least one UTI-related anti-infectious medication (Appendix B). If two unique UTI-relevant medications were dispensed on the same day, we assumed that both were for the UTI (and taken concurrently), whereas if multiple unique UTI-relevant medications were dispensed on different days, we assumed that the later-prescribed (within the 72 hour window) UTI-relevant medication replaced the initial one. Patients who received three or more unique UTI-relevant medications on the same day were excluded as having an excessively complex situation. Unique medications were defined by unique NDC codes.

Individuals in the annual cohorts (see Section 2.3.1 "Study Population") may have experienced multiple UTI episodes within a calendar year. To qualify as a claim for a unique UTI episode, the claim must have occurred ≥72 hours following the initial claim for the previous UTI episode.

2.2.2 UTI Patients

An enrollee/beneficiary was considered a UTI patient in a given calendar year if they met the inclusion criteria to be part of the study population (see Section 2.3.1 "Study Population") and experienced a UTI episode (see Section 2.2.1 "UTI Episodes") during that calendar year.

2.2.3 Birth Date

CDM provides birth year for enrollees but does not provide exact birth date. Thus, all enrollees were assigned an arbitrary birth date of July 1. The CMS 5% Sample provides birth month and year, but not exact birth date. Thus, all beneficiaries were assigned the 15th of the birth month as their birth date. Age at January 1 of a given calendar year was employed for age-specific analyses.

2.2.4 Race/Ethnicity

The race/ethnicity information currently provided by CDM is categorized as White, Black, Hispanic, Asian, or missing. The race/ethnicity information currently provided by the CMS 5% Sample is categorized as White, Black, Asian, Hispanic, North American Native, Other, or missing.

2.2.5 Geographic Region

Geographic region information currently provided by both CDM and the CMS 5% Sample was condensed into the categories of Northeast, Midwest, South, and West (Appendix C).

2.2.6 Socioeconomic Status

a. CDM

In the CDM sample, annual household income was utilized as a marker of socioeconomic status and split into the following categories: <$40,000; $40,000 – $49,000; $50,000 – $59,000; $60,000 – $74,000; $75,000 – $99,000; $100,000+; and Missing.

b. CMS 5% Sample

In the CMS 5% Sample, annual Medicare dual eligibility was utilized as a marker of socioeconomic status. Dual eligibility was defined as "yes" if the beneficiary was eligible for at least 1 month during their enrollment period and "no" otherwise.

2.3 Annual UTI Analyses

Annual analyses for each year of the study period (2007-2016) were conducted among annual cohorts created from the CDM database and CMS 5% Sample. All analyses were reported overall and stratified by year, age, gender, race/ethnicity, geographic region, and socioeconomic status. Age, geographic region, and household income (for CDM analyses) were taken on January 1 of each year.

2.3.1 Study Population

a. CDM

The inclusion criteria for each annual cohort was all privately insured enrollees in CDM who:

1) Were aged 18-64 years on January 1 of the year;
2) Resided in the 50 states or Washington, DC on January 1 of the year; and
3) Were continuously and fully enrolled for at least the full calendar year (January 1 – December 31)

b. CMS 5% Sample

The inclusion criteria for each annual cohort was all fee-for-service beneficiaries who:

1) Were aged 65+ years on January 1 of the year;
2) Resided in the 50 US states or Washington, DC on January 1 of the year; and
3) Were continuously and fully enrolled in Parts A, B, and D for at least the full calendar year (January 1 – December 31)

In the 2012 calendar year, a one-time shift in the sources of the CMS 5% Sample enrollment data resulted in poor matching of Part A/B enrollment with Part D enrollment. This resulted in biased, low estimates of pharmaceutical use in 2012. Other years

were unaffected by the poor enrollment matching. Consequently, analytic findings for the CMS 5% Sample were not reported for 2012.

2.3.2 UTI Prevalence

Prevalence of UTI in a given year was estimated from the percentage of eligible participants (defined in Section 2.3.1) who experienced a UTI episode (defined in Section 2.2.1) during that year.

2.3.3 UTI Prescription Fills

Prevalence of UTI-relevant prescription fills in a given year was estimated from the percentage of UTI events (defined in Section 2.3.1) that fell into the various medication categories during that year. The UTI-relevant medications (Appendix B) were grouped into 10 different categories based on the first six numbers of the American Hospital Formulary Service class variable (AHFSCLSS) of the medication associated with each UTI episode. These categories included:

1) Quinolones (AHSFCLSS = 081218 or 082200)
2) Urinary Anti-Infectives (AHSFCLSS = 083600)
3) Sulfonamides (AHSFCLSS = 081220 or 082400)
4) Cephalosporins (AHSFCLSS = 081206)
5) Penicillins (AHSFCLSS = 081216)
6) Azoles (AHSFCLSS = 081408)
7) Macrolides (AHSFCLSS = 081212)
8) Tetracyclines (AHSFCLSS = 081224)
9) Other [includes: Aminoglycosides (AHSFCLSS = 081202), Antifungal Antibiotics (AHSFCLSS = 081204), Miscellaneous B-Lactam Antibiotics (AHSFCLSS = 081207), Miscellaneous Antibiotics (AHSFCLSS = 081228), Miscellaneous Antifungals (AHSFCLSS = 081492)]
10) Combination therapy
    a. Including Azoles
    b. Not including Azoles

2.3.4 Medication Duration

The CDM pharmacy and CMS Part D files provide data on the number of days for which the filled medication was prescribed. We assessed the mean (and standard deviation) number of days that UTI medications were prescribed among UTI cases in the annual cohorts. We additionally categorized duration into 1, 2-3, 4-5, 6-7, and >7 days and calculated the frequency (number and percentage) of UTI episodes falling into these categories. In addition to stratification by year and demographic characteristics, this analysis was further stratified by medication class.

2.3.5 Comorbid Conditions

We assessed the frequency (number and percentage) of various comorbid conditions among UTI patients in each annual cohort. Nine conditions were examined:

1. Benign prostatic hyperplasia (BPH), among male patients
2. Chronic kidney disease
3. Diabetes mellitus
4. Human immunodeficiency virus infection and/or acquired immunodeficiency syndrome (HIV/AIDS)
5. Ischemic heart disease
6. Multiple sclerosis and transverse myelitis (MS/TM)
7. Prostate cancer, among male patients
8. Spinal cord injury
9. Stroke / Transient ischemic attack

To identify these conditions in the claims databases, we utilized condition-defining algorithms provided by the CMS Chronic Conditions Data Warehouse (https://www.ccwdata.org/web/guest/condition-categories).[6] The CMS Chronic Conditions Data Warehouse suggested an observation period of 2+ years for the following conditions: chronic kidney disease, diabetes mellitus, immunodeficiency virus infection and/or acquired immunodeficiency syndrome, ischemic heart disease, MS/TM, and spinal cord injury. However, given the nature of how the annual cohorts were identified, we used a one-year observation period. This may have resulted in underestimation of these comorbid conditions if more than a year had passed since affected participants sought care or filled a prescription for their comorbid condition.

2.4 Longitudinal UTI Analyses

Among UTI cases identified in each study year, we longitudinally assessed the frequency of a recurrent UTI over a 12-month period following the first UTI episode in a given year. To allow for a full 12-months of follow-up, these analyses were limited to cases identified between 2007-2015 among patients who were continuously and fully enrolled for at least 12 months following their first UTI episode in a given year.

2.4.1 Study Population

a. CDM

Nine longitudinal cohorts were constructed among CDM enrollees, one for UTI cases occurring in each year from 2007-2015. The inclusion criteria for each of the nine longitudinal cohorts were all initial UTI cases occurring during that calendar year (2007-2015) among privately insured enrollees in CDM who:

1) Were aged 18-64 years at the time of the UTI episode;
2) Resided in the 50 US states or Washington, DC at the time of the UTI episode; and
3) Were continuously and fully enrolled for at least 12 months following the UTI episode

b. CMS 5% Sample

Seven longitudinal cohorts were constructed among Medicare beneficiaries; cohorts for 2011 and 2012 were excluded due to the aforementioned issues with the 2012 Part D data (see Section 2.3.1). The inclusion criteria for each of the seven longitudinal cohorts were all initial UTI cases occurring during that calendar year (2007-2015, excluding 2011 and 2012) among fee-for-service beneficiaries who:

1) Were aged 65+ years at the time of the UTI episode;
2) Resided in the 50 US states or Washington, DC at the time of the UTI episode; and
3) Were continuously and fully enrolled in Parts A, B, and D for at least 12 months following the UTI episode

2.4.2 Definition of Initial and Recurrent UTI

a. Initial UTI

The initial episode in a given calendar year was defined as the first UTI episode (defined in Section 2.2.1) in that calendar year.

b. Recurrent UTI

A recurrent UTI was defined as a UTI episode (defined in Section 2.2.1) that occurred between 72 hours and 12 months following the initial UTI episode. UTI claims occurring within 72 hours of the initial claim were considered residual to the initial UTI episode.[5]

UTI patients who were enrolled for multiple years could have belonged to more than one longitudinal cohort if they experienced a UTI during multiple years and were subsequently enrolled for at least 12 months following each episode. A single UTI episode could have counted as both recurrent to an initial UTI episode in the previous calendar year and as an initial UTI episode for the year in which it occurred if the UTI patient was then enrolled for at least another 12 months.

2.4.3 Frequency of Recurrent UTI

Among UTI patients in the longitudinal cohorts, we assessed the mean (and standard deviation) number of UTI episodes occurring during the 12-month period during which the UTI patient was followed. We additionally categorized number of episodes into 1, 2, or 3+ and calculated the frequency (number and percentage) of UTI patients falling into each category.

2.4.4 Time to Recurrent UTI

Among the UTI cases identified from the eligible study population (defined in Section 2.4.1), we assessed the cumulative percent of a recurrent UTI at 1, 3, 6, 9, and 12 months following the initial UTI event. Time to recurrent UTI was examined in the population overall (averaged across the longitudinal cohorts and weighted by cohort population size) and by year of the initial UTI, age, gender, race/ethnicity, geographic region, socioeconomic status, medication associated with the initial UTI, medication duration, and comorbid conditions.

2.4.5 Insurer Expenditures for UTI

a. CDM

Insurer expenditures for UTI were estimated for the 12-month period following a UTI episode among the nine longitudinal cohorts constructed among CDM enrollees from 2007-2015. All outpatient claims with a primary diagnostic code for a UTI were included in this analysis. Medication expenditures were not included in this analysis.

The insurer payments recorded in the CDM were amounts after standardization across plans and providers. In CDM, all expenditures were re-calculated using specific pricing algorithms to account for differences in pricing across health plans and provider contracts. We also converted all dollar amounts to 2017 dollar-equivalent values based on the adjusting methods suggested by CDM. To derive an estimated paid amount, we used the algorithm below in which the standardized price serves as an estimate of the allowed amount:

Estimated paid amount = Standardized amount - Coinsurance amount - Copay amount - Deductible amount

These insurer expenditures were aggregated overall and by year of UTI, age, gender, race/ethnicity, geographic region, and household income. In addition, expenditure estimates were derived separately for physician office services, outpatient hospital services, emergency room services, laboratory services, and all other services. Per person per year expenditures were calculated by dividing the total expenditures by the number of UTI patients followed.

b. CMS 5% Sample

Medicare Parts A and B fee-for-service expenditures for UTI were estimated for the 12-month period following a UTI episode among the seven longitudinal Medicare cohorts from 2007-2015. As with the CDM expenditure analysis, we included all outpatient claims with a primary diagnostic code for a UTI and excluded medication expenditures. All dollar amounts were converted to 2017 dollar-equivalent values based on annual Gross Domestic Product Price Indexes from the US Bureau of Economic Analysis (https://apps.bea.gov/histdata/fileStructDisplay.cfm?HMI=7&DY=2018&DQ=Q4&DV=Third&dNRD=March-29-2019).[7]

As with the CDM analysis, Medicare expenditures were aggregated overall and by year of UTI, age, gender, race/ethnicity, geographic region, and Medicare dual eligibility status. In addition, expenditure estimates were derived separately for physician office services, outpatient hospital services, emergency room services, laboratory services, and all other services. Per person per year expenditures were calculated by dividing the total expenditures by the number of UTI patients followed.

3.0 Results

3.1 Annual Analyses

3.1.1 Study Population

a. CDM

The size of the overall annual cohorts in the CDM file ranged from 5,472,895 to 6,694,814 (Table C.1). Those aged 45-54 years were consistently the largest age group (2007-2016 average: 25.4%), followed by those aged 35-44 years (2007-2016 average: 23.9%). Females made up approximately half of the enrollees and nearly three-quarters of the population identified as non-Hispanic White. The largest proportion of participants resided in the Southern region of the United States (2007-2016 average: 44.3%). A large proportion of the CDM population did not report their income; however, among those who did report income, the majority had an annual household income of ≥$75,000.

b. CMS 5% Sample

The size of the overall annual cohorts in the CDM file steadily increased from 2007 (N=554,906) to 2016 (N=845,408; Table M.1). Those aged 65-69 and 70-74 years were consistently the largest age groups, and both made up a larger proportion of the annual cohorts over time. On average, females made up 62.2% of the beneficiaries and 85.9% were Non-Hispanic Whites. The largest proportion of participants resided in the Southern region of the

United States (2007-2016 average: 38.8%), and approximately three-quarters of beneficiaries did not qualify for Medicare dual eligibility.

3.1.2 Prevalence

a. CDM

The claims-based prevalence of UTI among CDM enrollees remained stable over the study period (range: 3.3% to 3.7%; Table C.2.1). The overall 2007-2016 prevalence of UTI was 3.5%, and was higher in women compared to men (6.3% vs. 0.7%). Age-related patterns in UTI prevalence differed across gender: UTI prevalence was higher among older men compared to younger men (peaking at 1.2% for 55-64 year olds) while UTI prevalence was highest in women aged 18-24 years (7.3%; Table C.2.2). Compared to other racial/ethnic groups, the highest UTI prevalence occurred in Hispanic women (6.9%) and the lowest among Asian men (0.5%). There was also a socioeconomic gradient in UTI prevalence, with higher prevalence among low-income groups compared to high-income groups (4.1% for <$40,000 vs. 3.3% among ≥$100,000). These between-group patterns in UTI prevalence did not appear to change over time.

b. CMS 5% Sample

The claims-based prevalence of UTI among Medicare beneficiaries was relatively stable across the ten-year study period, averaging 9.5% (Table M.2.1). The overall 2007-2016 prevalence was higher in women compared to men (12.6% vs. 4.4%), and was higher in older beneficiaries than younger beneficiaries (6.8% among those aged 65-69 years vs. 14.3% among those aged ≥85 years). Race/ethnicity-related and regional patterns in UTI prevalence differed somewhat across gender. UTI prevalence for women was highest among North American Native beneficiaries (17.0%) and for men was highest among Black beneficiaries (5.6%). However, White and Hispanic women had a higher UTI prevalence (13.0% and 13.5%, respectively) relative to Black women (9.4%), whereas White men had a lower UTI prevalence (4.3%) relative to Black and Hispanic men (5.6% and 5.5%, respectively; Table M.2.2). Regarding regional differences, UTI prevalence was highest in the South among both men (4.8%) and women (14.2%). Among men, this prevalence did not greatly differ from the other regions; however, among women the prevalence in the South was notably higher than in other regions. Finally, for both genders, those with Medicare dual eligibility had higher UTI prevalence than those without (12.8% vs. 8.5%). These between-group patterns in UTI prevalence did not shift dramatically over time.

3.1.3 Prevalence of Medication Use

a. CDM

Over the 10-year study period from 2007-2016, quinolones were the most commonly prescribed medication class (41.2%) for UTI among CDM enrollees, followed by urinary anti-infectives (22.0%), sulfonamides (17.4%), cephalosporins (4.7%), and penicillins (3.0%; Table C.3.1). Combination therapy of any kind, defined as filling two anti-infectives in the same day, made up 6.7% of overall medication use among UTI cases. Quinolone use decreased over time (46.8% in 2007 vs. 32.9% in 2016; Table C.3.1). Conversely, use of urinary anti-infectives increased over time (18.8% in 2007 vs. 27.7% in 2016). Cephalosporin use and combination therapy including azoles also increased over the study period (3.1% in 2007 to 7.4% in 2016 for cephalosporins; 3.6% in 2007 to 5.7% in 2016 for combination therapy including azoles). Quinolone use increased with increasing age (34.5% among those 18-24 vs. 46.4% among those 55-64), while urinary anti-infective use decreased with age (24.7% among those 18-24 vs. 19.7% among those 55-64; Table C.3.2). Prevalence of quinolone use was much higher for UTI cases among men (58.4%) than among women (39.5%; Table C.3.3). Conversely, urinary anti-infective prescriptions were more prevalent for UTI cases among women (23.7%) than among men (5.2%). Urinary anti-infective prevalence was lowest for UTI cases among Black enrollees (18.8%) and highest among Asian enrollees (25.0%), while sulfonamide use was highest among Black enrollees (18.7%) and lowest among Asian enrollees (15.0%; Table C.3.4). Black enrollees also had the highest prevalence of combination therapy including azoles (6.5% among Black enrollees compared to 4.5%, 4.2%, and 3.2% among White, Hispanic, and Asian enrollees, respectively). While

there were not large regional differences for most UTI-related medications among CDM enrollees, the Midwest did demonstrate the highest prevalence of sulfonamide use compared to the other regions (22.1% in the Midwest compared to 15.6%, 16.6%, and 15.0% in the Northeast, South, and West, respectively; Table C.3.5). Quinolone use increased slightly with increasing household income (Table C.3.6). Prevalence of urinary anti-infectives also appeared to increase with increasing income (19.8% among those with <$40,000 vs. 23.8% among those with ≥$100,000). Sulfonamide use, conversely, decreased with increasing income (18.9% among those with <$40,000 vs. 16.3% among those with ≥$100,000).

b. CMS 5% Sample

Over the 10-year study period from 2007-2016, quinolones were the most commonly prescribed medication class (41.7%) for UTI among Medicare beneficiaries, followed by urinary anti-infectives (18.3%), sulfonamides (15.4%), cephalosporins (10.7%), and penicillins (5.0%; Table M.3.1). Quinolone use decreased over time (47.3% in 2007 to 35.2% in 2016). Cephalosporin use more than doubled over the study period (6.3% in 2007 to 15.5% by 2016). Medication use was largely similar across age groups, although quinolone and sulfonamide use decreased slightly with increasing age (43.3% among those aged 65-69 years vs. 39.0% among those aged ≥85 years for quinolones; 16.9% among those aged 65-69 years vs. 14.0% among those aged ≥85 years for sulfonamides; Table M.3.2). Cephalosporin and penicillin prescriptions, on the other hand, increased in prevalence with increasing age (8.3% among those aged 65-69 years vs. 13.7% among those aged ≥85 years for cephalosporins; 4.1% among those aged 65-69 years vs. 5.9% among those aged ≥85 years for penicillins). Quinolone use was higher among men (47.5%) than women (40.5%; Table M.3.3). Conversely, urinary anti-infective prescriptions were more prevalent among women (19.9%) than men (10.2%). Compared to other racial/ethnic groups, quinolone prescriptions were lowest among North American Native beneficiaries (38.5%) and cephalosporin prscriptions highest among North American Native beneficiaries (15.1%; Table M.3.4). Use of urinary anti-infectives was lowest among Black beneficiaries (14.5%), and sulfonamide use was highest among Black beneficiaries (18.1%), compared to other groups. We did not observe notable regional differences for UTI-related medications among Medicare beneficiaries (Table M.3.5). Finally, compared to those without Medicare dual eligibility, those with Medicare dual eligibility had lower quinolone use (38.8% vs. 43.0%) and higher use of combination therapy not including azoles (4.0% vs. 2.0%; Table M.3.6).

3.1.4 Duration of Medication Use

a. CDM

Over the 10-year study period, the mean duration of medication use for UTI cases among CDM enrollees was 7.9 days (Table C.4). The mean medication duration did not appear to differ across study years; however, the prevalence of prescription fills in the 4-5 and 6-7 day categories did appear to increase over time while the prevalence of prescription fills in the 1, 2-3, and >7 categories slightly decreased. Mean medication duration was higher among older participants compared to younger (7.3 days for those aged 18-24 years vs. 8.6 days for those aged 55-64 years). Men had longer medication duration than women (10.1 vs. 7.6 days), and mean medication duration was shorter for those living in the Northeast compared to the other regions. Mean duration also differed by medication type, with tetracyclines and combination therapy not including an azole with the longest mean duration (12.4 and 15.4 days, respectively), and azoles alone and macrolides with the shortest duration (4.1 and 5.1 days, respectively). Mean duration did not appear to greatly differ by race or income, although it was shortest among Asian enrollees and those in the lowest income category.

b. CMS 5% Sample

Over the 10-year study period, the mean duration of medication use for UTI cases among the CMS 5% Sample was 9.4 days (Table M.4). Medication duration among the CMS 5% Sample demonstrated a similar time trend to that of the CDM population, whereby the mean number of days did not appear to

differ across study years but the prevalence of prescription fills in the 4-5 and 6-7 day categories slightly increased over time. Unlike CDM enrollees, medication duration among the CSM 5% Sample did not appear to greatly differ by age, although those in the oldest age category did have the lowest number of mean days (9.1). Also, while men did have longer mean duration than women (9.9 vs. 9.3 days), the gender difference was not as large as that observed in the CDM population. Mean medication duration was longest for White beneficiaries (9.5 days) and lowest for Black beneficiaries (8.5 days). As observed in the CDM population, mean medication duration was shorter for those living in the Northeast compared to the other regions. Those with Medicare dual eligibility also had shorter duration than those without dual eligibility (8.9 vs. 9.6 days). Mean duration also differed by medication type, with urinary anti-infectives, tetracyclines ,and combination therapy not including azoles with the longest mean duration (13.0, 11.9, and 17.8 days, respectively) and azoles alone and macrolides with the shortest duration (6.0 and 5.9 days, respectively).

3.1.5 Comorbid Conditions

a. CDM

Over the 10-year study period, the most common comorbidities among CDM enrollees with a UTI were diabetes mellitus (7.8%), chronic kidney disease (3.3%), ischemic heart disease (3.1%), BPH (12.2% of men), and prostate cancer (3.1% of men; Table C.5.1). All other comorbidities were found among <1% of CDM UTI patients. Prevalence of many comorbid conditions remained relatively stable across time. However, chronic kidney disease increased from 2.3% to 6.4% across the study period, and among men, BPH increased from 10.7% to 14.2% across the study period. The prevalence of diabetes mellitus and ischemic heart disease showed some variation from year to year, but did not vary greatly across the study period. Prevalence of nearly all comorbid conditions increased with increasing age (Table C.5.2). All comorbid conditions, with the exception of MS/TM, were more prevalent among men compared to women (Table C.5.3). Regarding race/ethnicity, Black UTI patients had a higher prevalence of chronic kidney disease (3.8%), diabetes mellitus (11.1%), HIV/AIDS (0.4%), ischemic heart disease (3.7%), prostate cancer (4.2%), and stroke/transient ischemic attack (0.9%), compared to other racial/ethnic groups (Table C.5.4). Asian UTI patients appeared to have lower comorbidity prevalence compared to other groups. Diabetes mellitus, chronic kidney disease, ischemic heart disease, and stroke/transient ischemic attack were most prevalent in the South, while BPH was most common in the Northeast (Table C.5.5). Prevalence of chronic kidney disease, diabetes mellitus, ischemic heart disease, and stroke/transient ischemic attack appeared to decrease with increasing income (Table C.5.6). Conversely, BPH, MS/TM, and prostate cancer slightly increased with increasing income.

b. CMS 5% Sample

Over the 10-year study period, the most common comorbidities among Medicare beneficiaries with a UTI were ischemic heart disease (34.7%), diabetes mellitus (34.4%), chronic kidney disease (23.2%), stroke/transient ischemic attack (8.9%), BPH (46.9% of men), and prostate cancer (16.7% of men; Table M.5.1). All other comorbidities were found among <1% of Medicare UTI patients. Across the study period, overall increases in prevalence were observed for BPH, chronic kidney disease, diabetes mellitus, MS/TM, prostate cancer, and spinal cord injury, and an overall decrease was observed for stroke/transient ischemic attack, although these trends were not all linear across time. Prevalence of chronic kidney disease, ischemic heart disease, prostate cancer, spinal cord injury, and stroke/transient ischemic attack increased with increasing age (Table M.5.2). Conversely, prevalence of HIV/AIDS and MS/TM decreased with increasing age. Diabetes mellitus and BPH increased with age in the younger Medicare UTI patients, followed by a subsequent decrease in prevalence. All comorbid conditions, with the exception of MS/TM, were more prevalent among men compared to women (Table M.5.3). Regarding race/ethnicity, Black UTI patients had a higher prevalence of chronic kidney disease (34.9%), HIV/AIDS (0.3%), prostate cancer (23.5% of men), and stroke/transient ischemic attack (14.3%), compared

to other racial/ethnic groups (Table M.5.4). Hispanic UTI patients had the highest prevalence of diabetes mellitus (55.1%) and ischemic heart disease (41.2%). BPH was most prevalent among Asian male beneficiaries (58.1%) and least prevalent among Black male beneficiaries (42.8%). Comorbidities did not differ greatly between regions, although BPH, diabetes mellitus, ischemic heart disease, MS/TM, prostate cancer, and stroke/transient ischemic attack were most prevalent in the Northeast (Table M.5.5). Prevalence of chronic kidney disease, diabetes mellitus, ischemic heart disease, and stroke/transient ischemic attack were notably higher among those with dual eligibility compared to those without (Table M.5.6). Conversely, BPH and prostate cancer were more common among those without dual eligibility.

3.2 Longitudinal Analyses

3.2.1 Study Population

a. CDM

Overall, 1,698,266 UTI cases were identified in the nine CDM longitudinal cohorts. Those aged 45-54 years were the largest age group, closely followed by those aged 35-44 years (Table C.6). Females made up over 90% of the UTI cases over the study period. Nearly three-quarters of the UTI cases were among non-Hispanic Whites and the largest proportion of UTI cases occurred in the Southern region of the United States. A large proportion of the CDM UTI cases occurred among those without a reported income; however, where income was reported, the majority of cases occurred among those with an annual household income of ≥$75,000.

b. CMS 5% Sample

Overall, 413,103 UTI cases were identified in the seven CMS 5% Sample longitudinal cohorts. Those aged ≥85 years were the largest age group, closely followed by those aged 70-74 years (Table M.6). Females made up 83.1% of the UTI cases over the study period. Nearly 90% of the UTI cases were among non-Hispanic Whites, and the largest proportion of UTI cases occurred in the Southern region of the United States. Approximately two-thirds of the UTI cases in this population occurred among those without Medicare dual eligibility.

3.2.2 12-month frequency of UTI

a. CDM

Over the study period, CDM enrollees with at least one UTI had an average of 1.4 UTI episodes within a 12-month period (Table C.6). The average 12-month frequency of UTI episodes did not appear to differ across study years, although in 2015 there was an increase in the proportion of UTI patients who experienced only the initial UTI episode (81.5% in 2015 vs. <74% in all other years). Average number of UTI episodes was highest among those aged 55-64 years (1.5 episodes) and lowest among those aged 25-34 years (1.3 episodes). Female UTI patients had a higher 12-month UTI frequency than males (1.4 vs. 1.2 episodes), and the prevalence of female UTI patients with 3+ UTIs was nearly two times the prevalence of male UTI patients with 3+ UTIs (8.6% vs. 4.4%). Average number of UTI episodes in a 12-month period did not greatly differ between racial/ethnic groups, although non-Hispanic White UTI patients had the highest prevalence of 3+ UTIs and Asians the lowest (8.7% vs. 6.2%). Average number of UTIs did not differ between regions, but the Northeast had the lowest prevalence of 3+ UTIs compared to the other regions (7.2% in the Northeast vs. >8% in all other regions). Average 12-month UTI frequency also did not greatly differ by income.

b. CMS 5% Sample

Over the study period, Medicare beneficiaries with at least one UTI had an average of 1.8 UTI episodes within a 12-month period (Table M.6). The average 12-month frequency of UTI episodes did not largely differ across study years. Average number of UTI episodes was highest among those aged 80 years and above (1.8 episodes) and lowest among those aged 65-69 years (1.6 episodes). Women had a slightly higher 12-month UTI frequency than men (1.9 vs. 1.7 episodes). Average number of UTIs also did not greatly differ between regions, but the Northeast had the lowest prevalence of 3+ UTIs compared to the other regions (17.0% in the Northeast vs. >19% in all other regions). Compared to other racial/ethnic groups, North American Native beneficiaries had the highest 12-month frequency of UTI episodes (1.9 episodes). Lastly, 12-month UTI frequency did not

greatly differ between those with and without dual eligibility (1.9 vs. 1.8 episodes).

3.2.3 Time to Recurrent UTI

a. CDM

The cumulative probability of a recurrent UTI among enrollees with an initial UTI was 27.2% over 12 months (Table C.7.1). This probability appeared to slightly increase from 2007 (26.2%) to 2015 (27.8%). The cumulative probability of recurrence was lowest among those aged 25-34 years (25.1%) and highest among those aged 55-64 years (30.5%). Women were also more likely to experience a recurrent UTI than men over the 12-month follow-up (28.4% vs. 15.9%). White enrollees had the highest probability of a recurrent UTI (27.9%), while Asian enrollees had the lowest probability (23.3%). Although there was not sizable geographic variation in recurrent UTI episodes, the Northeast did have a lower cumulative probability than the other geographic regions. We did not observe notable income differences for recurrent UTI.

Probability of a recurrent UTI over the 12-month follow-up period did differ greatly by type of anti-infectious agent (Table C.7.2). Those with combination therapy of any kind had a higher probability than those receiving any other single anti-infectious agent. Of those receiving combination therapy that *did not* include an azole, 83.0% had a recurrent UTI within 12 months. Of those receiving combination therapy that *did* include an azole, 33.4% had a recurrent UTI within 12 months. The cumulative probability of a recurrent UTI also increased with increasing medication duration, ranging from 21.3% for 1 day to ≥27% for 6 or more days.

Probability of a recurrent UTI over the 12-month follow-up period also appeared to differ by various comorbid conditions (Table C.7.3). For nearly every comorbid condition, with the exception of HIV/AIDS, those with the condition had a higher probability of a recurrent UTI during the 12-month follow-up period compared to those without. BPH, chronic kidney disease, MS/TM, prostate cancer, and spinal cord injury had the largest disparities. For each of these conditions, the 12-month cumulative probabilities of a recurrent UTI for those with the condition were ≥10 percentage points greater than for those without the condition. Conversely, those with HIV/AIDS had a 12-month cumulative probability of a recurrent UTI of 20.8% compared to 27.2% among those without HIV/AIDS.

b. CMS 5% Sample

The cumulative probability of a recurrent UTI among Medicare beneficiaries with an initial UTI was 42.2% over 12 months (Table M.7.1). This probability appeared to slightly increase from 2007 (40.4%) to 2015 (43.2%). The cumulative probability increased with increasing age, with the lowest 12-month probability among those aged 65-69 years (38.4%) and highest among those aged 85+ years (44.9%). Women were also more likely to experience a recurrent UTI than men over the 12-month follow-up (43.6% vs. 35.0%). North American Native beneficiaries had the highest probability of a recurrent UTI (45.8%), followed by White beneficiaries (42.9%), and Asian beneficiaries had the lowest (33.7%). As with the CDM sample, there was not sizable geographic variation in recurrent UTI, although the Northeast did have a lower cumulative probability than the other geographic regions (38.6% in the Northeast vs. >41% for all other regions). Those with Medicare dual eligibility had a higher cumulative probability of a recurrent UTI within 12 months compared to those without Medicare dual eligibility (44.6% vs. 41.0%).

Probability of a recurrent UTI over the 12-month follow-up period did differ substantially by type of anti-infectious agent (Table M.7.2), ranging from 32.7% for macrolides to 53.5% for other medication fills. The 12-month cumulative probability of a recurrent UTI was >40% for all other anti-infectious agent classes, with the exception of quinolones (39.2%). The cumulative probability of a recurrent UTI demonstrated a U-shaped pattern with medication duration, ranging from 43.2% for 1 day to 36.5% for 2-3 days and increasing to 44.1% for >7 days.

Probability of a recurrent UTI over the 12-month follow-up period also differed by various comorbid conditions (Table M.7.3). For every comorbid condition, those with the condition had a higher

probability of a recurrent UTI during the 12-month follow-up period compared to those without. BPH, chronic kidney disease, MS/TM, spinal cord injury, and stroke/transient ischemic attack had the largest disparities. For each of these conditions, the 12-month cumulative probabilities of a recurrent UTI for those with the condition were ≥10 percentage points greater than for those without the condition.

3.2.4 Insurer Expenditures for UTI

a. CDM

In the CDM population, $542,351,205 was spent in total by a private insurer from 2007-2015 on services with a primary UTI diagnosis among UTI patients who were followed for 12 months (Table C.8); this represents $319 per UTI patient per 12-month period. The majority of UTI expenditures occurred in the outpatient hospital setting (65.6%), followed by physician office services (21.4%). UTI-related services occurring in the emergency room, laboratory, or other service locations accounted for 1.3%, 5.0%, and 6.6% of the expenditures, respectively. Per person expenditures increased slightly over time, from $297 per 12-month period in 2007 to $369 in 2015. The proportion of expenditures occurring in the outpatient hospital setting increased over the study period, while the proportion for physician, emergency room, and laboratory services locations decreased over time. Per patient per year expenditures decreased with increasing age for the most part ($392 for those aged 18-24 years vs. $294 for those aged 45-54), with a slight increase for those aged 55-64 years ($323). A larger proportion of UTI expenditures among younger enrollees occurred in the outpatient hospital setting than of UTI expenditures among older enrollees, and the opposite pattern was observed for physician office services. Per patient per year UTI expenditures were higher among men than women ($398 vs. $311). For both men and women, the largest proportion of expenditures occurred in the outpatient hospital setting, although this proportion was slight higher among men than women (69.5% vs. 65.1%). Per person expenditures were highest among Hispanic enrollees ($408 per year) and lowest among Asian enrollees ($296 per year). For all racial/ethnic groups, the largest proportion of expenditures occurred in the outpatient hospital setting, although this proportion was highest among Black and Hispanic enrollees (71.7% and 69.4%, respectively) and lowest among Asian enrollees (58.9%). Overall and per person UTI expenditures were highest in the South compared to other regions. We observed some regional variation in place of service for expenditures, whereby a larger proportion of expenditures in the Northeast occurred in physician offices and the laboratory than in the other regions. Per person UTI expenditures decreased with increasing household income ($395 per year for the <$40,000 income group vs. $271 per year for the ≥$100,000 income group). For all income groups, expenditures were highest in the outpatient hospital setting, although the proportion occurring in this setting decreased with increasing income.

b. CMS 5% Sample

In the CMS 5% Sample, $113,536,149 was spent in total by Medicare from 2007-2015 on services with a primary UTI diagnosis among UTI patients who were followed for 12 months (Table M.8); this represents $275 per UTI patient per 12-month period. The largest proportion of UTI expenditures occurred in the physician office (25.2%). Laboratory, emergency room, and outpatient hospital services made up 18.8%, 17.7%, and 13.9% of Medicare expenditures, respectively. Other service locations made up 24.4% of expenditures. Per person expenditures increased over time, from $240 per 12-month period in 2007 to $296 in 2015. Over time, we observed a decrease in the proportion paid for physician and laboratory services and an increase in the proportion paid for outpatient hospital and emergency room services. Per patient per year expenditures increased with increasing age ($218 for those aged 65-69 years vs. $328 for those aged 85+ years). A larger proportion of UTI expenditures among younger beneficiaries occurred in physician offices and outpatient hospital settings than of UTI expenditures among older beneficiaries, and the opposite pattern was observed for emergency room and laboratory services. Per patient per year UTI expenditures were higher among men than women ($310 vs. $268). For men, the largest proportion of expenditures for a single place

of service occurred in the emergency room (20.1%), while for women, the largest proportion of expenditures occurred for physician office services (26.4%). Per person expenditures were highest among North American Native beneficiaries ($364 per year) and lowest among Asian beneficiaries ($242 per year). Among White, Asian, and Hispanic beneficiaries, the largest proportion of expenditures in a single place of service occurred in the physician office setting; while among North American Native beneficiaries, the proportion of expenditures was higher for outpatient hospital services, and among Black beneficiaries for emergency room services. Although overall UTI expenditures were highest in the South compared to other regions, per person expenditures were highest in the Northeast. Further, the proportion of expenditures occurring in the physician office was lowest in the Midwest and highest in the South, and the opposite pattern was observed for outpatient services. Per person UTI expenditures were higher among those with Medicare dual eligibility than among those without dual eligibility ($332 vs. $247). Among those with dual eligibility, the largest proportion of expenditures for a single place of service occurred in the emergency room; while among those without dual eligibility, physician office services made up the largest proportion of expenditures.

4.0 Discussion

UTI is one of the most common outpatient infections. It has been over a decade since the UDA project characterized the burden of UTI in the United States,[1, 2] and in that time both medical care as well as the United States population have changed.

The present UDA project now has access to two large administrative claims databases—including the CMS 5% Sample and the CDM—that when used in concert may offer one of the most comprehensive sources available to improve our understanding of the epidemiology of UTI in the United States among both working-age individuals and those aged 65 years and older. Although not without limitations, administrative claims capture healthcare utilization in the inpatient, outpatient, and emergency setting, allowing us to characterize healthcare provided at a full spectrum of health care delivery sites. They also permit the assessment of prescription drug treatments and expenditures. Furthermore, these datasets provide the ability to evaluate subjects in a longitudinal fashion, adding considerable strength to our understanding of recurrence and the effectiveness of therapies for patients with UTI.

Our first goal in undertaking an assessment of the epidemiology of UTI was to define the prevalence of the condition. Although both genders are affected by UTI, women have historically been affected to a greater extent than men. Using a claims-based definition of prevalence, we documented a striking difference in the prevalence of UTI by gender. A higher UTI prevalence among women than among men has been reported previously; however, our data suggest that the difference in this younger, working-age cohort is particularly stark, with 0.7% of men affected as compared to 6.3% of women. In addition, among this younger cohort of women, UTI prevalence is greatest in the 18-24 year age group (7.3%). The reason for the high prevalence of UTI in this cohort is not clear; it may be due to sexual activity, certain spermicidal contraceptives, or even increased testing due to healthcare utilization in peri-pregnancy settings. These data describing a higher UTI prevalence in younger women are consistent with those reported elsewhere. In the prior iteration of the UDA project, this trend was observed in national survey data; our present analysis augments these findings by identifying a similar pattern within administrative claims data.[8] UTI was also more common among low-income groups. Although this phenomenon has been described in countries outside of the United States,[9] our findings identify a similar association in a United States population.

Among the older Medicare population, the prevalence of UTI was also higher in women than men. In addition, as age increased in both the male and female Medicare cohorts, the prevalence of UTI increased as well. This is consistent with what was reported in the 2005 UDA analysis of UTI.[1, 2] Interestingly, UTI prevalence was greatest among the North American Native population. This finding has

not been previously described; it may be due to socioeconomic conditions associated with this group, but further investigation is warranted to better define this or other potential causes. It should also be noted that those with Medicare dual eligibility, an indicator of lower socioeconomic position, also had higher UTI prevalence than those without dual eligibility.

UTIs are generally treated with antibiotic medications. As both CDM and Medicare data capture pharmaceutical prescriptions, we aimed to better characterize what agents are most commonly used in the treatment of UTI. In the CDM dataset, quinolones were the most commonly prescribed class of agents, accounting for 41.2% of all agents used. Interestingly, over this time period, quinolone resistance has emerged as a significant public health concern. The increasing resistance may be due, in part, to prior exposure of patients to quinolones, suggesting there may be an overutilization of this agent.[10] As a consequence of these emerging quinolone resistance patterns, guidelines now suggest that this agent should be used to treat patients with UTI only when local antibiograms suggest a less than 10% resistance prevalence.[11] These and similar recommendations from other groups are likely responsible for the decline in quinolone utilization that was observed over the time period of our analysis; although in 2007 quinolones were used in 46.8% of cases, by 2016 they were used in 32.9% of cases.

In the younger CDM population, quinolones were more commonly prescribed among men than women. This likely rests on the fact that quinolones are a commonly utilized agent for the treatment of prostatitis, as they can achieve high penetration of and concentrations within prostate tissue.[12] Of note, quinolone use increased with household income; this may be explained by the fact that during many years of this study, agents such as Ciprofloxacin and Levofloxacin were not available in a generic form, so pharmaceutical costs may have been greater. Conversely, sulfonamides, which were available in generic form throughout the study period, were more commonly prescribed to individuals with lower income status.

In the Medicare population, quinolones were also the most commonly prescribed agent for UTI. Similar to what was observed in the younger CDM cohort, quinolone utilization declined over the time period studied. As quinolone utilization declined, though, cephalosporin utilization increased. It has been reported that for patients who do not have risk factors for complicated UTI, cephalosporin agents may be used as an empiric therapy.[13]

It is important to quantify not only which agents are most commonly used in the treatment of patients with UTI, but also the duration of therapy. In the CDM dataset, the mean duration of medication use for UTI was 7.9 days, although the large majority (>70%) of UTI patients had a medication duration of ≤7 days. Guidelines suggest that treatment for acute, uncomplicated UTI, the type of UTI studied in our present analysis, may be safely prescribed for a duration as short as 3 days or as long as 7 days.[11] The duration of therapy depends on the agent, with quinolones being used as short as 3 days and beta lactam agents, such as cephalosporins, being used as long as 7 days. Therefore, in the CDM population, we may be observing an overprescribing, or at least an overly long prescribing duration, of antibiotic agents for the treatment of UTI episodes.

In the CMS 5% Sample, the duration of therapy was even longer; the average duration was reported as 9.4 days. There was a slight increase in the utilization of shorter prescribing durations as the study years progressed, but nonetheless the average value remained notably higher than what is recommended by guidelines. Although the exact reasons for extended therapy duration in this cohort are unknown, it may be that clinicians perceive this population as frail because of their advanced age, resulting in a bias towards extending the duration of therapy. However, the fact that medication duration did not increase with increasing age in the Medicare population does not necessarily support this conjecture, so it would be worthwhile for future studies to better define optimal duration of therapy and align clinical practice towards this duration.

UTI is associated with certain comorbid conditions that can increase an individual's susceptibility to this disease. We identified several comorbidities in the CDM population that were associated with UTI. Diabetes mellitus, which is known to increase susceptibility to systemic infection, was present in 7.8% of those with UTI. Chronic kidney disease, too, can have a deleterious effect on the immune system and was identified among 3.3% of persons with UTI; this prevalence increased over the study period. Urologic conditions which affect bladder function, such as benign prostatic hyperplasia and prostate cancer, were also found to be prevalent among men with UTI. Over the time period studied, benign prostatic hyperplasia increased among individuals with UTI. The mechanism of this increase is uncertain.

Similar associations were noted in the CMS 5% Sample, but the magnitude of the associations was even more notable. Over one-third (34.4%) of individuals with UTI had diabetes mellitus. Chronic kidney disease was present in nearly one-quarter (23.2%) of the population. Among men, benign prostatic hyperplasia was present in nearly half (46.9%) of individuals with UTI, and prostate cancer was present in 16.7%. The prevalence of these disorders increased over the period studied, and the prevalence also increased with advancing age of the cohort. These increases may reflect the fact that as individuals age they become increasingly susceptible to comorbid conditions, and the magnitude of risk that these comorbidities hold for UTI can become increasingly clinically meaningful.

One of the great benefits of the CDM and CMS 5% Sample is the ability to perform longitudinal analyses and thereby better understand disease evolution over time. To inform UTI treatment, it is important to understand the frequency of UTI as it occurs in these populations, as well as the time to recurrence from one UTI to the next. These issues, which are of significant importance to patient-centered care, have not yet been well defined in a longitudinal fashion. Therefore, we undertook analyses to address these questions.

Among UTI patients in the CDM cohort, the average number of UTI episodes within a 12-month period was 1.4. Although the frequency was greater among women than men, the magnitude of difference was not large (1.4 vs. 1.2). However, the prevalence of women with three or more UTIs was nearly two times that of men. As might be expected in the CMS 5% cohort, the frequency of UTI was greater than what was encountered in the younger CDM population, with an average of 1.8 episodes in a 12-month period. Again, although women experienced greater UTI frequency than men, the magnitude of difference was similarly modest (1.9 vs 1.7). There are robust data showing that UTIs are associated with pain, time lost from work, and diminished quality of life.[14] Thus, our findings regarding UTI recurrence are novel and provide context to how UTI can affect patients' overall well-being.

The time to recurrent UTI is also a meaningful metric to patients who suffer from this condition. In the CDM cohort, the cumulative probability of a recurrent UTI within 12 months was 27.2%; women were more likely than men to have a recurrent UTI episode within 12 months (28.4% vs. 15.9%). Additionally, if combination therapy was used as treatment, recurrence was greater than if a single agent was used. This may reflect that combination therapies are used in patients who are believe to be uniquely at-risk, or who may harbor a particularly virulent organism. Further, those with most comorbid conditions also appeared to be at increased risk of UTI recurrence over a 12-month period, suggesting that these populations may need to be more closely monitored for recurrent infection.

Among the older CMS 5% Sample, the 12-month cumulative probability of a recurrent UTI following an index UTI was 42.2%. We observed similar recurrence patterns among Medicare beneficiaries as among the CDM enrollees. For example, as with the CDM data, women were more likely to recur than men, but the cumulative probabilities for both were high: 43.6% vs. 35.0%. These data are novel, and illustrate the impact that UTI can have on an individual's health status. With recurrence prevalence this high, individuals can be exposed to repeated courses of antibiotic therapy,

which can increase risk for resistance, as well as antibiotic complications such as infectious diarrhea, which are known to hold significant morbidity.

Given the aforementioned prevalence and recurrence of UTI in the younger and older American population, it is important to define the economic burden on society of this condition. In the CDM population, over $542 million was spent by a private insurer on UTI care over the study period, representing $319 per UTI patient per 12-month period. In the CMS 5% Sample, over $113 million was spent on UTI services over the study period, representing $275 per UTI patient per 12-month period.

5.0 Conclusions

UTI remains a common medical condition that affects both younger and older individuals. Our findings are consistent with prior analyses showing that women are affected by UTI more commonly than men. The treatment of UTI evolved over the time period studied, shifting from a primarily quinolone-based treatment paradigm to a more diverse pharmaceutical armamentarium that increasingly relied on cephalosporin agents. This evolution was likely driven by resistance patterns that particularly affect quinolone agents. Nevertheless, regardless of the antibacterial agent used, duration of treatment appeared to be longer than what guidelines typically suggest. This may represent an opportunity for practice improvement.

The present analysis also informs the community as to how UTI may affect health status and quality of life in a longitudinal fashion. Individuals who develop UTI appear to be a unique population and may have a significant risk for frequent and recurrent UTI. In particular, UTI patients with comorbid conditions are at increased risk for future UTI episodes. This information will inform future studies to define what host-specific factors may predispose to UTI and how they can be modified.

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Appendix A. Diagnostic codes to identify UTI claims

Coding system	Code	Description
ICD-9-CM diagnosis codes	599.0	Urinary tract infection, site not specified
	595.9	Cystitis, unspecified
	595.0	Acute cystitis
	595.2	Other chronic cystitis
	590.10	Acute pyelonephritis without lesion of renal medullary necrosis
	595.89	Other specified types of cystitis
	590.9	Infection of kidney, unspecified
	595.3	Trigonitis
	590.00	Chronic pyelonephritis without lesion of renal medullary necrosis
ICD-10-CM diagnosis codes	N39.0	Urinary tract infection, site not specified
	N30.90	Cystitis, unspecified without hematuria
	N30.91	Cystitis, unspecified with hematuria
	N30.00	Acute cystitis without hematuria
	N30.01	Acute cystitis with hematuria
	N30.20	Other chronic cystitis without hematuria
	N30.21	Other chronic cystitis with hematuria
	N10	Acute pyelonephritis
	N30.80	Other cystitis without hematuria
	N30.81	Other cystitis with hematuria
	N15.9	Renal tubulo-interstitial disease, unspecified
	N30.30	Trigonitis without hematuria
	N30.31	Trigonitis with hematuria
	N11.0	Nonobstructive reflux-associated chronic pyelonephritis

Source of ICD-10 conversions: 2018 ICD-10-PCS CMS General Equivalence Mappings

Appendix B. American Hospital Formulary Service (AFHS) classes of UTI-related anti-infectious agents

AHFS classes	AHFS class description
081202	AMINOGLYCOSIDES
081204	ANTIFUNGAL ANTIBIOTICS
081206	CEPHALOSPORINS
081207	MISCELLANEOUS B-LACTAM ANTIBIOTICS
081212	MACROLIDES
081216	PENICILLINS
081218	QUINOLONES
081220	SULFONAMIDES (SYSTEMIC)
081224	TETRACYCLINES
081228	MISCELLANEOUS ANTIBIOTICS
081408	AZOLES
081492	MISCELLANEOUS ANTIFUNGALS
082200	QUINOLONES
082400	SULFONAMIDES
083600	URINARY ANTI-INFECTIVES

Appendix C. US States by Census Bureau Regions

Region	States
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, Pennsylvania
Midwest	Illinois, Indiana, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
South	Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, Texas
West	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming, Alaska, California, Hawaii, Oregon, Washington

Table C.1: Descriptive characteristics of annual cohorts of adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year, 2007 - 2016[a]

Demographic Characteristics		Average (2007-2016)[b]	2007		2008		2009		2010		2011	
		%	N	%	N	%	N	%	N	%	N	%
Overall		100.0	6,694,814	100.0	6,563,420	100.0	6,373,694	100.0	5,949,653	100.0	6,052,032	100.0
Age (years)[c]	**18 to 24**	12.6	738,227	11.0	737,789	11.2	716,629	11.2	668,020	11.2	787,125	13.0
	25 to 34	19.8	1,322,676	19.8	1,323,083	20.2	1,294,713	20.3	1,181,847	19.9	1,166,124	19.3
	35 to 44	23.9	1,754,805	26.2	1,668,261	25.4	1,592,013	25.0	1,462,752	24.6	1,427,823	23.6
	45 to 54	25.4	1,776,701	26.5	1,724,417	26.3	1,668,229	26.2	1,564,875	26.3	1,554,804	25.7
	55 to 64	18.2	1,102,405	16.5	1,109,870	16.9	1,102,110	17.3	1,072,159	18.0	1,116,156	18.4
Gender	**Male**	49.3	3,246,782	48.5	3,196,851	48.7	3,101,896	48.7	2,900,298	48.7	2,968,295	49.0
	Female	50.7	3,448,032	51.5	3,366,569	51.3	3,271,798	51.3	3,049,355	51.3	3,083,737	51.0
Race/Ethnicity	**White**	72.7	4,146,944	73.4	4,074,206	72.9	3,943,519	72.8	3,663,139	73.1	3,656,113	73.0
	Black	9.9	547,336	9.7	564,686	10.1	576,083	10.6	531,064	10.6	527,388	10.5
	Hispanic	11.9	680,977	12.0	668,984	12.0	621,094	11.5	554,754	11.1	566,200	11.3
	Asian	5.5	276,094	4.9	283,654	5.1	278,214	5.1	259,028	5.2	255,350	5.1
	Missing	-	1,043,463	-	971,890	-	954,784	-	941,668	-	1,046,981	-
Region	**Northeast**	9.6	617,277	9.2	627,153	9.6	623,874	9.8	586,504	9.9	588,746	9.7
	Midwest	25.3	1,553,066	23.2	1,543,708	23.5	1,484,741	23.3	1,432,684	24.1	1,498,788	24.8
	South	44.3	2,984,361	44.6	2,953,738	45.0	2,980,245	46.8	2,783,756	46.8	2,803,974	46.3
	West	20.7	1,540,110	23.0	1,438,821	21.9	1,284,834	20.2	1,146,709	19.3	1,160,524	19.2
Household income (US dollars)	**<$40,000**	13.8	502,807	12.5	650,296	13.1	697,903	13.3	651,460	13.2	676,638	13.5
	$40,000 to $49,999	6.3	249,298	6.2	321,953	6.5	342,445	6.5	315,387	6.4	320,000	6.4
	$50,000 to $59,999	6.9	279,784	7.0	356,195	7.2	376,893	7.2	348,110	7.1	352,056	7.0
	$60,000 to $74,999	10.5	431,002	10.7	541,642	10.9	574,219	10.9	532,976	10.8	537,764	10.7
	$75,000 to $99,999	16.9	690,210	17.2	851,706	17.2	905,734	17.2	849,739	17.2	864,546	17.2
	≥$100,000	45.5	1,859,321	46.3	2,230,329	45.0	2,362,985	44.9	2,238,904	45.4	2,276,273	45.3
	Missing	-	2,682,392	-	1,611,299	-	1,113,515	-	1,013,077	-	1,024,755	-

[a] Among enrollees with full enrollment in a commercial health plan
[b] Averaged across the 10-year study period, weighted by annual cohort population
[c] Age and region taken on January 1 of each year
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.1 (continued): Descriptive characteristics of annual cohorts of adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year, 2007 - 2016[a]

Demographic Characteristics		Average (2007-2016)[b]	2012		2013		2014		2015		2016	
		%	N	%	N	%	N	%	N	%	N	%
Overall		100.0	6,027,126	100.0	5,991,179	100.0	5,472,895	100.0	5,795,026	100.0	6,203,955	100.0
Age (years)[c]	**18 to 24**	12.6	814,692	13.5	830,099	13.9	769,756	14.1	807,043	13.9	843,729	13.6
	25 to 34	19.8	1,165,182	19.3	1,152,831	19.2	1,096,994	20.0	1,168,958	20.2	1,255,258	20.2
	35 to 44	23.9	1,401,968	23.3	1,375,594	23.0	1,250,157	22.8	1,310,607	22.6	1,376,296	22.2
	45 to 54	25.4	1,522,888	25.3	1,491,029	24.9	1,337,802	24.4	1,401,729	24.2	1,487,247	24.0
	55 to 64	18.2	1,122,396	18.6	1,141,626	19.1	1,018,186	18.6	1,106,689	19.1	1,241,425	20.0
Gender	**Male**	49.3	2,978,235	49.4	2,967,698	49.5	2,750,072	50.2	2,914,353	50.3	3,120,124	50.3
	Female	50.7	3,048,891	50.6	3,023,481	50.5	2,722,823	49.8	2,880,673	49.7	3,083,831	49.7
Race/Ethnicity	**White**	72.7	3,553,347	73.2	3,369,156	72.9	2,951,675	72.4	3,096,270	71.5	3,284,892	71.0
	Black	9.9	495,419	10.2	466,512	10.1	362,070	8.9	394,865	9.1	426,599	9.2
	Hispanic	11.9	539,998	11.1	522,082	11.3	514,375	12.6	569,251	13.1	623,591	13.5
	Asian	5.5	264,630	5.5	261,132	5.7	246,799	6.1	269,440	6.2	294,380	6.4
	Missing	-	1,173,732	-	1,372,297	-	1,397,976	-	1,465,200	-	1,574,493	-
Region	**Northeast**	9.6	593,158	9.8	577,655	9.6	517,692	9.5	567,552	9.8	587,669	9.5
	Midwest	25.3	1,570,412	26.1	1,594,793	26.6	1,538,346	28.1	1,588,989	27.4	1,665,460	26.8
	South	44.3	2,676,003	44.4	2,598,572	43.4	2,235,609	40.8	2,429,184	41.9	2,656,511	42.8
	West	20.7	1,187,553	19.7	1,220,159	20.4	1,181,248	21.6	1,209,301	20.9	1,294,315	20.9
Household income (US dollars)	**<$40,000**	13.8	677,357	13.6	680,675	14.0	625,662	14.4	675,456	14.9	735,801	15.4
	$40,000 to $49,999	6.3	312,358	6.3	301,310	6.2	265,172	6.1	283,882	6.2	306,591	6.4
	$50,000 to $59,999	6.9	341,145	6.9	325,615	6.7	283,821	6.5	301,012	6.6	323,818	6.8
	$60,000 to $74,999	10.5	523,220	10.5	498,737	10.3	431,092	9.9	454,565	10.0	482,559	10.1
	$75,000 to $99,999	16.9	849,934	17.1	820,140	16.9	717,742	16.5	749,948	16.5	785,373	16.4
	≥$100,000	45.5	2,273,369	45.7	2,236,079	46.0	2,015,368	46.4	2,083,505	45.8	2,150,538	44.9
	Missing	-	1,049,743	-	1,128,623	-	1,134,038	-	1,246,658	-	1,419,275	-

[a] Among enrollees with full enrollment in a commercial health plan
[b] Averaged across the 10-year study period, weighted by annual cohort population
[c] Age and region taken on January 1 of each year
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.2.1: Prevalence (%) of urinary tract infections (UTI)[a] among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year, 2007 - 2016[b]

Demographic Characteristics		Average (2007-2016)[c]	2007			2008			2009		
		%	Total N	N with UTI	%	Total N	N with UTI	%	Total N	N with UTI	%
Overall		3.5	6,694,814	220,023	3.3	6,563,420	229,340	3.5	6,373,694	233,123	3.7
Age (years)[d]	**18 to 24**	3.8	738,227	26,410	3.6	737,789	27,987	3.8	716,629	28,039	3.9
	25 to 34	3.6	1,322,676	48,050	3.6	1,323,083	49,967	3.8	1,294,713	50,433	3.9
	35 to 44	3.4	1,754,805	54,707	3.1	1,668,261	55,456	3.3	1,592,013	56,204	3.5
	45 to 54	3.3	1,776,701	53,127	3.0	1,724,417	55,213	3.2	1,668,229	55,986	3.4
	55 to 64	3.8	1,102,405	37,729	3.4	1,109,870	40,717	3.7	1,102,110	42,461	3.9
Gender	**Male**	0.7	3,246,782	23,822	0.7	3,196,851	23,857	0.7	3,101,896	23,862	0.8
	Female	6.3	3,448,032	196,201	5.7	3,366,569	205,483	6.1	3,271,798	209,261	6.4
Race/Ethnicity	**White**	3.5	4,146,944	138,488	3.3	4,074,206	142,406	3.5	3,943,519	142,852	3.6
	Black	3.8	547,336	19,535	3.6	564,686	21,850	3.9	576,083	23,152	4.0
	Hispanic	3.8	680,977	22,293	3.3	668,984	24,511	3.7	621,094	25,138	4.0
	Asian	2.4	276,094	6,222	2.3	283,654	7,019	2.5	278,214	7,302	2.6
	Missing	3.6	1,043,463	33,485	3.2	971,890	33,554	3.5	954,784	34,679	3.6
Region	**Northeast**	3.2	617,277	19,884	3.2	627,153	20,380	3.2	623,874	20,242	3.2
	Midwest	3.1	1,553,066	48,922	3.2	1,543,708	48,997	3.2	1,484,741	47,024	3.2
	South	3.9	2,984,361	115,096	3.9	2,953,738	117,782	4.0	2,980,245	121,448	4.1
	West	3.3	1,540,110	36,121	2.3	1,438,821	42,181	2.9	1,284,834	44,409	3.5
Household income (US dollars)	**<$40,000**	4.1	502,807	19,614	3.9	650,296	27,783	4.3	697,903	30,901	4.4
	$40,000 to $49,999	3.8	249,298	8,983	3.6	321,953	12,478	3.9	342,445	13,860	4.0
	$50,000 to $59,999	3.7	279,784	9,881	3.5	356,195	13,320	3.7	376,893	14,728	3.9
	$60,000 to $74,999	3.6	431,002	14,843	3.4	541,642	19,702	3.6	574,219	21,754	3.8
	$75,000 to $99,999	3.5	690,210	22,950	3.3	851,706	29,688	3.5	905,734	33,046	3.6
	≥$100,000	3.3	1,859,321	58,230	3.1	2,230,329	71,640	3.2	2,362,985	78,452	3.3
	Missing	3.4	2,682,392	85,522	3.2	1,611,299	54,729	3.4	1,113,515	40,382	3.6

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Among enrollees with full enrollment in a commercial health plan.
[c] Averaged across the 10-year study period, weighted by annual cohort population.
[d] Age and region taken on January 1 of each year.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.2.1 (continued): Prevalence (%) of urinary tract infections (UTI)[a] among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year, 2007 - 2016[b]

Demographic Characteristics		Average (2007-2016)[c]	2010			2011			2012		
		%	Total N	N with UTI	%	Total N	N with UTI	%	Total N	N with UTI	%
Overall		3.5	5,949,653	220,407	3.7	6,052,032	223,669	3.7	6,027,126	222,149	3.7
Age (years)[d]	**18 to 24**	3.8	668,020	26,203	3.9	787,125	30,849	3.9	814,692	32,524	4.0
	25 to 34	3.6	1,181,847	45,966	3.9	1,166,124	44,161	3.8	1,165,182	42,989	3.7
	35 to 44	3.4	1,462,752	51,935	3.6	1,427,823	50,767	3.6	1,401,968	49,822	3.6
	45 to 54	3.3	1,564,875	53,879	3.4	1,554,804	53,616	3.4	1,522,888	52,840	3.5
	55 to 64	3.8	1,072,159	42,424	4.0	1,116,156	44,276	4.0	1,122,396	43,974	3.9
Gender	**Male**	0.7	2,900,298	22,208	0.8	2,968,295	21,887	0.7	2,978,235	21,054	0.7
	Female	6.3	3,049,355	198,199	6.5	3,083,737	201,782	6.5	3,048,891	201,095	6.6
Race/Ethnicity	**White**	3.5	3,663,139	133,544	3.6	3,656,113	133,178	3.6	3,553,347	129,586	3.6
	Black	3.8	531,064	21,697	4.1	527,388	21,318	4.0	495,419	19,654	4.0
	Hispanic	3.8	554,754	22,938	4.1	566,200	23,118	4.1	539,998	21,807	4.0
	Asian	2.4	259,028	6,873	2.7	255,350	6,749	2.6	264,630	6,762	2.6
	Missing	3.6	941,668	35,355	3.8	1,046,981	39,306	3.8	1,173,732	44,340	3.8
Region	**Northeast**	3.2	586,504	18,847	3.2	588,746	19,382	3.3	593,158	19,822	3.3
	Midwest	3.1	1,432,684	45,608	3.2	1,498,788	48,300	3.2	1,570,412	50,377	3.2
	South	3.9	2,783,756	112,682	4.0	2,803,974	113,078	4.0	2,676,003	108,602	4.1
	West	3.3	1,146,709	43,270	3.8	1,160,524	42,909	3.7	1,187,553	43,348	3.7
Household income (US dollars)	**<$40,000**	4.1	651,460	29,360	4.5	676,638	29,651	4.4	677,357	29,134	4.3
	$40,000 to $49,999	3.8	315,387	12,778	4.1	320,000	12,749	4.0	312,358	12,517	4.0
	$50,000 to $59,999	3.7	348,110	13,698	3.9	352,056	13,648	3.9	341,145	13,150	3.9
	$60,000 to $74,999	3.6	532,976	20,123	3.8	537,764	20,124	3.7	523,220	19,536	3.7
	$75,000 to $99,999	3.5	849,739	31,479	3.7	864,546	31,758	3.7	849,934	31,335	3.7
	≥$100,000	3.3	2,238,904	74,835	3.3	2,276,273	77,391	3.4	2,273,369	77,783	3.4
	Missing	3.4	1,013,077	38,134	3.8	1,024,755	38,348	3.7	1,049,743	38,694	3.7

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Among enrollees with full enrollment in a commercial health plan.
[c] Averaged across the 10-year study period, weighted by annual cohort population.
[d] Age and region taken on January 1 of each year.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.2.1 (continued): Prevalence (%) of urinary tract infections (UTI)[a] among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year, 2007 - 2016[b]

Demographic Characteristics		Average (2007-2016)[c]	2013			2014			2015		
		%	Total N	N with UTI	%	Total N	N with UTI	%	Total N	N with UTI	%
Overall		3.5	5,991,179	211,378	3.5	5,472,895	189,492	3.5	5,795,026	195,652	3.4
Age (years)[d]	**18 to 24**	3.8	830,099	31,842	3.8	769,756	29,903	3.9	807,043	30,569	3.8
	25 to 34	3.6	1,152,831	40,316	3.5	1,096,994	36,583	3.3	1,168,958	36,859	3.2
	35 to 44	3.4	1,375,594	46,088	3.4	1,250,157	40,834	3.3	1,310,607	41,570	3.2
	45 to 54	3.3	1,491,029	49,847	3.3	1,337,802	44,606	3.3	1,401,729	46,088	3.3
	55 to 64	3.8	1,141,626	43,285	3.8	1,018,186	37,566	3.7	1,106,689	40,566	3.7
Gender	**Male**	0.7	2,967,698	19,837	0.7	2,750,072	17,750	0.6	2,914,353	18,044	0.6
	Female	6.3	3,023,481	191,541	6.3	2,722,823	171,742	6.3	2,880,673	177,608	6.2
Race/Ethnicity	**White**	3.5	3,369,156	117,849	3.5	2,951,675	101,017	3.4	3,096,270	103,137	3.3
	Black	3.8	466,512	17,348	3.7	362,070	12,641	3.5	394,865	13,805	3.5
	Hispanic	3.8	522,082	20,089	3.8	514,375	19,773	3.8	569,251	21,534	3.8
	Asian	2.4	261,132	6,357	2.4	246,799	5,762	2.3	269,440	6,123	2.3
	Missing	3.6	1,372,297	49,735	3.6	1,397,976	50,299	3.6	1,465,200	51,053	3.5
Region	**Northeast**	3.2	577,655	18,729	3.2	517,692	16,124	3.1	567,552	16,823	3.0
	Midwest	3.1	1,594,793	49,819	3.1	1,538,346	46,191	3.0	1,588,989	45,984	2.9
	South	3.9	2,598,572	101,035	3.9	2,235,609	86,676	3.9	2,429,184	92,963	3.8
	West	3.3	1,220,159	41,795	3.4	1,181,248	40,501	3.4	1,209,301	39,882	3.3
Household income (US dollars)	**<$40,000**	4.1	680,675	27,443	4.0	625,662	23,975	3.8	675,456	25,285	3.7
	$40,000 to $49,999	3.8	301,310	11,197	3.7	265,172	9,438	3.6	283,882	9,908	3.5
	$50,000 to $59,999	3.7	325,615	11,719	3.6	283,821	10,012	3.5	301,012	10,499	3.5
	$60,000 to $74,999	3.6	498,737	17,843	3.6	431,092	15,084	3.5	454,565	15,398	3.4
	$75,000 to $99,999	3.5	820,140	28,878	3.5	717,742	24,925	3.5	749,948	25,564	3.4
	≥$100,000	3.3	2,236,079	74,689	3.3	2,015,368	66,878	3.3	2,083,505	67,527	3.2
	Missing	3.4	1,128,623	39,609	3.5	1,134,038	39,180	3.5	1,246,658	41,471	3.3

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Among enrollees with full enrollment in a commercial health plan.
[c] Averaged across the 10-year study period, weighted by annual cohort population.
[d] Age and region taken on January 1 of each year.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.2.1 (continued): Prevalence (%) of urinary tract infections (UTI)[a] among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year, 2007 - 2016[b]

Demographic Characteristics		Average (2007-2016)[c]	2016		
		%	Total N	N with UTI	%
Overall		3.5	6,203,955	206,638	3.3
Age (years)[d]	**18 to 24**	3.8	843,729	30,826	3.7
	25 to 34	3.6	1,255,258	37,565	3.0
	35 to 44	3.4	1,376,296	42,814	3.1
	45 to 54	3.3	1,487,247	49,357	3.3
	55 to 64	3.8	1,241,425	46,076	3.7
Gender	**Male**	0.7	3,120,124	19,014	0.6
	Female	6.3	3,083,831	187,624	6.1
Race/Ethnicity	**White**	3.5	3,284,892	108,752	3.3
	Black	3.8	426,599	14,907	3.5
	Hispanic	3.8	623,591	23,058	3.7
	Asian	2.4	294,380	6,535	2.2
	Missing	3.6	1,574,493	53,386	3.4
Region	**Northeast**	3.2	587,669	17,275	2.9
	Midwest	3.1	1,665,460	48,330	2.9
	South	3.9	2,656,511	100,640	3.8
	West	3.3	1,294,315	40,393	3.1
Household income (US dollars)	**<$40,000**	4.1	735,801	27,969	3.8
	$40,000 to $49,999	3.8	306,591	10,529	3.4
	$50,000 to $59,999	3.7	323,818	10,982	3.4
	$60,000 to $74,999	3.6	482,559	16,278	3.4
	$75,000 to $99,999	3.5	785,373	26,112	3.3
	≥$100,000	3.3	2,150,538	68,707	3.2
	Missing	3.4	1,419,275	46,061	3.2

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Among enrollees with full enrollment in a commercial health plan.
[c] Averaged across the 10-year study period, weighted by annual cohort population.
[d] Age and region taken on January 1 of each year.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.2.2: Prevalence (%) of urinary tract infections (UTI)[a] among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year and gender, 2007 - 2016[b]

Demographic Characteristics		Average (2007-2016)[c]			Year								
					2007			2008			2009		
		Overall (%)	Gender		Overall (%)	Gender		Overall (%)	Gender		Overall (%)	Gender	
			Male	Female		Male	Female		Male	Female		Male	Female
Overall		3.5	0.7	6.3	3.3	0.7	5.7	3.5	0.7	6.1	3.7	0.8	6.4
Age (years)[d]	**18 to 24**	3.8	0.4	7.3	3.6	0.4	6.6	3.8	0.4	7.1	3.9	0.4	7.3
	25 to 34	3.6	0.5	6.6	3.6	0.5	6.5	3.8	0.5	6.8	3.9	0.6	7.0
	35 to 44	3.4	0.6	6.1	3.1	0.6	5.5	3.3	0.6	5.9	3.5	0.7	6.3
	45 to 54	3.3	0.8	5.8	3.0	0.8	5.0	3.2	0.8	5.5	3.4	0.8	5.7
	55 to 64	3.8	1.2	6.2	3.4	1.3	5.5	3.7	1.3	5.9	3.9	1.3	6.3
Race/Ethnicity	**White**	3.5	0.7	6.3	3.3	0.7	5.8	3.5	0.7	6.2	3.6	0.7	6.4
	Black	3.8	0.9	6.1	3.6	0.9	5.6	3.9	1.0	6.1	4.0	1.0	6.3
	Hispanic	3.8	0.8	6.9	3.3	0.8	5.7	3.7	0.9	6.4	4.0	1.0	7.1
	Asian	2.4	0.5	4.3	2.3	0.5	3.9	2.5	0.5	4.4	2.6	0.5	4.6
	Missing	3.6	0.7	6.4	3.2	0.7	5.6	3.5	0.7	6.1	3.6	0.7	6.4
Region	**Northeast**	3.2	0.7	5.6	3.2	0.9	5.5	3.2	0.8	5.6	3.2	0.8	5.6
	Midwest	3.1	0.5	5.6	3.2	0.6	5.6	3.2	0.6	5.7	3.2	0.6	5.7
	South	3.9	0.8	6.9	3.9	0.9	6.6	4.0	0.9	6.9	4.1	0.9	7.0
	West	3.3	0.6	5.9	2.3	0.5	4.1	2.9	0.6	5.1	3.5	0.7	6.1
Household income (US dollars)	**<$40,000**	4.1	0.8	6.6	3.9	0.9	5.9	4.3	0.9	6.5	4.4	0.9	6.8
	$40,000 to $49,999	3.8	0.8	6.6	3.6	0.9	5.9	3.9	0.9	6.5	4.0	0.9	6.8
	$50,000 to $59,999	3.7	0.8	6.5	3.5	0.8	5.9	3.7	0.9	6.4	3.9	0.9	6.7
	$60,000 to $74,999	3.6	0.8	6.4	3.4	0.8	5.9	3.6	0.8	6.3	3.8	0.8	6.6
	$75,000 to $99,999	3.5	0.7	6.3	3.3	0.8	5.8	3.5	0.8	6.2	3.6	0.8	6.4
	≥$100,000	3.3	0.7	6.0	3.1	0.7	5.6	3.2	0.7	5.8	3.3	0.7	6.0
	Missing	3.4	0.7	6.2	3.2	0.7	5.6	3.4	0.7	6.0	3.6	0.7	6.5

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Among enrollees with full enrollment in a commercial health plan.
[c] Averaged across the 10-year study period, weighted by annual cohort population.
[d] Age and region taken on January 1 of each year.
Source: Optum© de-dentified Clinformatics® Data Mart Database, 2007-2016

Table C.2.2 (continued): Prevalence (%) of urinary tract infections (UTI)[a] among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year and gender, 2007 - 2016[b]

Demographic Characteristics		Average (2007-2016)[c]			Year								
					2010			2011			2012		
		Overall (%)	Gender		Overall (%)	Gender		Overall (%)	Gender		Overall (%)	Gender	
			Male	Female		Male	Female		Male	Female		Male	Female
Overall		3.5	0.7	6.3	3.7	0.8	6.5	3.7	0.7	6.5	3.7	0.7	6.6
Age (years)[d]	**18 to 24**	3.8	0.4	7.3	3.9	0.4	7.4	3.9	0.4	7.5	4.0	0.4	7.7
	25 to 34	3.6	0.5	6.6	3.9	0.5	7.0	3.8	0.5	6.9	3.7	0.5	6.8
	35 to 44	3.4	0.6	6.1	3.6	0.6	6.4	3.6	0.6	6.4	3.6	0.6	6.5
	45 to 54	3.3	0.8	5.8	3.4	0.8	5.9	3.4	0.8	6.0	3.5	0.8	6.1
	55 to 64	3.8	1.2	6.2	4.0	1.4	6.4	4.0	1.3	6.5	3.9	1.2	6.5
Race/Ethnicity	**White**	3.5	0.7	6.3	3.6	0.7	6.5	3.6	0.7	6.5	3.6	0.7	6.6
	Black	3.8	0.9	6.1	4.1	1.0	6.4	4.0	0.9	6.4	4.0	0.9	6.4
	Hispanic	3.8	0.8	6.9	4.1	0.9	7.4	4.1	0.9	7.4	4.0	0.9	7.4
	Asian	2.4	0.5	4.3	2.7	0.6	4.7	2.6	0.5	4.7	2.6	0.5	4.5
	Missing	3.6	0.7	6.4	3.8	0.7	6.7	3.8	0.7	6.8	3.8	0.7	6.9
Region	**Northeast**	3.2	0.7	5.6	3.2	0.8	5.6	3.3	0.8	5.8	3.3	0.8	5.9
	Midwest	3.1	0.5	5.6	3.2	0.6	5.8	3.2	0.6	5.9	3.2	0.5	5.9
	South	3.9	0.8	6.9	4.0	0.9	7.0	4.0	0.8	7.0	4.1	0.8	7.2
	West	3.3	0.6	5.9	3.8	0.7	6.7	3.7	0.7	6.6	3.7	0.7	6.6
Household income (US dollars)	**<$40,000**	4.1	0.8	6.6	4.5	1.0	7.0	4.4	0.8	6.9	4.3	0.8	6.9
	$40,000 to $49,999	3.8	0.8	6.6	4.1	0.9	6.8	4.0	0.8	6.8	4.0	0.8	7.0
	$50,000 to $59,999	3.7	0.8	6.5	3.9	0.8	6.8	3.9	0.8	6.7	3.9	0.7	6.8
	$60,000 to $74,999	3.6	0.8	6.4	3.8	0.8	6.6	3.7	0.8	6.6	3.7	0.8	6.6
	$75,000 to $99,999	3.5	0.7	6.3	3.7	0.8	6.6	3.7	0.8	6.6	3.7	0.7	6.6
	≥$100,000	3.3	0.7	6.0	3.3	0.7	6.1	3.4	0.7	6.2	3.4	0.7	6.3
	Missing	3.4	0.7	6.2	3.8	0.7	6.8	3.7	0.7	6.8	3.7	0.7	6.8

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Among enrollees with full enrollment in a commercial health plan.
[c] Averaged across the 10-year study period, weighted by annual cohort population.
[d] Age and region taken on January 1 of each year.
Source: Optum© de-dentified Clinformatics® Data Mart Database, 2007-2016

Table C.2.2 (continued): Prevalence (%) of urinary tract infections (UTI)[a] among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year and gender, 2007 - 2016[b]

Demographic Characteristics		Average (2007-2016)[c]			Year								
					2013			2014			2015		
		Overall (%)	Gender		Overall (%)	Gender		Overall (%)	Gender		Overall (%)	Gender	
			Male	Female		Male	Female		Male	Female		Male	Female
Overall		3.5	0.7	6.3	3.5	0.7	6.3	3.5	0.6	6.3	3.4	0.6	6.2
Age (years)[d]	**18 to 24**	3.8	0.4	7.3	3.8	0.4	7.4	3.9	0.3	7.6	3.8	0.3	7.4
	25 to 34	3.6	0.5	6.6	3.5	0.5	6.5	3.3	0.4	6.3	3.2	0.4	6.0
	35 to 44	3.4	0.6	6.1	3.4	0.6	6.1	3.3	0.5	6.0	3.2	0.5	5.9
	45 to 54	3.3	0.8	5.8	3.3	0.7	5.9	3.3	0.7	5.9	3.3	0.7	5.9
	55 to 64	3.8	1.2	6.2	3.8	1.2	6.3	3.7	1.2	6.2	3.7	1.1	6.2
Race/Ethnicity	**White**	3.5	0.7	6.3	3.5	0.6	6.3	3.4	0.6	6.3	3.3	0.6	6.1
	Black	3.8	0.9	6.1	3.7	0.9	6.0	3.5	0.8	5.8	3.5	0.8	5.8
	Hispanic	3.8	0.8	6.9	3.8	0.8	7.0	3.8	0.8	7.1	3.8	0.8	7.0
	Asian	2.4	0.5	4.3	2.4	0.5	4.3	2.3	0.5	4.2	2.3	0.4	4.1
	Missing	3.6	0.7	6.4	3.6	0.6	6.6	3.6	0.6	6.6	3.5	0.6	6.4
Region	**Northeast**	3.2	0.7	5.6	3.2	0.7	5.8	3.1	0.7	5.7	3.0	0.6	5.4
	Midwest	3.1	0.5	5.6	3.1	0.5	5.7	3.0	0.5	5.5	2.9	0.5	5.4
	South	3.9	0.8	6.9	3.9	0.8	6.9	3.9	0.8	7.0	3.8	0.7	6.9
	West	3.3	0.6	5.9	3.4	0.6	6.2	3.4	0.6	6.2	3.3	0.6	6.0
Household income (US dollars)	**<$40,000**	4.1	0.8	6.6	4.0	0.8	6.6	3.8	0.8	6.5	3.7	0.7	6.3
	$40,000 to $49,999	3.8	0.8	6.6	3.7	0.7	6.5	3.6	0.7	6.4	3.5	0.6	6.4
	$50,000 to $59,999	3.7	0.8	6.5	3.6	0.7	6.3	3.5	0.7	6.4	3.5	0.7	6.3
	$60,000 to $74,999	3.6	0.8	6.4	3.6	0.7	6.4	3.5	0.7	6.4	3.4	0.7	6.2
	$75,000 to $99,999	3.5	0.7	6.3	3.5	0.7	6.3	3.5	0.7	6.3	3.4	0.7	6.2
	≥$100,000	3.3	0.7	6.0	3.3	0.6	6.1	3.3	0.6	6.1	3.2	0.6	6.0
	Missing	3.4	0.7	6.2	3.5	0.6	6.5	3.5	0.6	6.5	3.3	0.6	6.3

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Among enrollees with full enrollment in a commercial health plan.
[c] Averaged across the 10-year study period, weighted by annual cohort population.
[d] Age and region taken on January 1 of each year.
Source: Optum© de-dentified Clinformatics® Data Mart Database, 2007-2016

Table C.2.2 (continued): Prevalence (%) of urinary tract infections (UTI)[a] among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year and gender, 2007 - 2016[b]

Demographic Characteristics		Average (2007-2016)[c]			Year 2016		
		Overall (%)	Gender		Overall (%)	Gender	
			Male	Female		Male	Female
Overall		3.5	0.7	6.3	3.3	0.6	6.1
Age (years)[d]	18 to 24	3.8	0.4	7.3	3.7	0.3	7.2
	25 to 34	3.6	0.5	6.6	3.0	0.4	5.7
	35 to 44	3.4	0.6	6.1	3.1	0.5	5.8
	45 to 54	3.3	0.8	5.8	3.3	0.7	5.9
	55 to 64	3.8	1.2	6.2	3.7	1.1	6.2
Race/Ethnicity	White	3.5	0.7	6.3	3.3	0.6	6.1
	Black	3.8	0.9	6.1	3.5	0.8	5.8
	Hispanic	3.8	0.8	6.9	3.7	0.7	6.9
	Asian	2.4	0.5	4.3	2.2	0.4	4.0
	Missing	3.6	0.7	6.4	3.4	0.6	6.3
Region	Northeast	3.2	0.7	5.6	2.9	0.6	5.4
	Midwest	3.1	0.5	5.6	2.9	0.5	5.4
	South	3.9	0.8	6.9	3.8	0.7	6.8
	West	3.3	0.6	5.9	3.1	0.5	5.7
Household income (US dollars)	<$40,000	4.1	0.8	6.6	3.8	0.7	6.4
	$40,000 to $49,999	3.8	0.8	6.6	3.4	0.7	6.2
	$50,000 to $59,999	3.7	0.8	6.5	3.4	0.7	6.2
	$60,000 to $74,999	3.6	0.8	6.4	3.4	0.6	6.2
	$75,000 to $99,999	3.5	0.7	6.3	3.3	0.6	6.0
	≥$100,000	3.3	0.7	6.0	3.2	0.6	5.9
	Missing	3.4	0.7	6.2	3.2	0.6	6.1

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Among enrollees with full enrollment in a commercial health plan.
[c] Averaged across the 10-year study period, weighted by annual cohort population.
[d] Age and region taken on January 1 of each year.
Source: Optum© de-dentified Clinformatics® Data Mart Database, 2007-2016

Table C.3.1: Medication use for episodes of urinary tract infection (UTI)[a] occurring among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year, 2007 - 2016[b]

Anti-Infectious Agent[c]	Overall		Year									
	Prevalence from 2007 to 2016 (N=2,691,529)[d]		2007 (N=272,469)		2008 (N=283,770)		2009 (N=289,847)		2010 (N=275,105)		2011 (N=280,017)	
	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%
Quinolones	1,110,054	41.2	127,501	46.8	128,256	45.2	124,923	43.1	117,786	42.8	117,449	41.9
Urinary Anti-Infectives	592,024	22.0	51,164	18.8	55,295	19.5	59,515	20.5	56,344	20.5	59,634	21.3
Sulfonamides	469,009	17.4	48,078	17.6	50,308	17.7	51,844	17.9	48,792	17.7	48,750	17.4
Cephalosporins	126,348	4.7	8,417	3.1	9,527	3.4	10,220	3.5	10,926	4.0	11,952	4.3
Penicillins	81,864	3.0	8,740	3.2	8,619	3.0	8,752	3.0	8,522	3.1	8,575	3.1
Azoles	63,067	2.3	5,749	2.1	6,571	2.3	7,286	2.5	6,939	2.5	7,148	2.6
Macrolides	33,052	1.2	3,672	1.3	3,970	1.4	4,249	1.5	3,711	1.3	3,712	1.3
Tetracyclines	29,402	1.1	2,970	1.1	3,241	1.1	3,381	1.2	3,189	1.2	3,108	1.1
Other[e]	5,250	0.2	484	0.2	546	0.2	577	0.2	512	0.2	590	0.2
Combination therapy[f]	181,459	6.7	15,694	5.8	17,437	6.1	19,100	6.6	18,384	6.7	19,099	6.8
Including Azoles	126,713	4.7	9,832	3.6	11,022	3.9	12,462	4.3	12,495	4.5	13,377	4.8
Not including Azoles	54,746	2.0	5,862	2.2	6,415	2.3	6,638	2.3	5,889	2.1	5,722	2.0

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.3.1 (continued): Medication use for episodes of urinary tract infection (UTI)[a] occurring among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year, 2007 - 2016[b]

Anti-Infectious Agent[c]	Overall		Year									
	Prevalence from 2007 to 2016 (N=2,691,529)[d]		2012 (N=279,045)		2013 (N=265,158)		2014 (N=238,239)		2015 (N=246,732)		2016 (N=261,147)	
	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%
Quinolones	1,110,054	41.2	114,465	41.0	105,782	39.9	93,529	39.3	94,506	38.3	85,857	32.9
Urinary Anti-Infectives	592,024	22.0	61,514	22.0	59,860	22.6	55,617	23.3	60,856	24.7	72,225	27.7
Sulfonamides	469,009	17.4	48,521	17.4	46,233	17.4	40,993	17.2	40,684	16.5	44,806	17.2
Cephalosporins	126,348	4.7	13,108	4.7	13,683	5.2	13,564	5.7	15,531	6.3	19,420	7.4
Penicillins	81,864	3.0	8,116	2.9	7,974	3.0	7,122	3.0	7,269	2.9	8,175	3.1
Azoles	63,067	2.3	7,047	2.5	6,601	2.5	5,171	2.2	5,165	2.1	5,390	2.1
Macrolides	33,052	1.2	3,452	1.2	2,938	1.1	2,447	1.0	2,394	1.0	2,507	1.0
Tetracyclines	29,402	1.1	3,085	1.1	2,851	1.1	2,507	1.1	2,468	1.0	2,602	1.0
Other[e]	5,250	0.2	583	0.2	555	0.2	474	0.2	459	0.2	470	0.2
Combination therapy[f]	181,459	6.7	19,154	6.9	18,681	7.0	16,815	7.1	17,400	7.1	19,695	7.5
Including Azoles	126,713	4.7	13,831	5.0	13,574	5.1	12,324	5.2	12,985	5.3	14,811	5.7
Not including Azoles	54,746	2.0	5,323	1.9	5,107	1.9	4,491	1.9	4,415	1.8	4,884	1.9

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.3.2: Medication use for episodes of urinary tract infection (UTI)[a] occurring among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by age, 2007 - 2016[b]

Anti-Infectious Agent[c]	Overall		Age (years)[e]									
	Prevalence from 2007 to 2016 (N=2,691,529)[d]		18 to 24 (N=364,196)		25 to 34 (N=527,279)		35 to 44 (N=603,497)		45 to 54 (N=646,880)		55 to 64 (N=549,677)	
	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%
Quinolones	1,110,054	41.2	125,736	34.5	189,086	35.9	248,552	41.2	291,376	45.0	255,304	46.4
Urinary Anti-Infectives	592,024	22.0	89,957	24.7	133,982	25.4	130,584	21.6	129,312	20.0	108,189	19.7
Sulfonamides	469,009	17.4	76,277	20.9	90,157	17.1	103,111	17.1	109,088	16.9	90,376	16.4
Cephalosporins	126,348	4.7	20,046	5.5	28,639	5.4	24,668	4.1	26,141	4.0	26,854	4.9
Penicillins	81,864	3.0	10,054	2.8	18,688	3.5	16,931	2.8	18,108	2.8	18,083	3.3
Azoles	63,067	2.3	7,913	2.2	14,092	2.7	17,055	2.8	14,725	2.3	9,282	1.7
Macrolides	33,052	1.2	4,737	1.3	7,015	1.3	7,502	1.2	7,644	1.2	6,154	1.1
Tetracyclines	29,402	1.1	4,572	1.3	6,104	1.2	6,441	1.1	6,539	1.0	5,746	1.0
Other[f]	5,250	0.2	563	0.2	994	0.2	1,073	0.2	1,228	0.2	1,392	0.3
Combination therapy[g]	181,459	6.7	24,341	6.7	38,522	7.3	47,580	7.9	42,719	6.6	28,297	5.1
Including Azoles	126,713	4.7	16,694	4.6	28,027	5.3	35,483	5.9	29,698	4.6	16,811	3.1
Not including Azoles	54,746	2.0	7,647	2.1	10,495	2.0	12,097	2.0	13,021	2.0	11,486	2.1

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Age was taken on January 1 of the year in which the UTI case occurred.
[f] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[g] Defined as two concurrent anti-infectives.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.3.3: Medication use for episodes of urinary tract infection (UTI)[a] occurring among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by gender, 2007 - 2016[b]

Anti-Infectious Agent[c]	Overall		Gender			
	Prevalence from 2007 to 2016 (N=2,691,529)[d]		Male (N=245,605)		Female (N=2,445,924)	
	N with medication	%	N with medication	%	N with medication	%
Quinolones	1,110,054	41.2	143,347	58.4	966,707	39.5
Urinary Anti-Infectives	592,024	22.0	12,829	5.2	579,195	23.7
Sulfonamides	469,009	17.4	36,763	15.0	432,246	17.7
Cephalosporins	126,348	4.7	11,761	4.8	114,587	4.7
Penicillins	81,864	3.0	9,516	3.9	72,348	3.0
Azoles	63,067	2.3	1,584	0.6	61,483	2.5
Macrolides	33,052	1.2	8,284	3.4	24,768	1.0
Tetracyclines	29,402	1.1	12,006	4.9	17,396	0.7
Other[e]	5,250	0.2	702	0.3	4,548	0.2
Combination therapy[f]	181,459	6.7	8,813	3.6	172,646	7.1
Including Azoles	126,713	4.7	1,240	0.5	125,473	5.1
Not including Azoles	54,746	2.0	7,573	3.1	47,173	1.9

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.3.4: Medication use for episodes of urinary tract infection (UTI)[a] occurring among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by race/ethnicity, 2007 - 2016[b]

Anti-Infectious Agent[c]	Overall		Race/Ethnicity							
	Prevalence from 2007 to 2016 (N=2,161,610)[d]		White (N=1,579,167)		Black (N=226,427)		Hispanic (N=276,942)		Asian (N=79,074)	
	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%
Quinolones	899,723	41.6	660,568	41.8	90,404	39.9	116,275	42.0	32,476	41.1
Urinary Anti-Infectives	467,693	21.6	345,963	21.9	42,669	18.8	59,300	21.4	19,761	25.0
Sulfonamides	379,093	17.5	281,212	17.8	42,354	18.7	43,676	15.8	11,851	15.0
Cephalosporins	99,548	4.6	69,773	4.4	9,262	4.1	16,339	5.9	4,174	5.3
Penicillins	65,879	3.0	46,015	2.9	7,081	3.1	9,639	3.5	3,144	4.0
Azoles	50,382	2.3	35,084	2.2	6,976	3.1	6,629	2.4	1,693	2.1
Macrolides	26,583	1.2	17,564	1.1	3,463	1.5	4,354	1.6	1,202	1.5
Tetracyclines	23,852	1.1	16,057	1.0	3,663	1.6	3,417	1.2	715	0.9
Other[e]	4,259	0.2	2,994	0.2	587	0.3	561	0.2	117	0.1
Combination therapy[f]	144,598	6.7	103,937	6.6	19,968	8.8	16,752	6.0	3,941	5.0
Including Azoles	100,124	4.6	71,355	4.5	14,725	6.5	11,526	4.2	2,518	3.2
Not including Azoles	44,474	2.1	32,582	2.1	5,243	2.3	5,226	1.9	1,423	1.8

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.3.5: Medication use for episodes of urinary tract infection (UTI)[a] occurring among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by region, 2007 - 2016[b]

Anti-Infectious Agent[c]	Overall		Region[e]							
	Prevalence from 2007 to 2016 (N=2,691,529)[d]		Northeast (N=229,620)		Midwest (N=599,674)		South (N=1,340,758)		West (N=521,477)	
	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%
Quinolones	1,110,054	41.2	98,847	43.0	242,310	40.4	554,602	41.4	214,295	41.1
Urinary Anti-Infectives	592,024	22.0	50,706	22.1	126,903	21.2	284,938	21.3	129,477	24.8
Sulfonamides	469,009	17.4	35,751	15.6	132,474	22.1	222,435	16.6	78,349	15.0
Cephalosporins	126,348	4.7	8,968	3.9	26,815	4.5	58,072	4.3	32,493	6.2
Penicillins	81,864	3.0	8,661	3.8	16,112	2.7	42,253	3.2	14,838	2.8
Azoles	63,067	2.3	6,755	2.9	10,726	1.8	35,639	2.7	9,947	1.9
Macrolides	33,052	1.2	4,580	2.0	5,054	0.8	17,750	1.3	5,668	1.1
Tetracyclines	29,402	1.1	2,940	1.3	4,857	0.8	17,082	1.3	4,523	0.9
Other[f]	5,250	0.2	439	0.2	1,007	0.2	2,972	0.2	832	0.2
Combination therapy[g]	181,459	6.7	11,973	5.2	33,416	5.6	105,015	7.8	31,055	6.0
Including Azoles	126,713	4.7	8,532	3.7	25,134	4.2	71,066	5.3	21,981	4.2
Not including Azoles	54,746	2.0	3,441	1.5	8,282	1.4	33,949	2.5	9,074	1.7

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Region was taken on January 1 of the year in which the UTI case occurred.
[f] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[g] Defined as two concurrent anti-infectives.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.3.6: Medication use for episodes of urinary tract infection (UTI)[a] occurring among adults enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by income, 2007 - 2016[b]

Anti-Infectious Agent[c]	Overall		Household income (US dollars)											
	Prevalence from 2007 to 2016 (N=2,117,907)[d]		<$40,000 (N=337,772)		$40,000 to $49,999 (N=142,799)		$50,000 to $59,999 (N=152,469)		$60,000 to $74,999 (N=226,531)		$75,000 to $99,999 (N=359,440)		≥$100,000 (N=898,896)	
	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%	N with medication	%
Quinolones	876,705	41.4	136,738	40.5	58,143	40.7	62,399	40.9	94,041	41.5	151,022	42.0	374,362	41.6
Urinary Anti-Infectives	465,161	22.0	66,761	19.8	28,949	20.3	31,387	20.6	47,395	20.9	76,739	21.3	213,930	23.8
Sulfonamides	369,443	17.4	63,903	18.9	26,398	18.5	28,008	18.4	40,799	18.0	63,595	17.7	146,740	16.3
Cephalosporins	98,130	4.6	17,519	5.2	7,074	5.0	7,245	4.8	10,651	4.7	16,360	4.6	39,281	4.4
Penicillins	64,197	3.0	10,235	3.0	4,482	3.1	4,706	3.1	7,008	3.1	10,965	3.1	26,801	3.0
Azoles	49,429	2.3	8,385	2.5	3,487	2.4	3,787	2.5	5,439	2.4	8,104	2.3	20,227	2.3
Macrolides	25,769	1.2	4,381	1.3	1,880	1.3	2,003	1.3	2,801	1.2	4,359	1.2	10,345	1.2
Tetracyclines	22,806	1.1	4,153	1.2	1,740	1.2	1,810	1.2	2,472	1.1	3,845	1.1	8,786	1.0
Other[e]	4,151	0.2	760	0.2	316	0.2	330	0.2	445	0.2	695	0.2	1,605	0.2
Combination therapy[f]	142,116	6.7	24,937	7.4	10,330	7.2	10,794	7.1	15,480	6.8	23,756	6.6	56,819	6.3
Including Azoles	99,123	4.7	18,267	5.4	7,479	5.2	7,665	5.0	10,942	4.8	16,659	4.6	38,111	4.2
Not including Azoles	42,993	2.0	6,670	2.0	2,851	2.0	3,129	2.1	4,538	2.0	7,097	2.0	18,708	2.1

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.4: Duration of medication use among adults with urinary tract infections (UTI)[a] and enrolled in private insurance in Optum© Clinformatics® Data Mart, 2007 - 2016[b]

Demographic Characteristics		Mean (standard deviation) medication duration in days from 2007-2016 (N=2,691,472)[c]	Medication duration (days)[d]									
			1		2-3		4-5		6-7		>7	
			N	%[e]	N	%	N	%	N	%	N	%
Overall		7.9 (5.6)	39,095	1.5	299,866	11.1	480,810	17.9	1,072,858	39.9	798,843	29.7
Year	**2007**	7.8 (5.4)	4,465	1.6	33,794	12.4	47,690	17.5	103,372	37.9	83,131	30.5
	2008	7.9 (5.6)	4,395	1.5	34,203	12.1	49,631	17.5	108,743	38.3	86,777	30.6
	2009	7.9 (5.5)	4,505	1.6	33,748	11.6	49,405	17.0	112,587	38.8	89,589	30.9
	2010	7.9 (5.5)	4,240	1.5	30,807	11.2	46,722	17.0	107,653	39.1	85,682	31.1
	2011	7.9 (6.0)	4,285	1.5	31,671	11.3	47,430	16.9	111,195	39.7	85,434	30.5
	2012	7.9 (5.8)	4,259	1.5	31,539	11.3	48,226	17.3	112,186	40.2	82,835	29.7
	2013	7.9 (5.5)	3,843	1.4	29,417	11.1	46,362	17.5	107,753	40.6	77,782	29.3
	2014	7.8 (5.6)	2,998	1.3	26,282	11.0	43,231	18.1	98,267	41.2	67,460	28.3
	2015	7.8 (5.6)	2,914	1.2	25,059	10.2	48,480	19.6	101,695	41.2	68,583	27.8
	2016	7.8 (5.7)	3,191	1.2	23,346	8.9	53,633	20.5	109,407	41.9	71,570	27.4
Age (years)[f]	**18 to 24**	7.3 (4.6)	6,358	1.7	49,253	13.5	67,654	18.6	147,254	40.4	93,669	25.7
	25 to 34	7.4 (4.8)	9,481	1.8	67,270	12.8	96,342	18.3	219,088	41.6	135,084	25.6
	35 to 44	7.7 (5.3)	10,004	1.7	70,622	11.7	109,955	18.2	240,816	39.9	172,081	28.5
	45 to 54	8.1 (5.9)	8,145	1.3	65,907	10.2	114,619	17.7	252,439	39.0	205,761	31.8
	55 to 64	8.6 (6.7)	5,107	0.9	46,814	8.5	92,240	16.8	213,261	38.8	192,248	35.0
Gender	**Male**	10.1 (6.2)	3,602	1.5	7,911	3.2	22,296	9.1	72,221	29.4	139,570	56.8
	Female	7.6 (5.5)	35,493	1.5	291,955	11.9	458,514	18.7	1,000,637	40.9	659,273	27.0
Race/ Ethnicity	**White**	7.9 (5.9)	20,959	1.3	174,920	11.1	285,187	18.1	624,273	39.5	473,804	30.0
	Black	7.7 (4.9)	4,629	2.0	25,324	11.2	35,650	15.7	90,609	40.0	70,209	31.0
	Hispanic	7.8 (5.0)	4,339	1.6	27,783	10.0	46,726	16.9	112,546	40.6	85,538	30.9
	Asian	7.6 (5.2)	1,036	1.3	10,109	12.8	15,211	19.2	31,762	40.2	20,954	26.5
	Missing	7.7 (5.6)	8,132	1.5	61,730	11.6	98,036	18.5	213,668	40.3	148,338	28.0
Region	**Northeast**	7.3 (5.7)	4,578	2.0	34,597	15.1	49,189	21.4	86,744	37.8	54,510	23.7
	Midwest	7.7 (5.9)	6,871	1.1	76,981	12.8	111,045	18.5	238,034	39.7	166,729	27.8
	South	8.1 (5.5)	21,100	1.6	128,968	9.6	218,085	16.3	540,185	40.3	432,386	32.3
	West	7.8 (5.7)	6,546	1.3	59,320	11.4	102,491	19.7	207,895	39.9	145,218	27.8

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.

[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.

[c] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.

[d] For UTI episodes associated with two concurrent medications, the medication with the longer duration of the two medications was used.

[e] This table displays row percentages.

[f] Age, region, and income taken on January 1 of each year.

[g] Based on American Hospital Formulary Service classes.

[h] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.

[i] Combination therapy defined as two concurrent anti-infectives.

Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.4 (continued): Duration of medication use among adults with urinary tract infections (UTI)[a] and enrolled in private insurance in Optum© Clinformatics® Data Mart, 2007 - 2016[b]

Demographic Characteristics		Mean (standard deviation) medication duration in days from 2007-2016 (N=2,691,472)[c]	Medication duration (days)[d]									
			1		2-3		4-5		6-7		>7	
			N	%[e]	N	%	N	%	N	%	N	%
Household income (US dollars)	<$40,000	7.8 (4.9)	5,160	1.5	33,801	10.0	54,787	16.2	136,182	40.3	107,838	31.9
	$40,000 to $49,999	7.9 (5.1)	2,186	1.5	14,752	10.3	23,658	16.6	56,863	39.8	45,334	31.7
	$50,000 to $59,999	7.9 (5.3)	2,319	1.5	15,458	10.1	25,465	16.7	61,020	40.0	48,205	31.6
	$60,000 to $74,999	8.0 (5.5)	3,252	1.4	23,175	10.2	38,454	17.0	90,656	40.0	70,986	31.3
	$75,000 to $99,999	7.9 (5.6)	4,830	1.3	38,377	10.7	63,252	17.6	143,255	39.9	109,723	30.5
	≥$100,000	7.9 (6.2)	12,289	1.4	109,153	12.1	172,846	19.2	355,245	39.5	249,345	27.7
	Missing	7.8 (5.4)	9,059	1.6	65,150	11.4	102,348	17.8	229,637	40.0	167,412	29.2
Anti-infectious agent class[h]	Quinolones	7.2 (3.7)	1,136	0.1	156,590	14.1	230,079	20.7	406,483	36.6	315,744	28.4
	Urinary Anti-Infectives	8.9 (7.3)	983	0.2	15,127	2.6	92,737	15.7	347,119	58.6	136,047	23.0
	Sulfonamides	7.3 (4.7)	302	0.1	92,147	19.6	84,536	18.0	154,951	33.0	137,068	29.2
	Cephalosporins	8.7 (4.9)	248	0.2	3,290	2.6	13,401	10.6	53,291	42.2	56,115	44.4
	Penicillins	8.9 (4.7)	324	0.4	1,771	2.2	6,329	7.7	28,237	34.5	45,200	55.2
	Azoles	4.1 (7.3)	30,834	48.9	14,123	22.4	4,834	7.7	6,044	9.6	7,228	11.5
	Macrolides	5.1 (3.6)	4,469	13.5	1,950	5.9	22,223	67.2	1,627	4.9	2,778	8.4
	Tetracyclines	12.4 (8.4)	53	0.2	259	0.9	780	2.7	7,750	26.4	20,559	69.9
	Other[g]	9.7 (7.0)	121	2.3	181	3.4	402	7.7	2,083	39.7	2,463	46.9
	Combination therapy including an Azole[i]	8.0 (4.9)	201	0.2	13,452	10.6	21,524	17.0	51,761	40.8	39,774	31.4
	Combination therapy not including an Azole[i]	15.4 (12.2)	424	0.8	976	1.8	3,965	7.2	13,512	24.7	35,867	65.5

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[d] For UTI episodes associated with two concurrent medications, the medication with the longer duration of the two medications was used.
[e] This table displays row percentages.
[f] Age, region, and income taken on January 1 of each year.
[g] Based on American Hospital Formulary Service classes.
[h] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[i] Combination therapy defined as two concurrent anti-infectives.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.5.1: Comorbidities among adults with urinary tract infections (UTI)[a] and enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year, 2007 - 2016[b]

Comorbid Condition[c]	Overall prevalence from 2007 to 2016 (N=2,151,871)[d]		Year									
			2007 (N=220,023)		2008 (N=229,340)		2009 (N=233,123)		2010 (N=220,407)		2011 (N=223,669)	
	N with condition	%	N with condition	%	N with condition	%	N with condition	%	N with condition	%	N with condition	%
Benign prostatic hyperplasia[e]	25,849	12.2	2,551	10.7	2,749	11.5	2,807	11.8	2,651	11.9	2,640	12.1
Chronic kidney disease	70,812	3.3	5,165	2.3	5,768	2.5	6,226	2.7	6,581	3.0	6,669	3.0
Diabetes mellitus	167,499	7.8	15,620	7.1	17,114	7.5	18,204	7.8	18,057	8.2	17,836	8.0
HIV/AIDS	3,203	0.1	341	0.2	295	0.1	344	0.1	348	0.2	362	0.2
Ischemic heart disease	67,455	3.1	7,724	3.5	8,027	3.5	8,070	3.5	7,446	3.4	6,945	3.1
Multiple sclerosis and transverse myelitis	12,869	0.6	1,298	0.6	1,285	0.6	1,357	0.6	1,324	0.6	1,348	0.6
Prostate cancer[e]	6,513	3.1	685	2.9	717	3.0	722	3.0	746	3.4	727	3.3
Spinal cord injury	2,481	0.1	209	0.1	226	0.1	234	0.1	250	0.1	268	0.1
Stroke/Transient ischemic attack	13,309	0.6	1,383	0.6	1,426	0.6	1,469	0.6	1,491	0.7	1,383	0.6

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of some comorbid conditions.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Calculated among male enrollees only.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.5.1 (continued): Comorbidities among adults with urinary tract infections (UTI)[a] and enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by year, 2007 - 2016[b]

Comorbid Condition[c]	Overall prevalence from 2007 to 2016 (N=2,151,871)[d]		Year									
			2012 (N=222,149)		2013 (N=211,378)		2014 (N=189,492)		2015 (N=195,652)		2016 (N=206,638)	
	N with condition	%	N with condition	%	N with condition	%	N with condition	%	N with condition	%	N with condition	%
Benign prostatic hyperplasia[e]	25,849	12.2	2,608	12.4	2,495	12.6	2,279	12.8	2,360	13.1	2,709	14.2
Chronic kidney disease	70,812	3.3	6,705	3.0	6,626	3.1	6,049	3.2	7,825	4.0	13,198	6.4
Diabetes mellitus	167,499	7.8	17,150	7.7	16,567	7.8	14,430	7.6	15,734	8.0	16,787	8.1
HIV/AIDS	3,203	0.1	298	0.1	314	0.1	254	0.1	312	0.2	335	0.2
Ischemic heart disease	67,455	3.1	6,656	3.0	5,973	2.8	4,963	2.6	5,286	2.7	6,365	3.1
Multiple sclerosis and transverse myelitis	12,869	0.6	1,324	0.6	1,351	0.6	1,147	0.6	1,151	0.6	1,284	0.6
Prostate cancer[e]	6,513	3.1	668	3.2	636	3.2	522	2.9	501	2.8	589	3.1
Spinal cord injury	2,481	0.1	246	0.1	259	0.1	232	0.1	232	0.1	325	0.2
Stroke/Transient ischemic attack	13,309	0.6	1,330	0.6	1,296	0.6	1,091	0.6	1,177	0.6	1,263	0.6

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of some comorbid conditions.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Calculated among male enrollees only.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.5.2: Comorbidities among adults with urinary tract infections (UTI)[a] and enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by age, 2007 - 2016[b]

Comorbid Condition[c]	Overall prevalence from 2007 to 2016 (N=2,151,871)[d]		Age (years)[e]									
			18 to 24 (N=295,152)		25 to 34 (N=432,889)		35 to 44 (N=490,197)		45 to 54 (N=514,559)		55 to 64 (N=419,074)	
	N with condition	%	N with condition	%	N with condition	%	N with condition	%	N with condition	%	N with condition	%
Benign prostatic hyperplasia[f]	25,849	12.2	37	0.3	250	0.9	1,444	3.4	6,779	11.7	17,339	25.7
Chronic kidney disease	70,812	3.3	3,465	1.2	7,106	1.6	11,587	2.4	20,154	3.9	28,500	6.8
Diabetes mellitus	167,499	7.8	3,091	1.0	9,370	2.2	25,585	5.2	53,691	10.4	75,762	18.1
HIV/AIDS	3,203	0.1	110	0.0	496	0.1	960	0.2	1,107	0.2	530	0.1
Ischemic heart disease	67,455	3.1	548	0.2	2,001	0.5	6,720	1.4	20,167	3.9	38,019	9.1
Multiple sclerosis and transverse myelitis	12,869	0.6	312	0.1	1,524	0.4	3,191	0.7	4,318	0.8	3,524	0.8
Prostate cancer[f]	6,513	3.1	2	0.0	11	0.0	99	0.2	1,381	2.4	5,020	7.4
Spinal cord injury	2,481	0.1	313	0.1	359	0.1	440	0.1	673	0.1	696	0.2
Stroke/Transient ischemic attack	13,309	0.6	265	0.1	755	0.2	1,913	0.4	4,109	0.8	6,267	1.5

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of some comorbid conditions.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Age was taken on January 1 of the year in which the UTI case occurred.
[f] Calculated among male enrollees only.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.5.3: Comorbidities among adults with urinary tract infections (UTI)[a] and enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by gender, 2007 - 2016[b]

Comorbid Condition[c]	Overall prevalence from 2007 to 2016 (N=2,151,871)[d]		Gender			
			Male (N=211,335)		Female (N=1,940,536)	
	N with condition	%	N with condition	%	N with condition	%
Benign prostatic hyperplasia[e]	25,849	12.2	25,849	12.2	n/a	n/a
Chronic kidney disease	70,812	3.3	16,970	8.0	53,842	2.8
Diabetes mellitus	167,499	7.8	30,698	14.5	136,801	7.0
HIV/AIDS	3,203	0.1	1,961	0.9	1,242	0.1
Ischemic heart disease	67,455	3.1	18,750	8.9	48,705	2.5
Multiple sclerosis and transverse myelitis	12,869	0.6	909	0.4	11,960	0.6
Prostate cancer[e]	6,513	3.1	6,513	3.1	n/a	n/a
Spinal cord injury	2,481	0.1	1,359	0.6	1,122	0.1
Stroke/Transient ischemic attack	13,309	0.6	2,396	1.1	10,913	0.6

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of some comorbid conditions.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Calculated among male enrollees only.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.5.4: Comorbidities among adults with urinary tract infections (UTI)[a] and enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by race/ethnicity, 2007 - 2016[b]

Comorbid Condition[c]	Overall prevalence from 2007 to 2016 (N=1,726,679)[d]		Race/Ethnicity							
			White (N=1,250,809)		Black (N=185,907)		Hispanic (N=224,259)		Asian (N=65,704)	
	N with condition	%	N with condition	%	N with condition	%	N with condition	%	N with condition	%
Benign prostatic hyperplasia[e]	21,650	12.5	15,624	12.9	2,359	11.8	3,095	12.3	572	8.5
Chronic kidney disease	57,829	3.3	41,263	3.3	7,068	3.8	7,789	3.5	1,709	2.6
Diabetes mellitus	139,967	8.1	92,583	7.4	20,629	11.1	22,563	10.1	4,192	6.4
HIV/AIDS	2,497	0.1	1,293	0.1	792	0.4	376	0.2	36	0.1
Ischemic heart disease	56,370	3.3	41,721	3.3	6,896	3.7	6,525	2.9	1,228	1.9
Multiple sclerosis and transverse myelitis	10,508	0.6	8,668	0.7	953	0.5	725	0.3	162	0.2
Prostate cancer[e]	5,526	3.2	4,096	3.4	832	4.2	490	2.0	108	1.6
Spinal cord injury	1,972	0.1	1,603	0.1	170	0.1	148	0.1	51	0.1
Stroke/Transient ischemic attack	11,060	0.6	8,046	0.6	1,598	0.9	1,176	0.5	240	0.4

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of some comorbid conditions.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Calculated among male enrollees only.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.5.5: Comorbidities among adults with urinary tract infections (UTI)[a] and enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by region, 2007 - 2016[b]

Comorbid Condition[c]	Overall prevalence from 2007 to 2016 (N=2,151,871)[d]		Region[e]							
			Northeast (N=187,508)		Midwest (N=479,552)		South (N=1,070,002)		West (N=414,809)	
	N with condition	%	N with condition	%	N with condition	%	N with condition	%	N with condition	%
Benign prostatic hyperplasia[f]	25,849	12.2	3,111	14.1	4,691	11.5	13,444	12.2	4,603	12.1
Chronic kidney disease	70,812	3.3	4,992	2.7	15,774	3.3	36,862	3.4	13,184	3.2
Diabetes mellitus	167,499	7.8	11,312	6.0	36,590	7.6	92,225	8.6	27,372	6.6
HIV/AIDS	3,203	0.1	314	0.2	374	0.1	2,011	0.2	504	0.1
Ischemic heart disease	67,455	3.1	6,195	3.3	13,555	2.8	39,106	3.7	8,599	2.1
Multiple sclerosis and transverse myelitis	12,869	0.6	1,324	0.7	3,578	0.7	5,473	0.5	2,494	0.6
Prostate cancer[f]	6,513	3.1	644	2.9	1,274	3.1	3,493	3.2	1,102	2.9
Spinal cord injury	2,481	0.1	196	0.1	596	0.1	1,184	0.1	505	0.1
Stroke/Transient ischemic attack	13,309	0.6	955	0.5	2,710	0.6	7,570	0.7	2,074	0.5

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of some comorbid conditions.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Region was taken on January 1 of the year in which the UTI case occurred.
[f] Calculated among male enrollees only.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.5.6: Comorbidities among adults with urinary tract infections (UTI)[a] and enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by income, 2007 - 2016[b]

Comorbid Condition[c]	Overall prevalence from 2007 to 2016 (N=1,689,741)[d]		Household income (US dollars)							
			<$40,000 (N=271,115)		$40,000 to $49,999 (N=114,437)		$50,000 to $59,999 (N=121,637)		$60,000 to $74,999 (N=180,685)	
	N with condition	%	N with condition	%	N with condition	%	N with condition	%	N with condition	%
Benign prostatic hyperplasia[e]	21,711	13.0	2,732	11.6	1,353	11.9	1,474	11.8	2,349	12.5
Chronic kidney disease	57,336	3.4	11,078	4.1	4,265	3.7	4,765	3.9	6,837	3.8
Diabetes mellitus	137,263	8.1	30,777	11.4	11,564	10.1	12,443	10.2	17,394	9.6
HIV/AIDS	2,372	0.1	648	0.2	245	0.2	223	0.2	290	0.2
Ischemic heart disease	55,569	3.3	11,117	4.1	4,242	3.7	4,624	3.8	6,773	3.7
Multiple sclerosis and transverse myelitis	10,595	0.6	1,231	0.5	590	0.5	655	0.5	1,010	0.6
Prostate cancer[e]	5,540	3.3	680	2.9	352	3.1	401	3.2	625	3.3
Spinal cord injury	1,964	0.1	279	0.1	99	0.1	138	0.1	210	0.1
Stroke/Transient ischemic attack	10,819	0.6	2,157	0.8	875	0.8	913	0.8	1,262	0.7

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of some comorbid conditions.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Calculated among male enrollees only.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.5.6 (continued): Comorbidities among adults with urinary tract infections (UTI)[a] and enrolled in private insurance in Optum© Clinformatics® Data Mart, overall and by income, 2007 - 2016[b]

Comorbid Condition[c]	Overall prevalence from 2007 to 2016 (N=1,689,741)[d]		Household income (US dollars)			
			$75,000 to $99,999 (N=285,735)		≥$100,000 (N=716,132)	
	N with condition	%	N with condition	%	N with condition	%
Benign prostatic hyperplasia[e]	21,711	13.0	3,935	13.3	9,868	13.7
Chronic kidney disease	57,336	3.4	10,240	3.6	20,151	2.8
Diabetes mellitus	137,263	8.1	24,920	8.7	40,165	5.6
HIV/AIDS	2,372	0.1	378	0.1	588	0.1
Ischemic heart disease	55,569	3.3	10,090	3.5	18,723	2.6
Multiple sclerosis and transverse myelitis	10,595	0.6	1,975	0.7	5,134	0.7
Prostate cancer[e]	5,540	3.3	1,010	3.4	2,472	3.4
Spinal cord injury	1,964	0.1	351	0.1	887	0.1
Stroke/Transient ischemic attack	10,819	0.6	1,929	0.7	3,683	0.5

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among enrollees with full enrollment in a commercial health plan for each full calendar year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of some comorbid conditions.
[d] The total denominator was calculated from UTI episodes identified each year among CDM enrollees in each annual cohort and then summed across the 10-year study period.
[e] Calculated among male enrollees only.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.6: 12-month frequency of urinary tract infections (UTI)[a] among adults with at least one UTI episode, Optum© Clinformatics® Data Mart, 2007 - 2015[b]

Demographic Characteristics		Mean (standard deviation) number of UTI episodes	Total N[c]	Number of UTI episodes					
				1[d]		2		3+	
				N[e]	%	N	%	N	%
Overall		1.4 (0.8)	1,698,266	1,253,045	73.8	305,460	18.0	139,761	8.2
Year	**2007**	1.4 (0.8)	194,341	143,344	73.8	35,309	18.2	15,688	8.1
	2008	1.4 (0.8)	199,838	146,590	73.4	36,680	18.4	16,568	8.3
	2009	1.4 (0.8)	198,032	145,140	73.3	36,057	18.2	16,835	8.5
	2010	1.4 (0.8)	197,755	144,057	72.8	36,767	18.6	16,931	8.6
	2011	1.4 (0.8)	197,399	143,001	72.4	36,902	18.7	17,496	8.9
	2012	1.4 (0.8)	198,758	144,322	72.6	36,979	18.6	17,457	8.8
	2013	1.4 (0.8)	168,351	121,891	72.4	31,395	18.6	15,065	8.9
	2014	1.4 (0.8)	167,859	121,345	72.3	31,445	18.7	15,069	9.0
	2015	1.3 (0.6)	175,933	143,355	81.5	23,926	13.6	8,652	4.9
Age (years)[f]	**18 to 24**	1.4 (0.7)	227,656	168,708	74.1	41,700	18.3	17,248	7.6
	25 to 34	1.3 (0.7)	349,328	264,403	75.7	60,655	17.4	24,270	6.9
	35 to 44	1.4 (0.7)	393,460	294,067	74.7	69,641	17.7	29,752	7.6
	45 to 54	1.4 (0.8)	409,122	300,979	73.6	73,432	17.9	34,711	8.5
	55 to 64	1.5 (0.9)	318,700	224,888	70.6	60,032	18.8	33,780	10.6
Gender	**Male**	1.2 (0.6)	166,726	140,965	84.5	18,382	11.0	7,379	4.4
	Female	1.4 (0.8)	1,531,540	1,112,080	72.6	287,078	18.7	132,382	8.6
Race/Ethnicity	**White**	1.4 (0.8)	986,339	719,949	73.0	180,479	18.3	85,911	8.7
	Black	1.4 (0.7)	145,224	109,966	75.7	24,919	17.2	10,339	7.1
	Hispanic	1.4 (0.7)	174,779	130,551	74.7	31,001	17.7	13,227	7.6
	Asian	1.3 (0.7)	51,740	40,133	77.6	8,410	16.3	3,197	6.2
	Missing	1.4 (0.8)	340,184	252,446	74.2	60,651	17.8	27,087	8.0
Region	**Northeast**	1.4 (0.7)	149,453	113,359	75.8	25,359	17.0	10,735	7.2
	Midwest	1.4 (0.8)	378,930	280,013	73.9	67,949	17.9	30,968	8.2
	South	1.4 (0.8)	840,697	618,929	73.6	151,784	18.1	69,984	8.3
	West	1.4 (0.8)	329,186	240,744	73.1	60,368	18.3	28,074	8.5
Household income (US dollars)	**<$40,000**	1.4 (0.8)	215,082	159,217	74.0	38,570	17.9	17,295	8.0
	$40,000 to $49,999	1.4 (0.8)	91,876	67,858	73.9	16,455	17.9	7,563	8.2
	$50,000 to $59,999	1.4 (0.8)	97,668	71,917	73.6	17,570	18.0	8,181	8.4
	$60,000 to $74,999	1.4 (0.8)	146,081	107,451	73.6	26,405	18.1	12,225	8.4
	$75,000 to $99,999	1.4 (0.8)	231,526	169,706	73.3	41,943	18.1	19,877	8.6
	≥$100,000	1.4 (0.8)	581,945	428,343	73.6	105,020	18.0	48,582	8.3
	Missing	1.4 (0.8)	334,088	248,553	74.4	59,497	17.8	26,038	7.8

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.

[b] Longitudinal cohorts created for each year among enrollees experiencing a UTI episode in that calendar year who were then enrolled for at least 12 months following the initial episode.

[c] The total denominator was calculated from UTI patients identified among CDM enrollees in each annual longitudinal cohort and then summed across the 9 longitudinal cohorts.

[d] This table displays row percents.

[e] Only UTI events occurring > 72 hours following the initial UTI claim for the previous UTI event were counted as distinct UTI events.

[f] Age and region were taken at the time the UTI occurred.

Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.7.1: Cumulative probability of recurrent urinary tract infection (UTI)[a] over 12 months among adults with a UTI, overall and by sociodemographic characteristics, Optum© Clinformatics® Data Mart, 2007 - 2015[b]

Demographic Characteristics		Total initial UTI episodes[c]	Cumulative Probability of Recurrent UTI (%)				
			1 months	3 months	6 months	9 months	12 months
Overall		1,698,266	5.8	11.7	18.1	23.1	27.2
Year	**2007**	194,341	5.8	11.5	17.6	22.3	26.2
	2008	199,838	5.6	11.4	17.6	22.6	26.6
	2009	198,032	5.7	11.6	17.8	22.6	26.7
	2010	197,755	5.8	11.7	18.0	22.9	27.2
	2011	197,399	5.8	11.9	18.4	23.4	27.6
	2012	198,758	5.9	11.9	18.3	23.3	27.4
	2013	168,351	5.8	11.7	18.3	23.4	27.6
	2014	167,859	5.9	11.9	18.5	23.6	27.7
	2015	175,933	5.8	12.1	18.8	23.8	27.8
Age (years)[d]	**18 - 24**	227,656	4.9	11.1	17.8	22.9	27.0
	25 - 34	349,328	5.0	10.5	16.6	21.3	25.1
	35 - 44	393,460	5.5	11.0	17.2	22.1	26.2
	45 - 54	409,122	6.1	12.0	18.3	23.3	27.4
	55 - 64	318,700	7.2	14.0	21.0	26.2	30.5
Gender	**Male**	166,726	5.3	9.0	12.0	14.1	15.9
	Female	1,531,540	5.8	12.0	18.8	24.0	28.4
Race/Ethnicity	**White**	986,339	6.1	12.2	18.7	23.8	27.9
	Black	145,224	5.0	10.2	16.3	21.0	25.0
	Hispanic	174,779	5.3	10.9	17.2	22.2	26.4
	Asian	51,740	5.4	10.3	15.7	19.9	23.3
Region	**Northeast**	149,453	5.4	10.7	16.6	21.2	25.0
	Midwest	378,930	5.7	11.7	18.1	23.0	27.1
	South	840,697	5.8	11.7	18.2	23.2	27.3
	West	329,186	6.0	12.1	18.7	23.8	27.9
Household income (US dollars)	**<$40,000**	215,082	5.5	11.3	17.9	22.9	27.0
	$40,000 to $49,999	91,876	5.5	11.4	17.9	22.8	27.0
	$50,000 to $59,999	97,668	5.8	11.7	18.2	23.2	27.3
	$60,000 to $74,999	146,081	5.9	11.9	18.2	23.2	27.3
	$75,000 to $99,999	231,526	5.9	12.0	18.5	23.5	27.6
	≥$100,000	581,945	6.0	11.9	18.3	23.3	27.4

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.

[b] Longitudinal cohorts created for each year among enrollees experiencing a UTI episode in that calendar year who were then enrolled for at least 12 months following the initial episode.

[c] The total denominator was calculated from UTI patients identified among CDM enrollees in each annual longitudinal cohort and then summed across the 9 longitudinal cohorts.

[d] Age, region, and income were taken at the time the UTI occurred.

Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.7.2: Cumulative probability of recurrent urinary tract infection (UTI)[a] over 12 months among adults with a UTI, overall and by medication use for initial UTI, Optum© Clinformatics® Data Mart, 2007 - 2015[b]

		Total initial UTI episodes[c]	Cumulative Probability of Recurrent UTI (%)				
			1 months	3 months	6 months	9 months	12 months
Overall		1,698,232	5.8	11.7	18.1	23.1	27.2
Anti-infectious agents[d]	**Quinolones**	597,923	2.0	4.0	6.6	9.0	11.4
	Urinary Anti-Infectives	276,622	2.4	4.8	7.8	10.3	12.8
	Sulfonamides	248,478	2.4	4.5	7.3	10.0	12.4
	Cephalosporins	52,447	2.5	4.6	7.2	9.2	11.4
	Penicillins	34,651	2.4	4.5	6.7	8.8	10.8
	Azoles	24,599	1.6	3.5	5.9	8.1	10.2
	Macrolides	17,689	1.2	2.4	4.2	5.8	7.4
	Tetracyclines	14,350	1.7	3.3	5.0	6.8	8.4
	Other[e]	1,964	1.6	3.9	6.3	7.7	9.3
	Combination therapy including an Azole[f]	89,645	6.3	13.6	21.8	28.2	33.4
	Combination therapy not including an Azole[f]	339,864	19.1	39.0	58.9	72.7	83.0
Medication duration (days)[g]	**1**	18,508	4.0	8.4	13.5	17.7	21.3
	2-3	202,412	5.3	10.9	17.2	22.1	26.2
	4-5	307,671	5.6	11.3	17.7	22.7	26.9
	6-7	683,016	6.0	12.2	18.7	23.7	27.8
	>7	486,625	5.8	11.8	18.2	23.0	27.0

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Longitudinal cohorts created for each year among enrollees experiencing a UTI episode in that calendar year who were then enrolled for at least 12 months following the initial episode.
[c] The total denominator was calculated from UTI patients identified among CDM enrollees in each annual longitudinal cohort and then summed across the 9 longitudinal cohorts.
[d] Based on American Hospital Formulary Service classes.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Combination therapy defined as two concurrent anti-infectives.
[g] For UTI episodes associated with two concurrent medications, the medication with the longer duration of the two medications was used.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.7.3: Cumulative probability of recurrent urinary tract infection (UTI)[a] over 12 months among adults with a UTI, overall and by comorbid conditions, Optum© Clinformatics® Data Mart, 2007 - 2015[b]

Comorbid Conditions[c]		Total initial UTI episodes[d]	Cumulative Probability of Recurrent UTI (%)				
			1 months	3 months	6 months	9 months	12 months
Overall		1,698,266	5.8	11.7	18.1	23.1	27.2
Benign prostatic hyperplasia[e]	**No**	146,210	4.7	7.9	10.5	12.5	14.1
	Yes	20,516	9.8	17.3	22.4	26.1	28.7
Chronic kidney disease	**No**	1,646,416	5.6	11.4	17.8	22.7	26.8
	Yes	51,850	10.4	20.3	28.9	35.0	39.8
Diabetes mellitus	**No**	1,565,551	5.7	11.5	17.8	22.7	26.8
	Yes	132,715	7.1	14.2	21.6	27.2	31.7
HIV/AIDS	**No**	1,695,667	5.8	11.7	18.1	23.1	27.2
	Yes	2,599	5.7	10.2	15.4	18.4	20.8
Ischemic heart disease	**No**	1,644,995	5.7	11.6	18.0	23.0	27.1
	Yes	53,271	7.6	14.6	21.5	26.7	30.9
Multiple sclerosis and transverse myelitis	**No**	1,687,994	5.8	11.7	18.1	23.0	27.1
	Yes	10,272	8.3	18.3	28.2	35.4	40.8
Prostate cancer[e]	**No**	161,424	5.2	8.8	11.7	13.8	15.6
	Yes	5,302	8.2	15.4	20.3	23.5	25.7
Spinal cord injury	**No**	1,696,452	5.8	11.7	18.1	23.0	27.1
	Yes	1,814	12.8	29.4	43.9	52.3	57.8
Stroke/Transient ischemic attack	**No**	1,688,199	5.8	11.7	18.1	23.0	27.1
	Yes	10,067	7.6	15.4	23.3	29.3	33.7

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Longitudinal cohorts created for each year among enrollees experiencing a UTI episode in that calendar year who were then enrolled for at least 12 months following the initial episode.
[c] Based on definitions from the CMS Chronic Conditions Data Warehouse.
[d] The total denominator was calculated from UTI patients identified among CDM enrollees in each annual longitudinal cohort and then summed across the 9 longitudinal cohorts.
[e] Calculated among male enrollees only.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.8: Total 12-month insurer expenditures on adults with a urinary tract infection (UTI)[a] for services with a primary diagnosis of UTI, Optum© Clinformatics® Data Mart, 2007 - 2015[b]

Demographic Characteristics		Overall[c]			Place of service			
					Physician office services		Outpatient hospital services	
		Total N	Total $[d]	PPPY	Total $	%[e]	Total $	%
Overall		1,698,266	$542,351,205	$319	$116,296,845	21.4	$355,792,394	65.6
Year	**2007**	194,341	$57,690,194	$297	$15,656,985	27.1	$34,114,810	59.1
	2008	199,838	$62,058,305	$311	$15,968,906	25.7	$38,058,511	61.3
	2009	198,032	$61,946,254	$313	$15,192,950	24.5	$37,341,354	60.3
	2010	197,755	$60,983,978	$308	$13,893,092	22.8	$38,950,311	63.9
	2011	197,399	$59,673,541	$302	$13,179,881	22.1	$39,023,351	65.4
	2012	198,758	$62,697,936	$315	$12,438,655	19.8	$42,801,286	68.3
	2013	168,351	$56,459,468	$335	$10,435,316	18.5	$40,143,528	71.1
	2014	167,859	$55,854,168	$333	$9,733,349	17.4	$39,954,013	71.5
	2015	175,933	$64,987,361	$369	$9,797,709	15.1	$45,405,230	69.9
Age (years)[f]	**18 to 24**	227,656	$89,177,671	$392	$14,544,001	16.3	$66,336,049	74.4
	25 to 34	349,328	$109,575,099	$314	$22,078,895	20.1	$74,922,933	68.4
	35 to 44	393,460	$120,462,796	$306	$26,443,863	22.0	$77,925,788	64.7
	45 to 54	409,122	$120,316,560	$294	$28,536,347	23.7	$74,353,016	61.8
	55 to 64	318,700	$102,819,079	$323	$24,693,738	24.0	$62,254,608	60.5
Gender	**Male**	166,726	$66,318,420	$398	$9,374,353	14.1	$46,090,307	69.5
	Female	1,531,540	$476,032,784	$311	$106,922,492	22.5	$309,702,087	65.1
Race/Ethnicity	**White**	986,339	$293,802,980	$298	$70,175,970	23.9	$186,588,190	63.5
	Black	145,224	$50,325,146	$347	$8,761,916	17.4	$36,063,125	71.7
	Hispanic	174,779	$71,358,900	$408	$11,765,853	16.5	$49,538,481	69.4
	Asian	51,740	$14,779,374	$286	$3,571,510	24.2	$8,701,690	58.9
	Missing	340,184	$112,084,805	$329	$22,021,596	19.6	$74,900,909	66.8
Region	**Northeast**	149,453	$44,777,658	$300	$11,265,576	25.2	$28,303,603	63.2
	Midwest	378,930	$104,531,019	$276	$22,105,360	21.1	$70,439,308	67.4
	South	840,697	$286,343,955	$341	$62,668,924	21.9	$191,853,324	67.0
	West	329,186	$106,698,574	$324	$20,256,985	19.0	$65,196,160	61.1
Household income (US dollars)	**<$40,000**	215,082	$84,980,457	$395	$13,518,962	15.9	$62,074,439	73.0
	$40,000 to $49,999	91,876	$33,281,192	$362	$6,057,253	18.2	$23,485,980	70.6
	$50,000 to $59,999	97,668	$33,409,832	$342	$6,475,106	19.4	$22,959,596	68.7
	$60,000 to $74,999	146,081	$45,767,232	$313	$9,990,610	21.8	$30,114,324	65.8
	$75,000 to $99,999	231,526	$69,861,964	$302	$16,206,645	23.2	$44,387,573	63.5
	≥$100,000	581,945	$157,777,060	$271	$42,043,327	26.6	$92,944,252	58.9
	Missing	334,088	$117,273,468	$351	$22,004,942	18.8	$79,826,230	68.1

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.

[b] Longitudinal cohorts created for each year among enrollees experiencing a UTI episode in that calendar year who were then enrolled for at least 12 months following the initial episode.

[c] The total denominator was calculated from UTI patients identified among CDM enrollees in each annual longitudinal cohort and then summed across the 9 longitudinal cohorts.

[d] All amounts are in 2017 US dollars and do not include medication-related costs.

[e] Percent columns display the percent of each row's total expenditures that was spent in that place of service.

[f] Age and region were taken at the time the UTI occurred.

Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table C.8 (continued): Total 12-month insurer expenditures on adults with a urinary tract infection (UTI)[a] for services with a primary diagnosis of UTI, Optum© Clinformatics® Data Mart, 2007 - 2015[b]

Demographic Characteristics		Overall[c]			Place of service					
					Emergency room services		Laboratory services		All other services	
		Total N	Total $[d]	PPPY	Total $	%	Total $	%	Total $	%
Overall		1,698,266	$542,351,205	$319	$7,127,587	1.3	$27,220,051	5.0	$35,914,328	6.6
Year	**2007**	194,341	$57,690,194	$297	$1,933,175	3.4	$3,261,831	5.7	$2,723,393	4.7
	2008	199,838	$62,058,305	$311	$1,063,053	1.7	$3,523,615	5.7	$3,444,221	5.5
	2009	198,032	$61,946,254	$313	$841,561	1.4	$3,608,828	5.8	$4,961,560	8.0
	2010	197,755	$60,983,978	$308	$617,783	1.0	$3,429,591	5.6	$4,093,200	6.7
	2011	197,399	$59,673,541	$302	$558,675	0.9	$3,356,565	5.6	$3,555,069	6.0
	2012	198,758	$62,697,936	$315	$654,791	1.0	$3,199,889	5.1	$3,603,315	5.7
	2013	168,351	$56,459,468	$335	$548,740	1.0	$2,265,310	4.0	$3,066,574	5.4
	2014	167,859	$55,854,168	$333	$476,210	0.9	$2,216,113	4.0	$3,474,483	6.2
	2015	175,933	$64,987,361	$369	$433,599	0.7	$2,358,310	3.6	$6,992,513	10.8
Age (years)[f]	**18 to 24**	227,656	$89,177,671	$392	$1,256,207	1.4	$3,249,990	3.6	$3,791,423	4.3
	25 to 34	349,328	$109,575,099	$314	$1,381,591	1.3	$5,426,652	5.0	$5,765,028	5.3
	35 to 44	393,460	$120,462,796	$306	$1,475,112	1.2	$6,281,567	5.2	$8,336,466	6.9
	45 to 54	409,122	$120,316,560	$294	$1,708,087	1.4	$6,648,619	5.5	$9,070,491	7.5
	55 to 64	318,700	$102,819,079	$323	$1,306,590	1.3	$5,613,223	5.5	$8,950,920	8.7
Gender	**Male**	166,726	$66,318,420	$398	$931,467	1.4	$2,738,868	4.1	$7,183,425	10.8
	Female	1,531,540	$476,032,784	$311	$6,196,120	1.3	$24,481,182	5.1	$28,730,902	6.0
Race/Ethnicity	**White**	986,339	$293,802,980	$298	$4,022,814	1.4	$15,350,782	5.2	$17,665,224	6.0
	Black	145,224	$50,325,146	$347	$643,074	1.3	$2,355,316	4.7	$2,501,715	5.0
	Hispanic	174,779	$71,358,900	$408	$485,480	0.7	$3,165,358	4.4	$6,403,728	9.0
	Asian	51,740	$14,779,374	$286	$184,496	1.2	$851,036	5.8	$1,470,643	10.0
	Missing	340,184	$112,084,805	$329	$1,791,723	1.6	$5,497,559	4.9	$7,873,018	7.0
Region	**Northeast**	149,453	$44,777,658	$300	$161,387	0.4	$3,374,886	7.5	$1,672,205	3.7
	Midwest	378,930	$104,531,019	$276	$3,200,286	3.1	$3,442,164	3.3	$5,343,902	5.1
	South	840,697	$286,343,955	$341	$2,675,326	0.9	$15,491,443	5.4	$13,654,938	4.8
	West	329,186	$106,698,574	$324	$1,090,588	1.0	$4,911,558	4.6	$15,243,282	14.3
Household income (US dollars)	**<$40,000**	215,082	$84,980,457	$395	$882,631	1.0	$2,963,009	3.5	$5,541,415	6.5
	$40,000 to $49,999	91,876	$33,281,192	$362	$447,512	1.3	$1,348,526	4.1	$1,941,921	5.8
	$50,000 to $59,999	97,668	$33,409,832	$342	$342,186	1.0	$1,477,080	4.4	$2,155,864	6.5
	$60,000 to $74,999	146,081	$45,767,232	$313	$607,520	1.3	$2,245,453	4.9	$2,809,325	6.1
	$75,000 to $99,999	231,526	$69,861,964	$302	$880,939	1.3	$3,678,727	5.3	$4,708,081	6.7
	≥$100,000	581,945	$157,777,060	$271	$2,020,425	1.3	$10,240,887	6.5	$10,528,169	6.7
	Missing	334,088	$117,273,468	$351	$1,946,375	1.7	$5,266,369	4.5	$8,229,553	7.0

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Longitudinal cohorts created for each year among enrollees experiencing a UTI episode in that calendar year who were then enrolled for at least 12 months following the initial episode.
[c] The total denominator was calculated from UTI patients identified among CDM enrollees in each annual longitudinal cohort and then summed across the 9 longitudinal cohorts.
[d] All amounts are in 2017 US dollars and do not include medication-related costs.
[e] Percent columns display the percent of each row's total expenditures that was spent in that place of service.
[f] Age and region were taken at the time the UTI occurred.
Source: Optum© de-identified Clinformatics® Data Mart Database, 2007-2016

Table M.1: Descriptive characteristics of annual cohorts of Medicare beneficiaries, overall and by year, 2007-2016[a]

Demographic Characteristics		Average (2007-2016)[b]	2007		2008		2009		2010		2011	
		%	N	%	N	%	N	%	N	%	N	%
Overall		100.0	554,906	100.0	565,203	100.0	570,841	100.0	582,517	100.0	610,164	100.0
Age (years)[c]	**65 to 69**	28.7	148,045	26.7	151,998	26.9	154,537	27.1	160,046	27.5	169,301	27.7
	70 to 74	24.2	126,279	22.8	129,573	22.9	133,601	23.4	137,872	23.7	146,397	24.0
	75 to 79	18.6	111,875	20.2	110,391	19.5	107,584	18.8	108,022	18.5	112,051	18.4
	80 to 84	14.2	86,611	15.6	88,810	15.7	89,008	15.6	88,890	15.3	91,536	15.0
	≥85	14.3	82,096	14.8	84,431	14.9	86,111	15.1	87,687	15.1	90,879	14.9
Gender	**Male**	37.8	192,703	34.7	198,879	35.2	203,465	35.6	210,744	36.2	225,320	36.9
	Female	62.2	362,203	65.3	366,324	64.8	367,376	64.4	371,773	63.8	384,844	63.1
Race/Ethnicity	**White**	85.9	470,462	84.9	480,791	85.2	484,899	85.0	493,962	84.9	518,269	85.1
	Black	7.6	45,287	8.2	44,284	7.8	44,427	7.8	45,371	7.8	47,145	7.7
	Asian	2.4	13,965	2.5	14,557	2.6	15,033	2.6	15,739	2.7	16,118	2.6
	Hispanic	2.2	14,601	2.6	14,570	2.6	15,018	2.6	15,274	2.6	15,545	2.6
	North American Native	0.4	2,355	0.4	2,411	0.4	2,416	0.4	2,467	0.4	2,504	0.4
	Other	1.5	7,578	1.4	7,955	1.4	8,438	1.5	8,893	1.5	9,283	1.5
	Missing	-	658	-	635	-	610	-	811	-	1,300	-
Region	**Northeast**	19.2	100,411	18.1	105,216	18.6	105,505	18.5	107,442	18.4	112,807	18.5
	Midwest	24.3	140,387	25.3	139,815	24.7	141,634	24.8	144,488	24.8	149,371	24.5
	South	38.8	219,681	39.6	222,865	39.4	224,981	39.4	228,722	39.3	240,016	39.3
	West	17.6	94,427	17.0	97,307	17.2	98,721	17.3	101,865	17.5	107,970	17.7
Medicare dual eligibility[d]	**Yes**	23.4	159,727	28.8	157,169	27.8	159,110	27.9	162,100	27.8	164,353	26.9
	No	76.6	395,179	71.2	408,034	72.2	411,731	72.1	420,417	72.2	445,811	73.1

[a] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.

[b] Averaged across the 10-year study period, weighted by annual study cohort population.

[c] Age and region taken on January 1 of each year.

[d] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.

Source: Centers for Medicare and Medicaid Services, 5% Denominator File, 2007-2016

Table M.1 (continued): Descriptive characteristics of annual cohorts of Medicare beneficiaries, overall and by year, 2007-2016[a]

Demographic Characteristics		Average (2007-2016)[b]	2013		2014		2015		2016	
		%	N	%	N	%	N	%	N	%
Overall		100.0	748,302	100.0	769,888	100.0	796,349	100.0	845,408	100.0
Age (years)[c]	**65 to 69**	28.7	218,066	29.1	227,416	29.5	243,123	30.5	264,871	31.3
	70 to 74	24.2	183,627	24.5	191,590	24.9	200,199	25.1	210,876	24.9
	75 to 79	18.6	136,497	18.2	141,463	18.4	145,137	18.2	154,090	18.2
	80 to 84	14.2	103,976	13.9	102,155	13.3	101,454	12.7	105,256	12.5
	≥85	14.3	106,136	14.2	107,264	13.9	106,436	13.4	110,315	13.0
Gender	**Male**	37.8	290,996	38.9	303,513	39.4	318,435	40.0	340,282	40.3
	Female	62.2	457,306	61.1	466,375	60.6	477,914	60.0	505,126	59.7
Race/Ethnicity	**White**	85.9	639,230	85.9	660,999	86.6	686,445	87.2	724,203	87.0
	Black	7.6	57,609	7.7	57,297	7.5	56,603	7.2	59,729	7.2
	Asian	2.4	17,135	2.3	16,087	2.1	15,474	2.0	17,869	2.1
	Hispanic	2.2	15,674	2.1	14,154	1.9	13,488	1.7	14,746	1.8
	North American Native	0.4	2,841	0.4	2,862	0.4	2,917	0.4	3,024	0.4
	Other	1.5	11,425	1.5	11,722	1.5	12,088	1.5	13,295	1.6
	Missing	-	4,388	-	6,767	-	9,334	-	12,542	-
Region	**Northeast**	19.2	147,213	19.7	153,434	19.9	160,416	20.1	170,244	20.1
	Midwest	24.3	183,291	24.5	185,322	24.1	187,093	23.5	198,632	23.5
	South	38.8	286,686	38.3	295,805	38.4	306,175	38.4	320,824	37.9
	West	17.6	131,112	17.5	135,327	17.6	142,665	17.9	155,708	18.4
Medicare dual eligibility[d]	**Yes**	23.4	160,939	21.5	151,838	19.7	143,879	18.1	152,714	18.1
	No	76.6	587,363	78.5	618,050	80.3	652,470	81.9	692,694	81.9

[a] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[b] Averaged across the 10-year study period, weighted by annual study cohort population.
[c] Age and region taken on January 1 of each year.
[d] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.
Source: Centers for Medicare and Medicaid Services, 5% Denominator File, 2007-2016

Table M.2.1: Prevalence (%) of urinary tract infections (UTI)[a] among Medicare beneficiaries, overall and by year, 2007-2016[b]

Demographic Characteristics		Average (2007-2016)[c]	2007			2008			2009		
		%	Total N	N with UTI	%	Total N	N with UTI	%	Total N	N with UTI	%
Overall		9.5	554,906	51,588	9.3	565,203	53,052	9.4	570,841	55,247	9.7
Age (years)[d]	**65 to 69**	6.8	148,045	9,723	6.6	151,998	10,184	6.7	154,537	10,727	6.9
	70 to 74	8.2	126,279	10,194	8.1	129,573	10,615	8.2	133,601	11,177	8.4
	75 to 79	10.0	111,875	10,900	9.7	110,391	10,640	9.6	107,584	10,768	10.0
	80 to 84	11.8	86,611	9,686	11.2	88,810	10,092	11.4	89,008	10,432	11.7
	≥85	14.3	82,096	11,085	13.5	84,431	11,521	13.6	86,111	12,143	14.1
Gender	**Male**	4.4	192,703	8,481	4.4	198,879	8,904	4.5	203,465	9,221	4.5
	Female	12.6	362,203	43,107	11.9	366,324	44,148	12.1	367,376	46,026	12.5
Race/Ethnicity	**White**	9.8	470,462	44,868	9.5	480,791	46,175	9.6	484,899	48,015	9.9
	Black	8.1	45,287	3,614	8.0	44,284	3,581	8.1	44,427	3,781	8.5
	Asian	6.4	13,965	834	6.0	14,557	919	6.3	15,033	988	6.6
	Hispanic	10.5	14,601	1,498	10.3	14,570	1,524	10.5	15,018	1,609	10.7
	North American Native	12.7	2,355	261	11.1	2,411	305	12.7	2,416	283	11.7
	Other	5.9	7,578	442	5.8	7,955	488	6.1	8,438	513	6.1
	Missing	4.8	658	71	10.8	635	60	9.4	610	58	9.5
Region	**Northeast**	8.1	100,411	8,031	8.0	105,216	8,537	8.1	105,505	8,609	8.2
	Midwest	9.2	140,387	12,588	9.0	139,815	12,644	9.0	141,634	13,307	9.4
	South	10.7	219,681	22,968	10.5	222,865	23,501	10.5	224,981	24,393	10.8
	West	8.9	94,427	8,001	8.5	97,307	8,370	8.6	98,721	8,938	9.1
Medicare dual eligibility[e]	**Yes**	12.8	159,727	19,582	12.3	157,169	19,956	12.7	159,110	20,819	13.1
	No	8.5	395,179	32,006	8.1	408,034	33,096	8.1	411,731	34,428	8.4

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year.
Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Averaged across the 10-year period, weighted by annual study cohort population.
[d] Age and region taken on January 1 of each year.
[e] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.2.1 (continued): Prevalence (%) of urinary tract infections (UTI)[a] among Medicare beneficiaries, overall and by year, 2007-2016[b]

Demographic Characteristics		Average (2007-2016)[c]	2010			2011			2013		
		%	Total N	N with UTI	%	Total N	N with UTI	%	Total N	N with UTI	%
Overall		9.5	582,517	56,926	9.8	610,164	59,711	9.8	748,302	70,484	9.4
Age (years)[d]	**65 to 69**	6.8	160,046	11,237	7.0	169,301	11,827	7.0	218,066	14,665	6.7
	70 to 74	8.2	137,872	11,483	8.3	146,397	12,239	8.4	183,627	14,806	8.1
	75 to 79	10.0	108,022	10,931	10.1	112,051	11,485	10.2	136,497	13,654	10.0
	80 to 84	11.8	88,890	10,576	11.9	91,536	10,913	11.9	103,976	12,201	11.7
	≥85	14.3	87,687	12,699	14.5	90,879	13,247	14.6	106,136	15,158	14.3
Gender	**Male**	4.4	210,744	9,548	4.5	225,320	10,129	4.5	290,996	12,767	4.4
	Female	12.6	371,773	47,378	12.7	384,844	49,582	12.9	457,306	57,717	12.6
Race/Ethnicity	**White**	9.8	493,962	49,254	10.0	518,269	51,873	10.0	639,230	61,868	9.7
	Black	8.1	45,371	4,058	8.9	47,145	4,042	8.6	57,609	4,620	8.0
	Asian	6.4	15,739	1,067	6.8	16,118	1,097	6.8	17,135	1,113	6.5
	Hispanic	10.5	15,274	1,594	10.4	15,545	1,719	11.1	15,674	1,636	10.4
	North American Native	12.7	2,467	323	13.1	2,504	301	12.0	2,841	363	12.8
	Other	5.9	8,893	564	6.3	9,283	590	6.4	11,425	679	5.9
	Missing	4.8	811	66	8.1	1,300	89	6.8	4,388	205	4.7
Region	**Northeast**	8.1	107,442	8,896	8.3	112,807	9,469	8.4	147,213	11,860	8.1
	Midwest	9.2	144,488	13,828	9.6	149,371	14,092	9.4	183,291	16,814	9.2
	South	10.7	228,722	24,846	10.9	240,016	26,156	10.9	286,686	30,042	10.5
	West	8.9	101,865	9,356	9.2	107,970	9,994	9.3	131,112	11,768	9.0
Medicare dual eligibility[e]	**Yes**	12.8	162,100	21,225	13.1	164,353	21,516	13.1	160,939	20,508	12.7
	No	8.5	420,417	35,701	8.5	445,811	38,195	8.6	587,363	49,976	8.5

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year.
Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Averaged across the 10-year period, weighted by annual study cohort population.
[d] Age and region taken on January 1 of each year.
[e] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.2.1 (continued): Prevalence (%) of urinary tract infections (UTI)[a] among Medicare beneficiaries, overall and by year, 2007-2016[b]

Demographic Characteristics		Average (2007-2016)[c]	2014			2015			2016		
		%	Total N	N with UTI	%	Total N	N with UTI	%	Total N	N with UTI	%
Overall		9.5	769,888	72,440	9.4	796,349	75,205	9.4	845,408	78,914	9.3
Age (years)[d]	**65 to 69**	6.8	227,416	15,099	6.6	243,123	16,336	6.7	264,871	17,489	6.6
	70 to 74	8.2	191,590	15,421	8.0	200,199	16,346	8.2	210,876	17,185	8.1
	75 to 79	10.0	141,463	14,274	10.1	145,137	14,544	10.0	154,090	15,404	10.0
	80 to 84	11.8	102,155	12,240	12.0	101,454	12,296	12.1	105,256	12,834	12.2
	≥85	14.3	107,264	15,406	14.4	106,436	15,683	14.7	110,315	16,002	14.5
Gender	**Male**	4.4	303,513	12,941	4.3	318,435	13,700	4.3	340,282	14,493	4.3
	Female	12.6	466,375	59,499	12.8	477,914	61,505	12.9	505,126	64,421	12.8
Race/Ethnicity	**White**	9.8	660,999	64,155	9.7	686,445	67,021	9.8	724,203	69,908	9.7
	Black	8.1	57,297	4,545	7.9	56,603	4,361	7.7	59,729	4,664	7.8
	Asian	6.4	16,087	983	6.1	15,474	964	6.2	17,869	1,103	6.2
	Hispanic	10.5	14,154	1,416	10.0	13,488	1,383	10.3	14,746	1,529	10.4
	North American Native	12.7	2,862	367	12.8	2,917	414	14.2	3,024	412	13.6
	Other	5.9	11,722	698	6.0	12,088	655	5.4	13,295	757	5.7
	Missing	4.8	6,767	276	4.1	9,334	407	4.4	12,542	541	4.3
Region	**Northeast**	8.1	153,434	12,264	8.0	160,416	12,606	7.9	170,244	13,341	7.8
	Midwest	9.2	185,322	16,864	9.1	187,093	16,988	9.1	198,632	18,339	9.2
	South	10.7	295,805	31,441	10.6	306,175	32,871	10.7	320,824	33,961	10.6
	West	8.9	135,327	11,871	8.8	142,665	12,740	8.9	155,708	13,273	8.5
Medicare dual eligibility[e]	**Yes**	12.8	151,838	19,323	12.7	143,879	18,658	13.0	152,714	19,230	12.6
	No	8.5	618,050	53,117	8.6	652,470	56,547	8.7	692,694	59,684	8.6

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year.
Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Averaged across the 10-year period, weighted by annual study cohort population.
[d] Age and region taken on January 1 of each year.
[e] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.2.2: Prevalence (%) of urinary tract infections (UTI)[a] among Medicare beneficiaries, overall and by year and gender, 2007-2016[b]

Demographic Characteristics		Average (2007-2016)[c]			2007			2008			2009		
		Overall[d]	Gender		Overall	Gender		Overall	Gender		Overall	Gender	
			Male	Female		Male	Female		Male	Female		Male	Female
Overall		9.5	4.4	12.6	9.3	4.4	11.9	9.4	4.5	12.1	9.7	4.5	12.5
Age (years)[e]	65 to 69	6.8	2.8	9.6	6.6	2.9	9.2	6.7	3.0	9.4	6.9	3.0	9.8
	70 to 74	8.2	3.7	11.4	8.1	3.6	10.9	8.2	3.9	11.0	8.4	3.8	11.4
	75 to 79	10.0	4.9	13.2	9.7	4.9	12.2	9.6	4.8	12.2	10.0	5.0	12.8
	80 to 84	11.8	6.2	14.6	11.2	5.9	13.4	11.4	6.1	13.6	11.7	6.3	14.1
	≥85	14.3	8.3	16.3	13.5	8.1	15.1	13.6	8.2	15.3	14.1	8.3	15.8
Race/Ethnicity	White	9.8	4.3	13.0	9.5	4.3	12.3	9.6	4.4	12.4	9.9	4.4	13.0
	Black	8.1	5.6	9.4	8.0	5.6	9.0	8.1	5.5	9.2	8.5	6.1	9.6
	Asian	6.4	3.2	8.4	6.0	3.1	7.8	6.3	3.0	8.4	6.6	3.6	8.5
	Hispanic	10.5	5.5	13.5	10.3	5.3	13.2	10.5	5.8	13.2	10.7	5.6	13.7
	North American Native	12.7	5.4	17.0	11.1	4.2	14.9	12.7	5.4	16.8	11.7	5.4	15.3
	Other	5.9	3.0	8.6	5.8	3.1	8.0	6.1	3.2	8.6	6.1	3.1	8.7
	Missing	4.8	2.4	8.2	10.8	7.6	12.1	9.4	-	11.0	9.5	9.9	9.3
Region	Northeast	8.1	4.2	10.2	8.0	4.5	9.7	8.1	4.5	9.9	8.2	4.3	10.1
	Midwest	9.2	4.1	12.2	9.0	4.2	11.4	9.0	4.2	11.6	9.4	4.3	12.1
	South	10.7	4.8	14.2	10.5	4.8	13.4	10.5	4.9	13.6	10.8	5.0	14.1
	West	8.9	4.0	12.2	8.5	3.7	11.5	8.6	4.0	11.6	9.1	4.2	12.2
Medicare dual eligibility[f]	Yes	12.8	6.8	15.5	12.3	6.6	14.6	12.7	6.9	15.1	13.1	7.0	15.6
	No	8.5	3.8	11.6	8.1	3.7	10.7	8.1	3.7	10.7	8.4	3.8	11.2

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Averaged across the 10-year period, weighted by annual study cohort population.
[d] Cells based on an N of 10 or fewer were suppressed due to lack of reliability.
[e] Age and region taken on January 1 of each year.
[f] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.2.2 (continued): Prevalence (%) of urinary tract infections (UTI)[a] among Medicare beneficiaries, overall and by year and gender, 2007-2016[b]

Demographic Characteristics		Average (2007-2016)[c]			2010			2011			2013		
		Overall[d]	Gender		Overall	Gender		Overall	Gender		Overall	Gender	
			Male	Female		Male	Female		Male	Female		Male	Female
Overall		9.5	4.4	12.6	9.8	4.5	12.7	9.8	4.5	12.9	9.4	4.4	12.6
Age (years)[e]	65 to 69	6.8	2.8	9.6	7.0	3.1	9.9	7.0	2.9	10.0	6.7	2.8	9.6
	70 to 74	8.2	3.7	11.4	8.3	3.7	11.5	8.4	3.8	11.6	8.1	3.7	11.3
	75 to 79	10.0	4.9	13.2	10.1	4.8	13.1	10.2	4.9	13.4	10.0	4.8	13.4
	80 to 84	11.8	6.2	14.6	11.9	6.4	14.4	11.9	6.3	14.6	11.7	6.1	14.8
	≥85	14.3	8.3	16.3	14.5	8.4	16.3	14.6	8.3	16.5	14.3	8.4	16.4
Race/Ethnicity	White	9.8	4.3	13.0	10.0	4.4	13.1	10.0	4.4	13.3	9.7	4.3	13.1
	Black	8.1	5.6	9.4	8.9	6.5	10.1	8.6	5.8	9.9	8.0	5.5	9.3
	Asian	6.4	3.2	8.4	6.8	3.5	8.8	6.8	3.4	9.0	6.5	3.0	8.7
	Hispanic	10.5	5.5	13.5	10.4	5.5	13.4	11.1	6.0	14.1	10.4	5.8	13.4
	North American Native	12.7	5.4	17.0	13.1	5.1	17.5	12.0	4.7	16.1	12.8	5.1	17.3
	Other	5.9	3.0	8.6	6.3	3.1	9.1	6.4	2.8	9.5	5.9	2.9	8.7
	Missing	4.8	2.4	8.2	8.1	5.6	9.5	6.8	4.1	9.1	4.7	2.4	8.0
Region	Northeast	8.1	4.2	10.2	8.3	4.4	10.2	8.4	4.4	10.5	8.1	4.3	10.4
	Midwest	9.2	4.1	12.2	9.6	4.2	12.5	9.4	4.2	12.4	9.2	4.2	12.3
	South	10.7	4.8	14.2	10.9	4.9	14.3	10.9	4.9	14.4	10.5	4.7	14.1
	West	8.9	4.0	12.2	9.2	4.3	12.4	9.3	4.2	12.7	9.0	4.1	12.4
Medicare dual eligibility[f]	Yes	12.8	6.8	15.5	13.1	7.1	15.7	13.1	6.8	15.9	12.7	6.7	15.5
	No	8.5	3.8	11.6	8.5	3.8	11.5	8.6	3.8	11.6	8.5	3.9	11.7

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Averaged across the 10-year period, weighted by annual study cohort population.
[d] Cells based on an N of 10 or fewer were suppressed due to lack of reliability.
[e] Age and region taken on January 1 of each year.
[f] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.2.2 (continued): Prevalence (%) of urinary tract infections (UTI)[a] among Medicare beneficiaries, overall and by year and gender, 2007-2016[b]

Demographic Characteristics		Average (2007-2016)[c]			2014			2015			2016		
		Overall[d]	Gender		Overall	Gender		Overall	Gender		Overall	Gender	
			Male	Female		Male	Female		Male	Female		Male	Female
Overall		9.5	4.4	12.6	9.4	4.3	12.8	9.4	4.3	12.9	9.3	4.3	12.8
Age (years)[e]	65 to 69	6.8	2.8	9.6	6.6	2.7	9.6	6.7	2.6	9.8	6.6	2.6	9.6
	70 to 74	8.2	3.7	11.4	8.0	3.6	11.4	8.2	3.6	11.6	8.1	3.5	11.7
	75 to 79	10.0	4.9	13.2	10.1	4.8	13.7	10.0	4.8	13.7	10.0	4.9	13.7
	80 to 84	11.8	6.2	14.6	12.0	5.9	15.4	12.1	6.4	15.5	12.2	6.2	15.8
	≥85	14.3	8.3	16.3	14.4	8.1	16.8	14.7	8.4	17.3	14.5	8.5	17.0
Race/Ethnicity	White	9.8	4.3	13.0	9.7	4.2	13.3	9.8	4.3	13.4	9.7	4.3	13.3
	Black	8.1	5.6	9.4	7.9	5.4	9.3	7.7	5.3	9.0	7.8	5.3	9.2
	Asian	6.4	3.2	8.4	6.1	3.0	8.0	6.2	3.1	8.3	6.2	3.0	8.2
	Hispanic	10.5	5.5	13.5	10.0	5.3	13.1	10.3	5.1	13.7	10.4	5.3	13.6
	North American Native	12.7	5.4	17.0	12.8	5.1	17.4	14.2	7.0	18.7	13.6	6.4	18.0
	Other	5.9	3.0	8.6	6.0	3.2	8.6	5.4	2.8	7.9	5.7	3.0	8.2
	Missing	4.8	2.4	8.2	4.1	2.1	7.2	4.4	2.3	7.8	4.3	2.1	8.0
Region	Northeast	8.1	4.2	10.2	8.0	4.2	10.4	7.9	4.0	10.3	7.8	4.0	10.3
	Midwest	9.2	4.1	12.2	9.1	3.9	12.4	9.1	4.0	12.4	9.2	4.1	12.7
	South	10.7	4.8	14.2	10.6	4.7	14.5	10.7	4.7	14.7	10.6	4.7	14.5
	West	8.9	4.0	12.2	8.8	3.9	12.2	8.9	4.1	12.4	8.5	3.8	11.9
Medicare dual eligibility[f]	Yes	12.8	6.8	15.5	12.7	6.7	15.6	13.0	6.8	16.0	12.6	6.5	15.6
	No	8.5	3.8	11.6	8.6	3.8	12.0	8.7	3.9	12.1	8.6	3.9	12.0

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Averaged across the 10-year period, weighted by annual study cohort population.
[d] Cells based on an N of 10 or fewer were suppressed due to lack of reliability.
[e] Age and region taken on January 1 of each year.
[f] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.3.1: Medication use for episodes of urinary tract infection (UTI)[a] occurring among Medicare beneficiaries, overall and by year, 2007-2016[b]

Anti-Infectious Agent[c]	Overall Prevalence from 2007 to 2016 (N=874,043)[d]		Year									
			2007 (N=76,622)		2008 (N=79,129)		2009 (N=83,501)		2010 (N=86,425)		2011 (N=91,225)	
	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%
Quinolones	364,104	41.7	36,258	47.3	36,645	46.3	36,789	44.1	37,488	43.4	37,905	41.6
Urinary Anti-infectives	160,261	18.3	13,221	17.3	13,819	17.5	15,594	18.7	16,179	18.7	17,739	19.4
Sulfonamides	134,860	15.4	12,538	16.4	12,966	16.4	13,647	16.3	13,578	15.7	14,017	15.4
Cephalosporins	93,272	10.7	4,808	6.3	5,399	6.8	6,257	7.5	7,333	8.5	8,802	9.6
Penicillins	43,437	5.0	3,476	4.5	3,629	4.6	3,825	4.6	4,077	4.7	4,399	4.8
Azoles	11,215	1.3	826	1.1	885	1.1	1,029	1.2	1,092	1.3	1,210	1.3
Macrolides	8,223	0.9	741	1.0	886	1.1	881	1.1	933	1.1	1,052	1.2
Tetracyclines	12,866	1.5	941	1.2	1,095	1.4	1,208	1.4	1,330	1.5	1,412	1.5
Other[e]	8,681	1.0	570	0.7	633	0.8	754	0.9	834	1.0	877	1.0
Combination Therapy[f]	37,124	4.2	3,243	4.2	3,172	4.0	3,517	4.2	3,581	4.1	3,812	4.2
Including Azoles	13,599	1.6	919	1.2	902	1.1	1,112	1.3	1,227	1.4	1,344	1.5
Not Including Azoles	23,525	2.7	2,324	3.0	2,270	2.9	2,405	2.9	2,354	2.7	2,468	2.7

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.3.1 (continued): Medication use for episodes of urinary tract infection (UTI)[a] occurring among Medicare beneficiaries, overall and by year, 2007-2016[b]

Anti-Infectious Agent[c]	Overall Prevalence from 2007 to 2016 (N=874,043)[d]		Year							
			2013 (N=107,795)		2014 (N=111,389)		2015 (N=116,265)		2016 (N=121,692)	
	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%
Quinolones	364,104	41.7	44,621	41.4	45,238	40.6	46,358	39.9	42,802	35.2
Urinary Anti-infectives	160,261	18.3	18,612	17.3	19,943	17.9	21,082	18.1	24,072	19.8
Sulfonamides	134,860	15.4	16,617	15.4	16,810	15.1	16,595	14.3	18,092	14.9
Cephalosporins	93,272	10.7	12,614	11.7	13,618	12.2	15,559	13.4	18,882	15.5
Penicillins	43,437	5.0	5,569	5.2	5,747	5.2	6,019	5.2	6,696	5.5
Azoles	11,215	1.3	1,487	1.4	1,499	1.3	1,550	1.3	1,637	1.3
Macrolides	8,223	0.9	990	0.9	885	0.8	951	0.8	904	0.7
Tetracyclines	12,866	1.5	1,523	1.4	1,626	1.5	1,751	1.5	1,980	1.6
Other[e]	8,681	1.0	1,232	1.1	1,154	1.0	1,329	1.1	1,298	1.1
Combination Therapy[f]	37,124	4.2	4,530	4.2	4,869	4.4	5,071	4.4	5,329	4.4
Including Azoles	13,599	1.6	1,720	1.6	2,013	1.8	2,091	1.8	2,271	1.9
Not Including Azoles	23,525	2.7	2,810	2.6	2,856	2.6	2,980	2.6	3,058	2.5

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.3.2: Medication use for episodes of urinary tract infection (UTI)[a] occurring among Medicare beneficiaries, overall and by age, 2007-2016[b]

Anti-Infectious Agent[c]	Overall Prevalence from 2007 to 2016 (N=874,043)[d]		Age (Years)[g]									
			65 to 69 (N=169,729)		70 to 74 (N=178,939)		75 to 79 (N=172,748)		80 to 84 (N=159,395)		≥85 (N=193,232)	
	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%
Quinolones	364,104	41.7	73,562	43.3	76,853	42.9	72,723	42.1	65,644	41.2	75,322	39.0
Urinary Anti-infectives	160,261	18.3	30,728	18.1	32,686	18.3	32,095	18.6	29,862	18.7	34,890	18.1
Sulfonamides	134,860	15.4	28,692	16.9	28,696	16.0	26,956	15.6	23,413	14.7	27,103	14.0
Cephalosporins	93,272	10.7	14,130	8.3	16,525	9.2	17,755	10.3	18,406	11.5	26,456	13.7
Penicillins	43,437	5.0	6,994	4.1	8,276	4.6	8,418	4.9	8,384	5.3	11,365	5.9
Azoles	11,215	1.3	2,585	1.5	2,614	1.5	2,233	1.3	1,818	1.1	1,965	1.0
Macrolides	8,223	0.9	1,668	1.0	1,733	1.0	1,588	0.9	1,388	0.9	1,846	1.0
Tetracyclines	12,866	1.5	2,183	1.3	2,485	1.4	2,568	1.5	2,437	1.5	3,193	1.7
Other[e]	8,681	1.0	1,294	0.8	1,406	0.8	1,585	0.9	1,737	1.1	2,659	1.4
Combination Therapy[f]	37,124	4.2	7,893	4.7	7,665	4.3	6,827	4.0	6,306	4.0	8,433	4.4
Including Azoles	13,599	1.6	4,181	2.5	3,471	1.9	2,463	1.4	1,822	1.1	1,662	0.9
Not Including Azoles	23,525	2.7	3,712	2.2	4,194	2.3	4,364	2.5	4,484	2.8	6,771	3.5

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
[g] Age was taken on January 1 of the year in which the UTI case occurred.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.3.3: Medication use for episodes of urinary tract infection (UTI)[a] occurring among Medicare beneficiaries, overall and by gender, 2007-2016[b]

Anti-Infectious Agent[c]	Overall Prevalence from 2007 to 2016 (N=874,043)[d]		Gender			
			Male (N=143,819)		Female (N=730,224)	
	N with Medication	%	N with Medication	%	N with Medication	%
Quinolones	364,104	41.7	68,309	47.5	295,795	40.5
Urinary Anti-infectives	160,261	18.3	14,633	10.2	145,628	19.9
Sulfonamides	134,860	15.4	23,169	16.1	111,691	15.3
Cephalosporins	93,272	10.7	16,037	11.2	77,235	10.6
Penicillins	43,437	5.0	8,733	6.1	34,704	4.8
Azoles	11,215	1.3	1,304	0.9	9,911	1.4
Macrolides	8,223	0.9	1,415	1.0	6,808	0.9
Tetracyclines	12,866	1.5	3,185	2.2	9,681	1.3
Other[e]	8,681	1.0	1,996	1.4	6,685	0.9
Combination Therapy[f]	37,124	4.2	5,038	3.5	32,086	4.4
Including Azoles	13,599	1.6	687	0.5	12,912	1.8
Not Including Azoles	23,525	2.7	4,351	3.0	19,174	2.6

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.3.4: Medication use for episodes of urinary tract infection (UTI)[a] occurring among Medicare beneficiaries, overall and by race/ethnicity, 2007-2016[b]

Anti-Infectious Agent[c]	Overall Prevalence from 2007 to 2016 (N=874,043)[d]		Race/Ethnicity													
			White (N=773,430)		Black (N=52,598)		Asian (N=12,459)		Hispanic (N=20,640)		North American Native (N=4,861)		Other (N=7,616)		Missing (N=2,439)	
	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%
Quinolones	364,104	41.7	319,662	41.3	22,567	42.9	6,291	50.5	9,049	43.8	1,871	38.5	3,544	46.5	1,120	45.9
Urinary Anti-infectives	160,261	18.3	144,521	18.7	7,607	14.5	1,994	16.0	3,622	17.5	845	17.4	1,253	16.5	419	17.2
Sulfonamides	134,860	15.4	118,318	15.3	9,507	18.1	1,490	12.0	3,223	15.6	789	16.2	1,170	15.4	363	14.9
Cephalosporins	93,272	10.7	82,938	10.7	5,406	10.3	1,068	8.6	2,199	10.7	733	15.1	692	9.1	236	9.7
Penicillins	43,437	5.0	38,496	5.0	2,615	5.0	705	5.7	949	4.6	200	4.1	365	4.8	107	4.4
Azoles	11,215	1.3	10,194	1.3	609	1.2	86	0.7	174	0.8	39	0.8	87	1.1	26	1.1
Macrolides	8,223	0.9	7,036	0.9	498	0.9	234	1.9	292	1.4	44	0.9	96	1.3	23	0.9
Tetracyclines	12,866	1.5	11,700	1.5	682	1.3	119	1.0	199	1.0	47	1.0	94	1.2	25	1.0
Other[e]	8,681	1.0	7,472	1.0	694	1.3	122	1.0	250	1.2	43	0.9	69	0.9	31	1.3
Combination Therapy[f]	37,124	4.2	33,093	4.3	2,413	4.6	350	2.8	683	3.3	250	5.1	246	3.2	89	3.6
Including Azoles	13,599	1.6	12,202	1.6	906	1.7	84	0.7	206	1.0	95	2.0	65	0.9	41	1.7
Not Including Azoles	23,525	2.7	20,891	2.7	1,507	2.9	266	2.1	477	2.3	155	3.2	181	2.4	48	2.0

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.3.5: Medication use for episodes of urinary tract infection (UTI)[a] occurring among Medicare beneficiaries, overall and by region, 2007-2016[b]

Anti-Infectious Agent[c]	Overall Prevalence from 2007 to 2016 (N=874,043)[d]		Region[g]							
			Northeast (N=136,805)		Midwest (N=206,387)		South (N=387,709)		West (N=143,142)	
	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%	N with Medication	%
Quinolones	364,104	41.7	58,110	42.5	86,655	42.0	158,173	40.8	61,166	42.7
Urinary Anti-infectives	160,261	18.3	25,799	18.9	35,600	17.2	72,483	18.7	26,379	18.4
Sulfonamides	134,860	15.4	20,384	14.9	34,279	16.6	59,170	15.3	21,027	14.7
Cephalosporins	93,272	10.7	13,431	9.8	22,967	11.1	40,105	10.3	16,769	11.7
Penicillins	43,437	5.0	7,690	5.6	10,090	4.9	19,015	4.9	6,642	4.6
Azoles	11,215	1.3	1,345	1.0	2,422	1.2	5,787	1.5	1,661	1.2
Macrolides	8,223	0.9	1,505	1.1	1,780	0.9	3,559	0.9	1,379	1.0
Tetracyclines	12,866	1.5	1,914	1.4	2,789	1.4	6,575	1.7	1,588	1.1
Other[e]	8,681	1.0	1,578	1.2	1,750	0.8	4,154	1.1	1,199	0.8
Combination Therapy[f]	37,124	4.2	5,049	3.7	8,055	3.9	18,688	4.8	5,332	3.7
Including Azoles	13,599	1.6	1,229	0.9	2,700	1.3	7,793	2.0	1,877	1.3
Not Including Azoles	23,525	2.7	3,820	2.8	5,355	2.6	10,895	2.8	3,455	2.4

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
[g] Region was taken on January 1 of each year.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.3.6: Medication use for episodes of urinary tract infection (UTI)[a] occurring among Medicare beneficiaries, overall and by Medicare dual eligibility, 2007-2016[b]

Anti-Infectious Agent[c]	Overall Prevalence from 2007 to 2016 (N=874,043)[d]		Medicare Dual Eligibility[g]			
			Yes (N=283,637)		No (N=590,406)	
	N with Medication	%	N with Medication	%	N with Medication	%
Quinolones	364,104	41.7	110,053	38.8	254,051	43.0
Urinary Anti-infectives	160,261	18.3	48,420	17.1	111,841	18.9
Sulfonamides	134,860	15.4	43,716	15.4	91,144	15.4
Cephalosporins	93,272	10.7	33,513	11.8	59,759	10.1
Penicillins	43,437	5.0	15,680	5.5	27,757	4.7
Azoles	11,215	1.3	3,556	1.3	7,659	1.3
Macrolides	8,223	0.9	3,320	1.2	4,903	0.8
Tetracyclines	12,866	1.5	4,336	1.5	8,530	1.4
Other[e]	8,681	1.0	5,560	2.0	3,121	0.5
Combination Therapy[f]	37,124	4.2	15,483	5.5	21,641	3.7
Including Azoles	13,599	1.6	4,036	1.4	9,563	1.6
Not Including Azoles	23,525	2.7	11,447	4.0	12,078	2.0

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Based on American Hospital Formulary Service classes.
[d] The total denominator was calculated from UTI episodes identified each year among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Defined as two concurrent anti-infectives.
[g] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.4: Duration of medication use among Medicare beneficiaries with urinary tract infections (UTI)[a], 2007-2016[b]

Demographic Characteristics		Mean (standard deviation) medication duration in days from 2007-2016 (N=873,915)[c]	Medication duration (days)									
			1		2 to 3		4 to 5		6 to 7		> 7	
			N	%[d]	N	%	N	%	N	%	N	%
Overall		9.4 (9.6)	11,464	1.3	55,851	6.4	132,628	15.2	344,670	39.4	329,302	37.7
Year	**2007**	9.3 (8.4)	1,051	1.4	5,239	6.8	11,490	15.0	28,877	37.7	29,958	39.1
	2008	9.3 (8.6)	1,082	1.4	5,190	6.6	11,700	14.8	30,073	38.0	31,081	39.3
	2009	9.5 (9.2)	1,166	1.4	5,148	6.2	12,382	14.8	31,769	38.1	33,020	39.6
	2010	9.5 (9.4)	1,174	1.4	5,417	6.3	12,450	14.4	33,037	38.2	34,335	39.7
	2011	9.5 (9.5)	1,234	1.4	5,604	6.1	13,436	14.7	35,396	38.8	35,542	39.0
	2013	9.4 (9.7)	1,403	1.3	7,040	6.5	16,269	15.1	42,682	39.6	40,383	37.5
	2014	9.3 (9.9)	1,422	1.3	7,218	6.5	17,157	15.4	44,901	40.3	40,671	36.5
	2015	9.4 (10.1)	1,486	1.3	7,402	6.4	18,273	15.7	47,194	40.6	41,896	36.0
	2016	9.4 (10.6)	1,446	1.2	7,593	6.2	19,471	16.0	50,741	41.7	42,416	34.9
Age (years)[e]	**65 to 69**	9.3 (9.2)	1,775	1.0	11,500	6.8	25,703	15.1	65,358	38.5	65,381	38.5
	70 to 74	9.5 (9.8)	1,841	1.0	11,507	6.4	26,574	14.9	69,905	39.1	69,097	38.6
	75 to 79	9.5 (9.9)	1,961	1.1	10,676	6.2	26,129	15.1	67,897	39.3	66,058	38.2
	80 to 84	9.5 (9.9)	2,234	1.4	9,935	6.2	24,256	15.2	63,064	39.6	59,880	37.6
	≥85	9.1 (9.2)	3,653	1.9	12,233	6.3	29,966	15.5	78,446	40.6	68,886	35.7
Gender	**Male**	9.9 (8.2)	1,736	1.2	5,954	4.1	15,279	10.6	49,993	34.8	70,835	49.3
	Female	9.3 (9.9)	9,728	1.3	49,897	6.8	117,349	16.1	294,677	40.4	258,467	35.4
Race/Ethnicity	**White**	9.5 (9.8)	10,236	1.3	48,865	6.3	118,013	15.3	304,988	39.4	291,209	37.7
	Black	8.5 (6.9)	828	1.6	3,777	7.2	7,563	14.4	21,066	40.1	19,359	36.8
	Asian	8.7 (7.5)	66	0.5	896	7.2	2,042	16.4	4,777	38.3	4,677	37.5
	Hispanic	9.2 (8.1)	166	0.8	1,254	6.1	2,731	13.2	8,068	39.1	8,419	40.8
	North American Native	9.3 (8.9)	72	1.5	285	5.9	669	13.8	1,809	37.2	2,025	41.7
	Other	9.1 (9.0)	71	0.9	585	7.7	1,218	16.0	2,977	39.1	2,765	36.3
	Missing	8.6 (7.6)	25	1.0	189	7.7	392	16.1	985	40.4	848	34.8

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.

[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.

[c] The total denominator was calculated from UTI episodes identified each year among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period, excluding 2012.

[d] This table displays row percents.

[e] Age and region taken on January 1 of each year.

[f] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.

[g] Based on American Hospital Formulary Service classes.

[h] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.

[i] Combination therapy defined as two concurrent anti-infectives. For UTI episodes associated with two concurrent medications, the medication with the longer duration of the two medications was used.

Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.4 (continued): Duration of medication use among Medicare beneficiaries with urinary tract infections (UTI)[a], 2007-2016[b]

Demographic Characteristics		Mean (standard deviation) medication duration in days from 2007-2016 (N=873,915)[c]	Medication duration (days)									
			1		2 to 3		4 to 5		6 to 7		> 7	
			N	%[d]	N	%	N	%	N	%	N	%
Region	Northeast	8.9 (9.8)	2,236	1.6	11,365	8.3	24,645	18.0	56,478	41.3	42,050	30.7
	Midwest	9.3 (9.5)	3,170	1.5	13,183	6.4	31,135	15.1	80,614	39.1	78,246	37.9
	South	9.6 (9.5)	4,720	1.2	21,502	5.5	52,688	13.6	152,186	39.3	156,565	40.4
	West	9.4 (9.9)	1,338	0.9	9,801	6.8	24,160	16.9	55,392	38.7	52,441	36.6
Medicare dual eligibility[f]	Yes	8.9 (7.7)	6,357	2.2	18,184	6.4	40,229	14.2	110,204	38.9	108,554	38.3
	No	9.6 (10.4)	5,107	0.9	37,667	6.4	92,399	15.7	234,466	39.7	220,748	37.4
Anti-infectious agent class[g]	Quinolones	7.6 (4.1)	2,356	0.6	29,668	8.1	67,633	18.6	148,039	40.7	116,408	32.0
	Urinary Anti-infectives	13.0 (15.2)	1,216	0.8	3,143	2.0	15,497	9.7	72,739	45.4	67,666	42.2
	Sulfonamides	9.1 (8.7)	781	0.6	10,996	8.2	19,495	14.5	50,440	37.4	53,148	39.4
	Cephalosporins	9.3 (9.1)	1,541	1.7	4,235	4.5	11,857	12.7	37,819	40.5	37,820	40.5
	Penicillins	8.8 (5.9)	937	2.2	1,465	3.4	4,434	10.2	16,015	36.9	20,586	47.4
	Azoles	6.0 (8.4)	3,361	30.0	2,621	23.4	1,333	11.9	1,709	15.2	2,191	19.5
	Macrolides	5.9 (5)	180	2.2	500	6.1	6,121	74.4	623	7.6	799	9.7
	Tetracyclines	11.9 (10.7)	127	1.0	197	1.5	804	6.2	3,846	29.9	7,892	61.3
	Other[h]	6.9 (6.4)	762	8.8	1,767	20.4	1,676	19.3	2,110	24.3	2,366	27.3
	Combination Therapy Including Azoles[i]	9.9 (8.4)	28	0.2	618	4.5	1,695	12.5	5,063	37.3	6,184	45.5
	Combination Therapy Not Including Azoles[i]	17.8 (19.7)	175	0.7	641	2.7	2,083	8.9	6,267	26.8	14,242	60.8

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.

[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.

[c] The total denominator was calculated from UTI episodes identified each year among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period, excluding 2012.

[d] This table displays row percents.

[e] Age and region taken on January 1 of each year.

[f] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.

[g] Based on American Hospital Formulary Service classes.

[h] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.

[i] Combination therapy defined as two concurrent anti-infectives. For UTI episodes associated with two concurrent medications, the medication with the longer duration of the two medications was used.

Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.5.1: Comorbidities among Medicare beneficiaries with urinary tract infection (UTI)[a], overall and by year, 2007-2016[b]

Comorbid Condition[c]	Overall Prevalence from 2007 to 2016 (N=573,567)[d]		Year							
			2007 (N=51,588)		2008 (N=53,052)		2009 (N=55,247)		2010 (N=56,926)	
	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%
Benign prostatic hyperplasia[e]	46,997	46.9	3,463	40.8	3,826	43.0	4,029	43.7	4,143	43.4
Chronic kidney disease	132,870	23.2	8,339	16.2	9,424	17.8	10,599	19.2	11,693	20.5
Diabetes mellitus	197,156	34.4	16,937	32.8	17,993	33.9	18,983	34.4	19,900	35.0
HIV/AIDS	331	0.1	27	0.1	25	0.0	28	0.1	29	0.1
Ischemic heart disease	199,254	34.7	18,883	36.6	19,318	36.4	20,203	36.6	20,619	36.2
Multiple sclerosis and transverse myelitis	3,340	0.6	230	0.4	273	0.5	278	0.5	308	0.5
Prostate cancer[e]	16,779	16.7	1,404	16.6	1,470	16.5	1,510	16.4	1,538	16.1
Spinal cord injury	2,520	0.4	131	0.3	143	0.3	150	0.3	168	0.3
Stroke/Transient ischemic attack	51,171	8.9	5,222	10.1	5,262	9.9	5,365	9.7	5,189	9.1

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of come comorbid conditions.
[d] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Calculated among male beneficiaries only.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.5.1 (continued): Comorbidities among Medicare beneficiaries with urinary tract infection (UTI)[a], overall and by year, 2007-2016[b]

Comorbid Condition[c]	Overall Prevalence from 2007 to 2016 (N=573,567)[d]		Year									
			2011 (N=59,711)		2013 (N=70,484)		2014 (N=72,440)		2015 (N=75,205)		2016 (N=78,914)	
	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%
Benign prostatic hyperplasia[e]	46,997	46.9	4,621	45.6	6,159	48.2	6,357	49.1	6,875	50.2	7,524	51.9
Chronic kidney disease	132,870	23.2	13,308	22.3	16,421	23.3	17,435	24.1	20,442	27.2	25,209	31.9
Diabetes mellitus	197,156	34.4	21,129	35.4	24,538	34.8	24,962	34.5	25,762	34.3	26,952	34.2
HIV/AIDS	331	0.1	31	0.1	41	0.1	44	0.1	51	0.1	55	0.1
Ischemic heart disease	199,254	34.7	21,487	36.0	24,116	34.2	24,249	33.5	24,487	32.6	25,892	32.8
Multiple sclerosis and transverse myelitis	3,340	0.6	353	0.6	428	0.6	430	0.6	479	0.6	561	0.7
Prostate cancer[e]	16,779	16.7	1,787	17.6	2,206	17.3	2,162	16.7	2,232	16.3	2,470	17.0
Spinal cord injury	2,520	0.4	202	0.3	225	0.3	227	0.3	426	0.6	848	1.1
Stroke/Transient ischemic attack	51,171	8.9	5,539	9.3	5,966	8.5	6,129	8.5	6,152	8.2	6,347	8.0

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of come comorbid conditions.
[d] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Calculated among male beneficiaries only.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.5.2: Comorbidities among Medicare beneficiaries with urinary tract infection (UTI)[a], overall and by age, 2007-2016[b]

Comorbid Condition[c]	Overall Prevalence from 2007 to 2016 (N=573,567)[d]		Age[e]									
			65 to 69 (N=117,287)		70 to 74 (N=119,466)		75 to 79 (N=112,600)		80 to 84 (N=101,270)		≥85 (N=122,944)	
	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%
Benign prostatic hyperplasia[f]	46,997	46.9	8,661	42.0	10,571	46.9	10,162	48.3	8,749	49.4	8,854	48.4
Chronic kidney disease	132,870	23.2	21,069	18.0	24,455	20.5	26,186	23.3	26,302	26.0	34,858	28.4
Diabetes mellitus	197,156	34.4	41,233	35.2	43,596	36.5	41,208	36.6	35,281	34.8	35,838	29.1
HIV/AIDS	331	0.1	155	0.1	82	0.1	52	0.0	27	0.0	15	0.0
Ischemic heart disease	199,254	34.7	29,763	25.4	37,102	31.1	40,916	36.3	40,803	40.3	50,670	41.2
Multiple sclerosis and transverse myelitis	3,340	0.6	1,391	1.2	879	0.7	563	0.5	322	0.3	185	0.2
Prostate cancer[f]	16,779	16.7	2,503	12.1	3,364	14.9	3,761	17.9	3,531	19.9	3,620	19.8
Spinal cord injury	2,520	0.4	447	0.4	482	0.4	462	0.4	492	0.5	637	0.5
Stroke/Transient ischemic attack	51,171	8.9	6,508	5.5	8,455	7.1	10,089	9.0	11,169	11.0	14,950	12.2

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of come comorbid conditions.
[d] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Age was taken on January 1 of the year in which the UTI case occurred.
[f] Calculated among male beneficiaries only.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.5.3: Comorbidities among Medicare beneficiaries with urinary tract infection (UTI)[a], overall and by gender, 2007-2016[b]

Comorbid Condition[c]	Overall Prevalence from 2007 to 2016 (N=573,567)[d]		Gender			
			Male (N=100,184)		Female (N=473,383)	
	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%
Benign prostatic hyperplasia[e]	46,997	46.9	46,997	46.9	N/A	N/A
Chronic kidney disease	132,870	23.2	33,268	33.2	99,602	21.0
Diabetes mellitus	197,156	34.4	40,214	40.1	156,942	33.2
HIV/AIDS	331	0.1	163	0.2	168	0.0
Ischemic heart disease	199,254	34.7	48,112	48.0	151,142	31.9
Multiple sclerosis and transverse myelitis	3,340	0.6	557	0.6	2,783	0.6
Prostate cancer[e]	16,779	16.7	16,779	16.7	N/A	N/A
Spinal cord injury	2,520	0.4	683	0.7	1,837	0.4
Stroke/Transient ischemic attack	51,171	8.9	10,593	10.6	40,578	8.6

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of come comorbid conditions.
[d] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Calculated among male beneficiaries only.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.5.4: Comorbidities among Medicare beneficiaries with urinary tract infection (UTI)[a], overall and by race/ethnicity, 2007-2016[b]

Comorbid condition[c]	Overall Prevalence from 2007 to 2016 (N=573,567)[d]		Race/Ethnicity							
			White (N=503,137)		Black (N=37,266)		Asian (N=9,068)		Hispanic (N=13,908)	
	N with Comorbidity[e]	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%
Benign prostatic hyperplasia[f]	46,997	46.9	39,637	46.8	3,657	42.8	1,028	58.1	1,506	53.5
Chronic kidney disease	132,870	23.2	111,487	22.2	13,003	34.9	2,225	24.5	3,660	26.3
Diabetes mellitus	197,156	34.4	160,759	32.0	19,649	52.7	4,476	49.4	7,665	55.1
HIV/AIDS	331	0.1	173	0.0	125	0.3	-	-	20	0.1
Ischemic heart disease	199,254	34.7	173,325	34.4	13,929	37.4	3,057	33.7	5,733	41.2
Multiple sclerosis and transverse myelitis	3,340	0.6	3,047	0.6	213	0.6	14	0.2	19	0.1
Prostate cancer[f]	16,779	16.7	13,842	16.3	2,012	23.5	203	11.5	387	13.8
Spinal cord injury	2,520	0.4	2,190	0.4	200	0.5	51	0.6	47	0.3
Stroke/Transient ischemic attack	51,171	8.9	43,128	8.6	5,317	14.3	667	7.4	1,273	9.2

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of come comorbid conditions.
[d] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Cells based on an N of 10 or fewer were suppressed due to lack of reliability.
[f] Calculated among male beneficiaries only.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.5.4 (continued): Comorbidities among Medicare beneficiaries with urinary tract infection (UTI)[a], overall and by race/ethnicity, 2007-2016[b]

Comorbid condition[c]	Overall Prevalence from 2007 to 2016 (N=573,567)[d]		Race/Ethnicity					
			North American Native (N=3,029)		Other (N=5,386)		Missing (N=1,773)	
	N with Comorbidity[e]	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%
Benign prostatic hyperplasia[f]	46,997	46.9	208	43.7	697	53.9	264	50.5
Chronic kidney disease	132,870	23.2	826	27.3	1,292	24.0	377	21.3
Diabetes mellitus	197,156	34.4	1,542	50.9	2,457	45.6	608	34.3
HIV/AIDS	331	0.1	-	-	-	-	-	-
Ischemic heart disease	199,254	34.7	1,006	33.2	1,756	32.6	448	25.3
Multiple sclerosis and transverse myelitis	3,340	0.6	-	-	31	0.6	-	-
Prostate cancer[f]	16,779	16.7	68	14.3	190	14.7	77	14.7
Spinal cord injury	2,520	0.4	-	-	21	0.4	-	-
Stroke/Transient ischemic attack	51,171	8.9	225	7.4	468	8.7	93	5.2

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of come comorbid conditions.
[d] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Cells based on an N of 10 or fewer were suppressed due to lack of reliability.
[f] Calculated among male beneficiaries only.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.5.5: Comorbidities among Medicare beneficiaries with urinary tract infection (UTI)[a] , overall and by region, 2007-2016[b]

Comorbid Condition[c]	Overall Prevalence from 2007 to 2016 (N=573,567)[d]		Region[e]							
			Northeast (N=93,613)		Midwest (N=135,464)		South (N=250,179)		West (N=94,311)	
	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%
Benign prostatic hyperplasia[f]	46,997	46.9	9,600	53.6	10,018	44.4	18,772	44.4	8,607	49.3
Chronic kidney disease	132,870	23.2	21,877	23.4	31,159	23.0	58,500	23.4	21,334	22.6
Diabetes mellitus	197,156	34.4	33,043	35.3	44,776	33.1	87,974	35.2	31,363	33.3
HIV/AIDS	331	0.1	83	0.1	36	0.0	173	0.1	39	0.0
Ischemic heart disease	199,254	34.7	35,642	38.1	45,815	33.8	89,923	35.9	27,874	29.6
Multiple sclerosis and transverse myelitis	3,340	0.6	747	0.8	933	0.7	1,020	0.4	640	0.7
Prostate cancer[f]	16,779	16.7	3,161	17.6	3,697	16.4	6,979	16.5	2,942	16.8
Spinal cord injury	2,520	0.4	432	0.5	526	0.4	1,157	0.5	405	0.4
Stroke/Transient ischemic attack	51,171	8.9	9,103	9.7	11,186	8.3	23,695	9.5	7,187	7.6

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of come comorbid conditions.
[d] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period, excluding 2012.
[e] Region was taken on January 1 of the year in which the UTI case occurred.
[f] Calculated among male beneficiaries only.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.5.6: Comorbidities among Medicare beneficiaries with urinary tract infection (UTI)[a], overall and by Medicare dual eligibility, 2007-2016[b]

Comorbid Condition[c]	Overall Prevalence from 2007 to 2016 (N=573,567)[d]		Medicare Dual Eligibility[e]			
			Yes (N=180,817)		No (N=392,750)	
	N with Comorbidity	%	N with Comorbidity	%	N with Comorbidity	%
Benign prostatic hyperplasia[f]	46,997	46.9	13,365	44.8	33,632	47.8
Chronic kidney disease	132,870	23.2	52,763	29.2	80,107	20.4
Diabetes mellitus	197,156	34.4	84,084	46.5	113,072	28.8
HIV/AIDS	331	0.1	197	0.1	134	0.0
Ischemic heart disease	199,254	34.7	75,931	42.0	123,323	31.4
Multiple sclerosis and transverse myelitis	3,340	0.6	1,378	0.8	1,962	0.5
Prostate cancer[f]	16,779	16.7	3,901	13.1	12,878	18.3
Spinal cord injury	2,520	0.4	1,022	0.6	1,498	0.4
Stroke/Transient ischemic attack	51,171	8.9	22,840	12.6	28,331	7.2

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Annual cohorts created for each year among beneficiaries with full enrollment in Parts A, B, and D for each full calendar year. Data from 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.
[c] Comorbidity definitions were based on definitions from the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of come comorbid conditions.
[d] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual cohort and then summed across the 10-year study period.
[e] Beneficiaries were considered to have dual eligibility in a calendar year if they were eligible during any month of that year.
[f] Calculated among male beneficiaries only.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.6: 12-month frequency of urinary tract infections (UTI)[a] among Medicare beneficiaries with at least one UTI episode, 2007-2015[b]

Demographic Characteristics		Mean (standard deviation) number of UTI episodes (N=413,103)[e]	Total N[c]	Number of UTI episodes					
				1[d]		2		3+	
				N	%	N	%	N	%
Total		1.8 (1.3)	413,103	238,628	57.8	93,397	22.6	81,078	19.6
Year	**2007**	1.8 (1.3)	48,821	29,060	59.5	10,913	22.4	8,848	18.1
	2008	1.8 (1.3)	50,379	29,632	58.8	11,223	22.3	9,524	18.9
	2009	1.8 (1.3)	52,296	30,344	58.0	11,855	22.7	10,097	19.3
	2010	1.8 (1.3)	54,353	31,442	57.8	12,315	22.7	10,596	19.5
	2013	1.8 (1.4)	66,646	38,268	57.4	15,086	22.6	13,292	19.9
	2014	1.8 (1.4)	68,427	38,926	56.9	15,522	22.7	13,979	20.4
	2015	1.9 (1.4)	72,181	40,956	56.7	16,483	22.8	14,742	20.4
Age (years)[f]	**65 to 69**	1.7 (1.2)	84,107	51,705	61.5	18,350	21.8	14,052	16.7
	70 to 74	1.8 (1.3)	86,231	51,100	59.3	19,278	22.4	15,853	18.4
	75 to 79	1.8 (1.4)	81,516	46,753	57.4	18,426	22.6	16,337	20.0
	80 to 84	1.9 (1.4)	73,215	40,664	55.5	16,734	22.9	15,817	21.6
	≥85	1.9 (1.4)	88,034	48,406	55.0	20,609	23.4	19,019	21.6
Gender	**Male**	1.7 (1.2)	69,973	45,421	64.9	13,803	19.7	10,749	15.4
	Female	1.9 (1.4)	343,130	193,207	56.3	79,594	23.2	70,329	20.5
Race/Ethnicity	**White**	1.8 (1.4)	362,141	206,608	57.1	82,556	22.8	72,977	20.2
	Black	1.7 (1.2)	26,721	17,088	63.9	5,582	20.9	4,051	15.2
	Asian	1.6 (1.1)	6,616	4,384	66.3	1,386	20.9	846	12.8
	Hispanic	1.8 (1.3)	10,283	6,044	58.8	2,296	22.3	1,943	18.9
	North American Native	1.9 (1.4)	2,222	1,204	54.2	516	23.2	502	22.6
	Other	1.7 (1.2)	3,904	2,502	64.1	817	20.9	585	15.0
	Missing	1.6 (1.2)	1,216	798	65.6	244	20.1	174	14.3
Region	**Northeast**	1.7 (1.3)	67,496	41,433	61.4	14,555	21.6	11,508	17.0
	Midwest	1.8 (1.3)	97,170	56,166	57.8	21,940	22.6	19,064	19.6
	South	1.9 (1.4)	180,362	101,547	56.3	41,406	23.0	37,409	20.7
	West	1.8 (1.3)	68,075	39,482	58.0	15,496	22.8	13,097	19.2
Medicare dual eligibility[g]	**Yes**	1.9 (1.4)	136,945	75,797	55.3	31,729	23.2	29,419	21.5
	No	1.8 (1.3)	276,158	162,831	59.0	61,668	22.3	51,659	18.7

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.

[b] Longitudinal cohorts created for each year among beneficiaries experiencing a UTI episode in that calendar year who were then continuously enrolled in Parts A, B, and D for at least 12 months following the initial episode. Cohorts for 2011 and 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in this year.

[c] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual longitudinal cohort and then summed across the 7 longitudinal cohorts.

[d] This table displays row percents.

[e] Only UTI events occurring > 72 hours following the initial UTI claim for the previous UTI event were counted as distinct UTI events.

[f] Age and region taken at the time the UTI occurred.

[g] Beneficiaries were considered to have dual eligibility in a 12-month period if they were eligible during any month of that period.

Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.7.1: Cumulative probability of a recurrent urinary tract infection (UTI)[a] over 12 months among Medicare beneficiaries with a UTI, overall and by sociodemographic characteristics, 2007-2015[b]

Demographic Characteristics		Total initial UTI episodes[c]	Cumulative probability of a recurrent UTI (%)				
			1 Month	3 Months	6 Months	9 Months	12 Months
Overall		413,103	9.5	19.8	29.6	36.6	42.2
Year	**2007**	48,821	9.0	19.1	28.4	35.1	40.4
	2008	50,379	9.1	18.9	28.6	35.6	41.1
	2009	52,296	9.5	19.8	29.4	36.4	41.9
	2010	54,353	9.7	19.8	29.7	36.6	42.1
	2013	66,646	9.5	19.8	29.8	36.9	42.5
	2014	68,427	9.6	20.2	30.3	37.5	43.0
	2015	72,181	9.8	20.4	30.5	37.6	43.2
Age (years)[d]	**65 to 69**	84,107	8.8	17.9	26.8	33.2	38.4
	70 to 74	86,231	9.4	19.1	28.5	35.3	40.7
	75 to 79	81,516	9.6	20.1	30.0	37.1	42.6
	80 to 84	73,215	10.0	21.0	31.5	38.7	44.4
	≥85	88,034	9.6	20.9	31.5	39.1	44.9
Gender	**Male**	69,973	9.6	18.5	25.8	31.1	35.0
	Female	343,130	9.4	20.0	30.4	37.8	43.6
Race/Ethnicity	**White**	362,141	9.7	20.2	30.2	37.3	42.9
	Black	26,721	7.4	16.0	24.6	30.9	36.0
	Asian	6,616	7.4	15.3	22.8	28.6	33.7
	Hispanic	10,283	8.5	18.6	28.5	35.5	41.1
	North American Native	2,222	9.8	20.8	32.3	40.2	45.8
	Other	3,904	8.5	16.3	24.9	31.4	35.9
	Missing	1,216	7.6	15.6	23.5	29.0	34.2
Region	**Northeast**	67,496	8.2	17.8	27.0	33.4	38.6
	Midwest	97,170	9.6	19.9	29.6	36.6	42.1
	South	180,362	9.9	20.4	30.7	37.9	43.6
	West	68,075	9.5	19.8	29.4	36.4	41.9
Medicare dual eligibility[e]	**Yes**	136,945	9.5	20.8	31.3	38.8	44.6
	No	276,158	9.5	19.3	28.8	35.5	41.0

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Longitudinal cohorts created for each year among beneficiaries experiencing a UTI episode in that calendar year who were then continuously enrolled in Parts A, B, and D for at least 12 months following the initial episode. Cohorts for 2011 and 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in these years.
[c] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual longitudinal cohort and then summed across the 7 longitudinal cohorts.
[d] Age and region taken at the time the UTI occurred.
[e] Beneficiaries were considered to have dual eligibility in a 12-month period if they were eligible during any month of that period.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.7.2: Cumulative probability of a recurrent urinary tract infection (UTI)[a] over 12 months among Medicare beneficiaries with a UTI, overall and by medication use for initial UTI, 2007-2015[b]

		Total initial UTI episodes[c]	Cumulative probability of a recurrent UTI (%)				
			1 Month	3 Months	6 Months	9 Months	12 Months
Overall		413,103	9.5	19.8	29.6	36.6	42.2
Anti-infectious agent class[d]	**Quinolones**	193,973	8.2	17.4	26.8	33.6	39.2
	Urinary Anti-infectives	67,205	11.8	23.5	34.3	41.8	47.5
	Sulfonamides	68,734	8.9	19.1	28.6	35.3	40.7
	Cephalosporins	35,792	11.5	23.7	34.3	41.4	46.8
	Penicillins	17,465	11.0	22.7	33.2	39.9	45.6
	Azoles	3,681	9.5	21.2	31.8	39.3	45.0
	Macrolides	3,966	6.0	13.2	21.5	28.0	32.7
	Tetracyclines	4,809	10.9	23.7	34.0	41.7	46.8
	Other[e]	2,447	17.5	30.3	41.0	48.3	53.5
	Combination Therapy - Including Azoles[f]	5,882	10.2	21.6	32.1	39.8	46.0
	Combination Therapy - Not Including Azoles[f]	9,149	10.2	22.7	34.4	41.6	47.7
Medication duration (days)[g]	**1**	3,256	10.3	20.7	30.1	37.4	43.2
	2 to 3	28,392	8.2	16.3	25.1	31.2	36.5
	4 to 5	66,408	8.6	17.9	27.0	33.9	39.3
	6-7	167,651	9.8	20.1	30.0	37.0	42.6
	>7	147,396	9.8	21.0	31.3	38.5	44.1

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Longitudinal cohorts created for each year among beneficiaries experiencing a UTI episode in that calendar year who were then continuously enrolled in Parts A, B, and D for at least 12 months following the initial episode. Cohorts for 2011 and 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in these years.
[c] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual longitudinal cohort and then summed across the 7 longitudinal cohorts.
[d] Based on American Hospital Formulary Service classes.
[e] Includes Aminoglycosides, Antifungal Antibiotics, Miscellaneous B-Lactam Antibiotics, Miscellaneous Antibiotics, Miscellaneous Antifungals.
[f] Combination therapy defined as two concurrent anti-infectives.
[g] For UTI episodes associated with two concurrent medications, the medication with the longer duration of the two medication was used.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.7.3: Cumulative probability of a recurrent urinary tract infection (UTI)[a] over 12 months among Medicare beneficiaries with a UTI, overall and by comorbid conditions, 2007-2015[b]

Comorbid Condition[c]		Total initial UTI episodes[d]	Cumulative probability of a recurrent UTI (%)				
			1 Month	3 Months	6 Months	9 Months	12 Months
Overall		413,103	9.5	19.8	29.6	36.6	42.2
Benign prostatic hyperplasia[e]	**No**	33,249	7.5	14.2	19.9	24.1	27.4
	Yes	36,724	11.5	22.4	31.1	37.3	42.0
Chronic kidney disease	**No**	291,409	8.7	18.0	27.0	33.4	38.5
	Yes	121,694	11.3	24.1	36.0	44.4	50.9
Diabetes mellitus	**No**	259,597	9.2	18.9	28.1	34.7	40.1
	Yes	153,506	10.0	21.3	32.2	39.9	45.7
HIV/AIDS	**No**	412,915	9.5	19.8	29.6	36.6	42.2
	Yes	188	9.6	21.8	31.9	38.8	42.6
Ischemic heart disease	**No**	243,689	8.8	18.2	27.4	33.8	39.0
	Yes	169,414	10.4	22.0	32.9	40.7	46.7
Multiple sclerosis and transverse myelitis	**No**	410,294	9.5	19.7	29.5	36.5	42.1
	Yes	2,809	13.0	28.8	41.0	51.4	58.5
Prostate cancer[e]	**No**	57,418	9.3	17.9	24.9	30.0	33.8
	Yes	12,555	10.9	21.3	30.0	36.1	40.8
Spinal cord injury	**No**	410,390	9.5	19.7	29.5	36.5	42.1
	Yes	2,713	13.3	27.9	42.2	52.7	59.2
Stroke/transient ischemic attack	**No**	359,639	9.2	19.1	28.5	35.3	40.6
	Yes	53,464	11.2	24.4	37.0	45.7	52.5

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Longitudinal cohorts created for each year among beneficiaries experiencing a UTI episode in that calendar year who were then continuously enrolled in Parts A, B, and D for at least 12 months following the initial episode. Cohorts for 2011 and 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in these years.
[c] All comorbidity definitions were based on the CMS Chronic Conditions Data Warehouse. For some conditions, the CMS Chronic Disease Data Warehouse suggests an observation period of 2+ years (CKD, diabetes, heart disease, HIV/AIDS, MS, spinal cord injury); however, given the nature of the annual cohorts, we were limited to a one-year observation period for all UTI patients. This may result in underestimation of some comorbidities.
[d] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual longitudinal cohort and then summed across the 7 longitudinal cohorts.
[e] Calculated among male beneficiaries only.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.8: Total 12-month insurer expenditures on Medicare beneficiaries with a urinary tract infection (UTI)[a] for services with a primary diagnosis of UTI, 2007-2015[b]

Demographic Characteristics		Overall[c]			Place of service			
					Physician services		Outpatient hospital services	
		Total N	Total $[d]	PPPY	Total $[e]	%	Total $	%
Overall		413,103	$113,536,149	$275	$28,570,410	25.2	$15,795,373	13.9
Calendar year	**2007**	48,821	$11,735,711	$240	$3,263,817	27.8	$1,356,083	11.6
	2008	50,379	$12,771,987	$254	$3,399,940	26.6	$1,542,185	12.1
	2009	52,296	$14,199,739	$272	$3,637,423	25.6	$1,790,305	12.6
	2010	54,353	$15,068,678	$277	$3,772,868	25.0	$1,953,912	13.0
	2013	66,646	$18,805,416	$282	$4,698,228	25.0	$2,814,149	15.0
	2014	68,427	$19,596,083	$286	$4,798,173	24.5	$3,066,879	15.7
	2015	72,181	$21,358,535	$296	$4,999,960	23.4	$3,271,862	15.3
Age (years)[f]	**65 to 69**	84,107	$18,341,347	$218	$5,549,844	30.3	$2,776,885	15.1
	70 to 74	86,231	$21,485,737	$249	$6,304,434	29.3	$3,241,719	15.1
	75 to 79	81,516	$22,565,920	$277	$6,124,051	27.1	$3,368,223	14.9
	80 to 84	73,215	$22,296,830	$305	$5,411,922	24.3	$2,930,574	13.1
	≥85	88,034	$28,846,315	$328	$5,180,158	18.0	$3,477,972	12.1
Gender	**Male**	69,973	$21,702,216	$310	$4,285,929	19.7	$3,585,824	16.5
	Female	343,130	$91,833,932	$268	$24,284,480	26.4	$12,209,549	13.3
Race/Ethnicity	**White**	362,141	$98,887,582	$273	$25,697,711	26.0	$13,571,029	13.7
	Black	26,721	$8,000,981	$299	$1,136,189	14.2	$1,147,767	14.3
	Asian	6,616	$1,602,486	$242	$547,396	34.2	$180,742	11.3
	Hispanic	10,283	$2,957,635	$288	$738,815	25.0	$396,581	13.4
	North American Native	2,222	$809,301	$364	$79,122	9.8	$316,273	39.1
	Other	3,904	$1,003,026	$257	$304,101	30.3	$140,939	14.1
	Missing	1,216	$275,139	$226	$67,076	24.4	$42,041	15.3
Region	**Northeast**	67,496	$19,382,771	$287	$4,684,180	24.2	$2,787,688	14.4
	Midwest	97,170	$26,189,471	$270	$5,273,728	20.1	$4,126,646	15.8
	South	180,362	$48,635,621	$270	$13,361,204	27.5	$6,314,006	13.0
	West	68,075	$19,328,286	$284	$5,251,297	27.2	$2,567,033	13.3
Medicare dual eligibility[g]	**Yes**	136,945	$45,455,103	$332	$6,899,376	15.2	$5,628,430	12.4
	No	276,158	$68,081,045	$247	$21,671,033	31.8	$10,166,943	14.9

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.
[b] Longitudinal cohorts created for each year among beneficiaries experiencing a UTI episode in that calendar year who were then continuously enrolled in Parts A, B, and D for at least 12 months following the initial episode. Cohorts for 2011 and 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in these years.
[c] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual longitudinal cohort and then summed across the 7 longitudinal cohorts.
[d] All amounts are in 2017 US dollars and do not include medication related costs.
[e] Percent columns display the percent of each row's total expenditures that was spent in that place of service.
[f] Age and region taken at the time the UTI occurred.
[g] Beneficiaries were considered to have dual eligibility in a 12-month period if they were eligible during any month of that period.
Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016

Table M.8 (continued): Total 12-month insurer expenditures on Medicare beneficiaries with a urinary tract infection (UTI)[a] for services with a primary diagnosis of UTI, 2007-2015[b]

Demographic Characteristics		Overall[c]			Place of Service					
					Emergency room services		Laboratory services		All other services	
		Total N	Total $[d]	PPPY	Total $	%[e]	Total $	%	Total $	%
Overall		413,103	$113,536,149	$275	$20,091,282	17.7	$21,375,502	18.8	$27,703,582	24.4
Calendar year	**2007**	48,821	$11,735,711	$240	$1,710,573	14.6	$2,554,827	21.8	$2,850,411	24.3
	2008	50,379	$12,771,987	$254	$1,831,938	14.3	$2,772,957	21.7	$3,224,967	25.3
	2009	52,296	$14,199,739	$272	$2,009,534	14.2	$3,051,839	21.5	$3,710,639	26.1
	2010	54,353	$15,068,678	$277	$2,262,885	15.0	$3,121,897	20.7	$3,957,115	26.3
	2013	66,646	$18,805,416	$282	$3,176,894	16.9	$3,598,890	19.1	$4,517,254	24.0
	2014	68,427	$19,596,083	$286	$4,067,825	20.8	$3,067,497	15.7	$4,595,709	23.5
	2015	72,181	$21,358,535	$296	$5,031,632	23.6	$3,207,595	15.0	$4,847,487	22.7
Age (years)[f]	**65 to 69**	84,107	$18,341,347	$218	$3,104,777	16.9	$3,328,988	18.2	$3,580,852	19.5
	70 to 74	86,231	$21,485,737	$249	$3,617,128	16.8	$3,920,110	18.2	$4,402,346	20.5
	75 to 79	81,516	$22,565,920	$277	$3,866,880	17.1	$4,186,614	18.6	$5,020,151	22.2
	80 to 84	73,215	$22,296,830	$305	$3,875,444	17.4	$4,272,711	19.2	$5,806,180	26.0
	≥85	88,034	$28,846,315	$328	$5,627,054	19.5	$5,667,078	19.6	$8,894,053	30.8
Gender	**Male**	69,973	$21,702,216	$310	$4,364,403	20.1	$3,579,046	16.5	$5,887,014	27.1
	Female	343,130	$91,833,932	$268	$15,726,879	17.1	$17,796,455	19.4	$21,816,569	23.8
Race/Ethnicity	**White**	362,141	$98,887,582	$273	$16,725,988	16.9	$19,073,385	19.3	$23,819,468	24.1
	Black	26,721	$8,000,981	$299	$2,140,393	26.8	$1,213,490	15.2	$2,363,143	29.5
	Asian	6,616	$1,602,486	$242	$254,170	15.9	$240,975	15.0	$379,202	23.7
	Hispanic	10,283	$2,957,635	$288	$615,258	20.8	$525,511	17.8	$681,470	23.0
	North American Native	2,222	$809,301	$364	$135,723	16.8	$98,182	12.1	$180,000	22.2
	Other	3,904	$1,003,026	$257	$166,804	16.6	$169,686	16.9	$221,495	22.1
	Missing	1,216	$275,139	$226	$52,946	19.2	$54,272	19.7	$58,804	21.4
Region	**Northeast**	67,496	$19,382,771	$287	$3,614,117	18.6	$3,394,622	17.5	$4,902,164	25.3
	Midwest	97,170	$26,189,471	$270	$4,618,533	17.6	$5,171,743	19.7	$6,998,820	26.7
	South	180,362	$48,635,621	$270	$8,258,924	17.0	$9,219,399	19.0	$11,482,088	23.6
	West	68,075	$19,328,286	$284	$3,599,708	18.6	$3,589,737	18.6	$4,320,510	22.4
Medicare dual eligibility[g]	**Yes**	136,945	$45,455,103	$332	$9,154,188	20.1	$8,451,343	18.6	$15,321,766	33.7
	No	276,158	$68,081,045	$247	$10,937,094	16.1	$12,924,158	19.0	$12,381,816	18.2

[a] Uncomplicated UTI only, defined as an outpatient claim with a UTI-related diagnosis code that was followed by a pharmacy claim for an anti-infectious agent within 72 hours.

[b] Longitudinal cohorts created for each year among beneficiaries experiencing a UTI episode in that calendar year who were then continuously enrolled in Parts A, B, and D for at least 12 months following the initial episode. Cohorts for 2011 and 2012 were excluded due to a one-time shift in the sources of enrollment data that resulted in poor enrollment matching in these years.

[c] The total denominator was calculated from UTI patients identified among Medicare beneficiaries in each annual longitudinal cohort and then summed across the 7 longitudinal cohorts.

[d] All amounts are in 2017 US dollars and do not include medication related costs.

[e] Percent columns display the percent of each row's total expenditures that was spent in that place of service.

[f] Age and region taken at the time the UTI occurred.

[g] Beneficiaries were considered to have dual eligibility in a 12-month period if they were eligible during any month of that period.

Source: Centers for Medicare and Medicaid Services, 5% Denominator, Parts A & B Outpatient, and Part D files, 2007-2016