National Institute of Diabetes and Digestive and Kidney Diseases

Urologic Diseases in America

2024

Urologic Diseases in America

ANNUAL DATA REPORT

Introduction and Methods

April 26, 2024

SPONSORED BY
National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)
National Institutes of Health (NIH)

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Acknowledgements

This year's *Urologic Diseases in America: Annual Data Report* was prepared in collaboration between Acumen, LLC and the contract sponsor, National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) of the National Institutes of Health (NIH). The NIDDK team composed of core members Kevin C. Abbott and Ziya Kirkali; as well as Kevin Friel, Melanie Hardy, Max Kimpson, and Ivonne Schulman.

Additional clinical urology contributions were coordinated by Acumen, LLC, led by Chad Ellimoottil (University of Michigan) and John P. Lavelle (Stanford University; Veterans Affairs Palo Alto, CA). The Acumen LLC team consisted of core members Kyle Buika, Po-Lun Chou, Myrna Cozen, Can Feng, John C. Hornberger, Sushant Joshi, Xiaofei Lai, Suraj Pant, and Lei Sandy Ye, with additional contributions from Yvonne Aubourg, Anqi Bu, Jiayue Chen, Tessa Davis, Natalia Derevnin, Johnathan Dinh, Paul Fanelli, Derek Fenson, Thomas Genova, Naomi Golin, Hanna Hassan, Zhiyuan Jiang, Gauri Kore, Sammy Murrell, Callie Richard, Rachel Rong, Nora Shepherd, Victoria Ta, Yiren Alan Wang, Chandler Xu, Jinjin Yu, Mandy Zhou, and many others.

Note

This document is one of the seven that collectively comprise the 2024 *Urologic Diseases in America: Annual Data Report (ADR)*. This document introduces the 2024 ADR and describes the methodology underlying the latest analyses on Benign Prostatic Hyperplasia and Associated Lower Urinary Tract Symptoms (BPH/LUTS); Urinary Stone Disease (USD); Urinary Incontinence (UI); Urologic Chronic Pelvic Pain Syndrome (UCPPS); Fournier's Gangrene (FG); and Healthcare Expenditures of Urologic Diseases. These analyses are available as separate documents on the UDA website. Additional details on the methodology and data sources are provided in Appendices A and B, respectively, that accompany this document.

Suggested citation

Urologic Diseases in America. 2024 UDA Data Report: Epidemiology of non-malignant urologic disease in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2024.

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Introduction and Methods

The Urologic Diseases in America (UDA) Annual Data Report (ADR) – herein in its fourth release since 2012 – is sponsored by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) of the National Institutes of Health (NIH). The primary audiences for the ADR are researchers, policy makers, patients, and clinicians. In review with NIDDK and its advisory panel, this ADR discusses gaps in existing epidemiological data and provides suggestions for future investigations. The first ADR was published in 2012, with a second release (or addendum) in 2018 and a fully updated third release in 2023. The 2012 ADR included cancerous and non-cancerous urologic diseases. The subsequent releases (including this one) excluded cancerous diseases, which are reported by the National Cancer Institute (NCI).[1] This latest release builds and expands upon the 2023 edition.

The current ADR's primary aim is to document epidemiological trends of benign urologic diseases in the past decade among Americans, including trends in management and resource use for four common urologic diseases: benign prostatic hyperplasia and associated lower urinary tract symptoms (BPH/LUTS), urinary stone disease (USD), urinary incontinence (UI), and urologic chronic pelvic pain syndrome (UCPPS). In addition, this ADR includes findings on Fournier's gangrene (FG), a rare but life-threatening condition, for the first time. UCPPS is also featured and expanded on for the first time since 2012.

This ADR employs a retrospective study design using claims or encounter data from four separate sources. This study cohort includes persons aged 18 and older residing in the United States. The age 18-64 cohort data are from a private insurer's claims data and Medicaid data. The age 65 and older cohort data are primarily from Medicare fee-for-service (FFS) claims and Medicare Advantage (MA) encounter data. Analyses based on MA and Medicaid data are featured for the first time in the ADR. This ADR study spans the years 2012 to 2021 or their subperiods.

The reported measures include disease/condition prevalence, incidence, comorbidities, utilization of diagnostic tests, prescription drugs filled, procedures used (surgery and other non-pharmaceutical treatments), and resource utilization for these disorders. The analyses are stratified by age groups, gender, reported race, dual Medicare/Medicaid eligibility status (age 65 and older), and geographic regions. This ADR includes additional retrospective follow-up outcomes related to BPH/LUTS and USD that were unexplored last year or in prior editions. Further, this ADR includes findings on healthcare expenditures, documenting Medicare FFS expenditure patterns for BPH/LUTS, USD, UI, and UCPPS among the age 65 and older cohort.

This ADR is organized as follows. The rest of this document summarizes the data sources and methods used (section 1), summarizes the measures reported in the study (section 2), provides an overview of the analytical approach (section 3), and highlights the characteristics of the cohorts (section 4). Additional details of the methodology and data sources are provided in Appendices A and B, respectively, that accompany this document. Drawing on the methodology described in this

document, this ADR reports findings for each of the five urologic conditions (BPH/LUTS, USD, UI, UCPPS, and FG) and healthcare expenditures, all available as six separate links on the UDA website. All associated data tables and charts are also available online on the NIH UDA website.[2]

1 Data sources

This ADR includes cohorts captured in four data sources: adults age 65 and older primarily drawn from (1) Medicare FFS and (2) MA data from the Centers for Medicare & Medicaid Services (CMS), and adults age 18 to 64 from (3) Optum's de-identified Clinformatics® Data Mart Database (CDM) and (4) CMS's Medicaid data.[3] All of the data sources used below identified claims or encounter data only, and did not contain any information from the medical record.

➔ Medicare FFS data

The data include information on enrollment status, demographics, inpatient stays, outpatient services, home health care, skilled nursing facilities care, hospice care, pharmacy (Part D data), and reimbursements.

➔ Medicare Advantage data

The data include information on enrollment status, demographics, inpatient stays, outpatient services, home health care, skilled nursing facilities care, professional services, and pharmacy (Part D data).

➔ CDM data

The data consist of private insurer paid claims that include information on plan member eligibility status, demographics, inpatient stays, outpatient services, pharmacy, and reimbursements.

➔ Medicaid data

The data include information on demographics, eligibility, inpatient, long-term care, and other services.

➔ Years of data

For this ADR, FFS and CDM data span the years 2012-2021. MA data span 2015-2021 and Medicaid data span 2016-2021. The interval of analysis is annual.

These data sources have been used extensively for clinical, epidemiologic, health services/outcomes, and economics research, with the strengths and limitations of using these data sources discussed in the literature (see Appendix A). Appendix B provides more details on the data files used. In the context of this ADR, Appendix A also describes general limitations relevant to interpreting the findings herein.

2 Brief summary of measures

This ADR reports prevalence and incidence of selected diseases, comorbidities, use of diagnostic tests, prescription drugs filled, utilization of procedures (including surgery and other non-pharmaceutical treatments), utilization of healthcare services, and healthcare expenditures. This section provides an overview of these outcomes. Diagnoses, testing, and procedures were identified by Healthcare Common Procedure Coding System (HCPCS) and International Classification of Diseases (ICD) codes as detailed in Appendix A section A.1.

Table 1 shows how prevalence and incidence are defined:

Table 1. Prevalence and Incidence

Measure	Description
Period prevalence	Number and percentage of eligible persons in the cohort who had recorded the disease or condition during a given period of time, specifically over each calendar year.
Incidence	Number and percentage of persons who had recorded a qualifying diagnosis for a given urological disease each year, and did not have a previous diagnosis for the given disease in claims in a lookback period of 36 months relative to any given incident month in the year. This does not ensure persons have not been diagnosed before the earliest date of the lookback period, but it is considered among the most feasible methods when using claims data.[4] Persons who have not had a claims code for a particular diagnosis for a prolonged interval have a reasonable likelihood of having incident (new) disease. The implications of different lookback periods have been discussed in the literature.[5]

➔ Prevalent versus incident cohorts

After using the above two definitions to identify patients with our diseases of interest (see Appendix A for more details), we formed two cohorts: "prevalent cohort" and "incident cohort." These cohorts were used for the remaining measures. For purposes of writing clarity, we may refer to the incident cohort as patients who are "newly identified" and the recording of incident diagnosis on claims as "incident diagnosis" or "initial diagnosis."

For prevalence and comorbidities (except urinary retention), cohorts from all four aforementioned data sources were studied. For all other metrics based on the prevalent cohort, only the Medicare FFS and CDM data were used for age 65 and older and age 18-64 (40-64 for BPH), respectively. For all metrics based on the incident cohort, our study focuses solely on the age 65 and

older cohort based on Medicare FFS data. This is due to the greater availability of longitudinal data from Medicare FFS, allowing for tracking of patients' follow-up over a period of one year or longer.

Table 2 shows metrics used and their descriptions.

Table 2. Metrics and Descriptions

Metric	Description
Comorbidities	For the prevalent cohort, we report the number and percentage of patients with each disease or condition who were also identified by one of the selected comorbidities (a coexisting condition). We report the proportion of patients with each comorbidity by disease and age group. For the 2015 incident cohort with BPH/LUTS aged 65 and older, we further report the following metrics: percentage of patients recorded with urinary retention (UR) within 4 and 5 years of incident diagnosis; percentages of patients who underwent a BPH procedure within a year of recording UR (by procedure type), among patients who were recorded with UR within 4 years; and the average time from recording of UR to BPH procedure.
Diagnostic tests	For the incident cohort, we report the number and percentage of patients who had a claim for a qualifying diagnostic test within 3 months prior and 12 months after the month of initial diagnosis, to capture diagnostic tests that may be related to the diagnosis. For the 2015 incident cohort with USD, we further report the following metrics: imaging procedure rates within 3 months and 5 years after recording of initial diagnosis; for each imaging procedure category, the number and the percentage of patients with 0, 1, 2, 3-4, 5-9, 10-19, and 20+ imaging procedures; and the number of procedures (by type) in year month since initial diagnosis (years 1-5).

Metric	Description
Prescription drugs	For the prevalent cohort of persons aged 65 and older, we counted the number of patients recorded with the disease who were also fully enrolled in Medicare Part D by year. We then report the number and percentage of them who filled at least one prescription in any of the identified relevant pharmacologic classes, and for each individual pharmacologic class. We applied a similar analysis for the prevalent cohort of persons aged 18-64; no Part-D-like restriction is needed as each enrollee is covered for both medical services and prescription drugs. For the incident cohort, we computed the number and percentage of patients with incident disease aged 65 and older who filled any disease-related prescriptions, the percentage shares of first filled prescriptions by type, and the average number of months from initial diagnosis to first filled prescription by type; all within 5 years after initial diagnosis (for incident year 2015). For the 2015 incident cohort with BPH/LUTS aged 65 and older, we report the percentage on combination therapy (defined by the use of alpha blockers and 5-alpha-reductase inhibitors simultaneously) within 5 years after initial diagnosis; and the distribution of these patients by month since initial diagnosis (0-60).
Procedures	For the prevalent cohort and each disease entity included in the ADR, the number and percentage of patients receiving any disease-related procedures are reported. Further, the number and percentage of patients receiving each major procedure type are reported. For the incident cohort aged 65 and older, we computed the number and percentage of patients with incident disease who underwent any disease-related procedure, the percentage shares of first procedures by type, and the average number of months from initial diagnosis to first procedure by type; all within 5 years after initial diagnosis (for incident year 2015). For the 2015 incident cohort aged 65 and older with BPH/LUTS or with USD, we repeat the computation in the previous paragraph with a 4-year (56 months for USD) follow-up window instead. Building on that, we report procedure retreatment rates within 2 years (120 days for USD) of first procedure (by retreatment procedure type); and the average time to retreatment.

Metric	Description
Utilization of healthcare services	We report four main service utilization outcomes for the incident cohort aged 65 and older: 1. Evaluation and Management (E&M) visits; 2. Emergency Department (ED) visits, 3. Hospitalization – observation, 4. Hospitalization - inpatient. E&M visits are defined as outpatient visits or other non-institutional health services visits with any diagnosis of the disease. ED visits are defined based on visits with primary diagnosis of the disease. Stays can be distinguished as observation only (either as outpatient or inpatient) or non-observation (all of which are inpatient hospital). Both types of stays are based on those with primary diagnosis of the disease. We report the percentage of incident patients with ED visits within 12 months after initial diagnosis. The same method used to report ED visits was also used to report inpatient-hospital stays and observation stays. We also report the number of E&M visits, ED visits, inpatient hospital stays, and observation stays on a per-person–per-year basis. For the 2015 incident cohort aged 65 and older with BPH/LUTS, we further report the following metrics: percentage of patients who had an E&M visit within 5 years of initial diagnosis, and among them, the percentage who visited a urologist; percentage of patients who had a urologist visit after an initial visit with primary care physicians (PCPs) within the same follow-up window; the percentage of patients with incident BPH/LUTS who had a urologist visit within 3 years of initial diagnosis, and among them, the percentage who had a BPH procedure within two years after the urologist visit. For the 2015 incident cohort aged 65 and older with USD, we further report the percentage of patients who had an ED or PCP visit within 3 years of initial diagnosis, and among them, the percentage who visited a urologist within the following 2 years. For this cohort, we also report the percentage of patients who had an ED visit within 1 and 5 years after the initial diagnosis, and the percentage of patients with 0, 1, 2, 3, and 4+ ED visits within 1 year/5 years after recording of initial diagnosis.

Metric	Description
Healthcare expenditures	For the prevalent cohort aged 65 and older, we report Medicare FFS expenditures (in nominal dollars) with primary diagnosis of the disease annually. Expenditures per patient per year, and total annual expenditures stratified by sites of service are also reported. Sites of service include inpatient services, emergency department (ED) services, outpatient services (including hospital outpatient and ambulatory surgical centers), physicians' office services, and all other services. For the incident cohort aged 65 and older, we report Medicare FFS expenditures (in nominal dollars) with primary diagnosis of the disease for persons with incident disease within 12 months after initial diagnosis. Expenditures are also reported on a per-person-per-year basis.
Mortality	For the incident cohort (age 65+) with Fournier's gangrene, we report the number and percentage of patients who died within 5 years of initial diagnosis.

➔ Stratification variables

Measures were stratified based on the variables shown in Table 3, with possible modified groupings:

Table 3. Variables and Descriptions

Variable	Description
Age groups	For Medicare FFS and MA data, age groups comprise 65-69, 70-74, 75-79, 80-84, and 85 or above. For CDM and Medicaid data, age groups comprise 18-24, 25-34, 35-44, 45-54, 55-64, and 65+(Medicaid only). For BPH/LUTS, CDM and Medicaid age groups start at 40 (40-44, 45-49, 50-54, 55-59, 60-64, 65+[Medicaid only]). Comorbidity data are stratified into two age groups for both Medicare (65-74 and 75+) and CDM (18-54 and 55-64; 40-54 and 55-64 for BPH/LUTS) data, and three age groups for Medicaid (18-54, 55-64, and 65+; 40-54, 55-64, and 65+ for BPH/LUTS) data.
Gender	Male or female
Geographic regions	The United States is grouped into four regions corresponding to those used by the US Census Bureau: Northeast, Midwest, South, and West.[6]

Variable	Description
Race	For Medicare FFS and MA data, race categories include White, Black, Hispanic, North American Native, Asian, Other, and Missing. For Medicaid data, race categories include White, Black, Hispanic, American Indian/Alaska Native, Asian, Hawaiian/Pacific Islander, and Missing. For CDM data, race categories include White, Black, Hispanic, Asian, and Missing.
Dual-eligibility status (Medicare only)	Persons with low income who are eligible for enrollment in both Medicare and Medicaid.[7]

3 Analyses summary

Appendix A provides details on analytical methods, including cohort and claims selection criteria (A.1), analytic approach and computations (A.2), validation methods (A.3), and general limitations (A.4). In summary, we used all claims across Medicare FFS, MA, and Medicaid settings or CDM diagnosis files for the years of interest, including a set of data restrictions in the process. For each person, we looked for occurrence of any of the specified medical conditions within a defined time window, and then recorded the person counts where these conditions are met. We then counted the occurrences of the outcomes described in the previous subsection, either within the same time window or a follow-up window, at the annual interval. We either divided these counts annually by the total count of the cohort, or by the total count of persons (prevalent or incident cohort) recorded with the disease of interest. As a result, most of our descriptive statistics are in the form of raw estimates such as total counts/percentages. The analyses were conducted in SAS version 15.2.

4 Cohort composition

4.1 Age 65 years and older

➔ **Overall trends**

This age group includes two cohorts, those in Medicare FFS and those enrolled in MA plans. The size of the Medicare FFS cohort increased from 24.4 million in 2012 to 25.6 million in 2019, and declined to 24.5 million in 2021. The smaller cohort size seen in 2021 has been attributed to the ongoing, well-documented trend toward higher proportion of eligible adults enrolling in MA (Part C) plans and to mortality effects of the COVID-19 pandemic that greatly affected older adults. Between 2012 and 2021, women comprised an annual average of 56% of the cohort. About 10% of the cohort were dually eligible for Medicare and Medicaid in 2021.

In contrast, the size of the MA cohort increased from 13.6 million in 2015 to 21.6 million in 2021. Among men, the size of the cohort increased from 5.8 million in 2015 to 9.3 million in 2021. Among women, the size of the cohort increased from 7.8 million to 12.3 million between 2015 and 2021.

Between 2015 and 2021, women comprised an annual average of 57% of the cohort. About 21% of the cohort were dually-eligible in 2021.

➔ Comparison with national data

The Medicare FFS cohort had more persons identifying as White compared to the proportion reported in 2021 US Census data for adults age 65 and older.[8] Specifically, persons identifying as White comprised 85.4% of the Medicare FFS cohort, compared with 75.1% of the national population in the same age group. 6.3% of the Medicare FFS cohort were persons identifying as Black, versus 9.5% of the national population, and persons identifying as Asian, Hispanic, and North American Natives comprised 2.1%, 1.5%, and 0.4% of the cohort; and 4.8%, 9.0%, and 0.6%, of the national population, respectively.

For the MA cohort, persons identifying as White comprised 76.4% compared with 75.1% of the national population in the same age group. Persons identifying as Black comprised 11.8% of the MA cohort versus 9.5% of the national population, and persons identifying as Asian, Hispanic, and North American Natives comprised 3.4%, 3.7%, and 0.2% of the cohort, and 4.8%, 9.0%, and 0.6% of the national population, respectively.

4.2 Age 18 to 64 years

➔ Overall trends

This age group includes two cohorts. The first includes privately insured individuals aged 18 to 64. The second includes Medicaid beneficiaries aged 18 and older.[9] The size of the privately insured cohort increased from 6.1 million in 2012 to 6.3 million in 2017, and then decreased to 5.6 million in 2021. The trends were the same regardless of gender. On average, during 2012-2021, the gender composition of this younger cohort was evenly balanced.

The size of the Medicaid cohort increased from 23.3 million in 2016 to 36.2 million in 2021.[10] Among men, the size of the cohort increased from 9.0 million in 2016 to 14.6 million in 2021. Among women, the size of the cohort increased from 14.2 million in 2016 to 21.6 million in 2021. Between 2016 and 2021, women comprised an annual average of 61% of the cohort.

➔ Comparison with national data

The privately insured cohort also had more persons identifying as White compared to the proportion reported in 2021 US Census data for adults aged 18-64 (64% versus 59%). Persons identifying as Black, Hispanic, or Asian comprised 8.6%, 12%, and 5.3%, compared to 13%, 19%, and 6.4% of the national population, respectively.

The Medicaid cohort had fewer persons identifying as White compared to the proportion reported in 2021 US Census data for adults aged 18-64 (38% versus 59%). Persons identifying as Black, Hispanic,

or Asian comprised 19.2%, 25.1%, and 5.0%, compared to 13%, 19%, and 6.4% of the national population, respectively.[11]

Appendix A: Methodological Details

This methodology appendix describes the analytic approach used in this ADR. The first subsection (A.1) describes the cohort and claims selection criteria for the prevalent and incident cohorts behind all metrics. The second subsection (A.2) provides additional details on the analytic process behind the computations of metrics. The third subsection (A.3) discusses validation methods used in the computation process. The fourth subsection (A.4) summarizes the limitations of the methodology. This appendix also discusses refinements and expansions in methodological approach relative to previous ADRs where relevant.

A.1 Cohort and claims selection criteria

Most summary statistics in this ADR rely on either the prevalent cohort or the incident cohort for a disease of interest. The prevalent cohort denotes persons who have a disease or condition in a given year. The incident cohort denotes persons who are newly identified with a urologic disease during a period of interest, among those without disease diagnosis in a lookback window. This subsection describes the computation process to draw these cohorts.

To identify a patient cohort, the process was the following: (1) use all claims/plan records across Medicare fee-for-service (FFS), Medicare Advantage (MA), and Medicaid settings; and Optum's de-identified Clinformatics® Data Mart Database (CDM) diagnosis files across years of interest, (2) for every person, look for occurrences of any of the specified medical conditions within a defined time window, and (3) record the person count where these conditions are met.

➔ Restrictions to data

For all analyses, the Medicare FFS, MA, Medicaid, and CDM data were subject to a number of restrictions. The Medicare FFS data contained the following restrictions: continuous Parts A and B enrollment in each year, age 65+, no Part C enrollment, and residence in the United States (50 states plus the District of Columbia). The MA data included persons continuously enrolled in Part C in each year, age 65+, and residence in the United States (50 states plus the District of Columbia). The Medicaid data contained the following restrictions: full continuous enrollment in each year, no dual enrollment in Medicare, and age 18+ (40+ for BPH/LUTS analysis). In the Medicaid analysis, Maryland, Florida, and Utah were excluded for 2016-2017, 2017-2018, and 2016, respectively, due to data reliability issues in those state-years.[12] CDM data were restricted to persons with full annual enrollment in a commercial health plan, aged 18-64 (40-64 for BPH/LUTS analysis), and residence in the United States (50 states plus the District of Columbia).

➔ Prevalent cohort

To identify a cohort of persons with specified medical conditions, a clinician-defined list of qualifying diagnosis codes (International Classification of Diseases [ICD]-9/10 diagnosis [DGN]) or procedure codes (ICD-9/10 procedure [PRC]), Current Procedural Terminology (CPT) codes, and Healthcare

Common Procedure Coding System (HCPCS) codes were compiled. For Medicare FFS and MA data, eligible claims/plan records to evaluate these codes referred to all claims/plan records in the Inpatient Stays (IP), Outpatient Services (OP), Home Health Agencies (HHA), Skilled Nursing Facilities (SNF), Hospice Care Organizations (HS) [FFS only], and Carrier (PB) settings. For Medicaid data, eligible claims to evaluate these codes referred to all claims in the IP, Long-Term Care (LT), and Other (OT) settings. For CDM data, eligible claims referred to those in the Inpatient Confinement files (for Acute Care Hospitals or SNF) and Medical Claims files.

For Medicare FFS and MA, institutional OP data were further restricted to those with presence of HCPCS codes 99201–99205, 99211–99215, 99241–99245, 99271–99275, 99281–99285, 99288 on the claim, indicating office or other outpatient visits for the evaluation, management, and consultation of existing and new patients. Medicare non-institutional claims were further restricted to those where the Service Type field was labeled "Medical care," "Surgery," or "Consultation" (this restriction is applied to Medicare FFS data only because there is no Service Type field in MA data); and there was no pharmacy, an ambulance, a mass immunization center, an independent laboratory, or other place of service recorded in the Service Place field.

For CDM data, medical claims were primarily further restricted to those where "Professional service: surgery," "Professional service: emergency room," "Professional service: consultation," "Professional service: office visits," or "Home health/hospice visits" appeared in the Service Type field; and further, no pharmacy, a mass immunization center, an ambulance, or an independent laboratory record was present on the Service Place field.

For DGN/PRC codes, since there was a transition from ICD-9 to ICD-10 in October 2015, codes in both versions were used if the study window crossed this transition point. The ICD 9-10 General Equivalence Mapping served as a guide to obtain comprehensive code mappings between ICD-9 and ICD-10 codes. This was further complemented by clinical expertise to address many-to-many mapping issues and differences in level of details introduced by the ICD transition. Please see associated codebooks accompanying this ADR for all the relevant codes and mapping used.[13]

➔ Incident cohort

The derivation of the incident cohort relied on the following process. The restrictions applied for the prevalent cohort were also applied to the incident cohort. The analysis then further restricted the cohort to those who did not indicate a urologic disease during a fixed window prior to the incident year-month. The analysis then further restricted this cohort to those with continuous and full enrollment during a defined follow-up period of varying length, depending on the outcome. Such restrictions allow for studying follow-up of person cohorts and help ensure a consistent sample of persons over time. For all metrics based on the "incident cohort," our study focuses solely on the age 65 and older Medicare FFS cohort. This is due to the greater availability of longitudinal data from Medicare FFS, allowing for tracking of patients' follow-up over a period of one year or longer.

More specifically, for each year-month t, a 36-month lookback window [t-36, t-1] was considered. For each year-month t, the Medicare population was restricted to those with continuous and full enrollment in Part A/B claims in the lookback window. Among this group, a person was considered an "incident patient" in year-month t if the person registered a qualifying diagnosis for that time; and did not have a given urologic disease diagnosis in claims in the lookback period. Rolling windows were used to study the incident cohort, in contrast to the use of a fixed incident year in earlier editions. The use of rolling windows allows time trends to be shown for incident statistics. Rolling windows also enhance the ability to consider short-, medium-, and long-term outcomes.

A.2 Computations

The statistical analyses behind the 2024 ADR data tables span the following categories of outcomes: prevalence, incidence, comorbidities, diagnostic tests, prescription drugs filled, procedure use, utilization of healthcare services, and healthcare expenditure. These outcomes were compiled annually for the prevalent cohort and on a monthly rolling basis (aggregated annually) for the incident cohort. The discussion below describes the analytical approach for the outcomes reported in this ADR.

➔ Prevalence

Prevalence was presented as the number and percentage of persons in each age cohort who were diagnosed with the disease of interest in each year. A patient with disease X was defined as a person who had a qualifying diagnosis code in at least one eligible claim within the calendar year.

For BPH, we also made an exclusion restriction – persons with "symptom" codes should not carry a diagnosis of prostate cancer (ICD-9 185 or ICD-10 C61). See accompanying BPH/LUTS Excel codebook for symptom codes.

In the case of UI, we classified the subcategories using the following logic in Table A.1.

Table A.1 Classification Logic for UI Types

UI Type	Classification Criteria
1. FUI	Person has Fistula incontinence (FUI) diagnosis code, regardless of existence of Mixed (MUI), Stress (SUI), Urgency (UUI), Overflow, or Other incontinence diagnosis codes in the same year.
2. MUI	Person has either Mixed incontinence diagnosis code, or both SUI AND UUI diagnosis codes; regardless of existence of SUI, UUI, Overflow, or Other incontinence diagnosis codes in the same year.
3. SUI	Person has SUI diagnosis code, regardless of existence of UUI, Overflow, or Other incontinence diagnosis codes in the same year.
4. UUI	Person has UUI diagnosis code, regardless of existence of Overflow or Other incontinence diagnosis codes in the same year.

UI Type	Classification Criteria
5. Overflow UI	Person has Overflow incontinence diagnosis code, regardless of existence of Other incontinence diagnosis codes in the same year.
6. Other UI	Person has Other incontinence diagnosis code. An Other incontinence person is not allowed to have any other UI type diagnosis codes in the same year.
7. Otherwise	Person is NOT a person with UI.

For UCPPS, prevalence was calculated for the overall condition and separately for its two subconditions: interstitial cystitis/bladder pain syndrome (IC/BPS) or chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS).

➔ Incidence

Given the incident cohort selection process described in the previous subsection, the main outcome for incidence was the following:

$$\%\ \text{of incident patients in year X} = \frac{\#\ \text{of incident patients in year X}}{\#\ \text{of restricted Medicare FFS individuals in year X}} \times 100$$

The restriction in the denominator refers to 36 months of continuous enrollment in the lookback period, age 65+, and residence in the United States (50 states plus District of Columbia); which were applied to all incident cohort analyses.

➔ Comorbidities

Comorbidities were identified via the Clinical Classifications Software (CCS), Clinical Classifications Software Refined (CCSR), and Multi-level CCS grouping systems, as well as individual diagnosis codes based on the contract team's clinical input. To maximize identification, we looked through claims for each person for the entire year. This multipronged approach allowed us to expand the comorbidity coverage from those covered in previous editions of the ADR. The CCSR grouper is a healthcare database tool, sponsored by the Agency for Healthcare Research and Quality (AHRQ), existing within a broader database suite developed in partnership with industry as well as state and federal government resources.[14] The CCSR consolidates many ICD-10 codes into clinically informative procedural and diagnostic categories. In turn, users can perform targeted statistical analyses by selecting from these subsets. Diagnosis codes span over 530 clinical categories covering 21 human body systems, while procedure codes encompass over 320 clinical categories within 31 clinical areas.[15] The full list of comorbidities for each disease is included in the Excel codebooks that accompany this ADR.

For the 2015 incident cohort, we further computed the percentage of patients with BPH who were both registered with a urinary retention code in claims and had a catheterization (defined

collectively as "urinary retention") within 5 years. We also computed the average length of time from recording of BPH diagnosis to recording of urinary retention. The steps were as follows.

For each patient with incident BPH, a flag was created on whether the patient experienced urinary retention (yes/no), based on whether one or more qualifying diagnosis codes for retention appear in any diagnosis positions (not just primary) and also had a procedure code for catheterization in their claims. Qualifying diagnosis codes for retention are defined by the ICD-9 codes 788.20 and 788.29, as well as ICD-10 codes R33.8 and R33.9. These codes were searched across all claim settings, except Durable Medical Equipment (DME), in the 60-month period after the beneficiary's recording of BPH diagnosis. Catheterization was identified by the following CPT codes: 51701, 51702, 51703, 51705, 51710, 51102, and 51040.

We computed the number and percent of patients who met this criterion among all patients with incident BPH in 2015. These metrics were computed with two alternative versions: one that excluded patients who had urinary retention diagnosis in the month of initial BPH diagnosis, and another that kept these patients. For each month, the total number of patients who developed urinary retention in that month were computed.

➔ Diagnostic test

Diagnostic tests were evaluated for rolling incident cohorts. Specifically, an "incident patient" is defined in the same way as the incident cohort, with one additional enrollment restriction: for each year-month t, further impose continuous Part A/B enrollment in a [t-3, t+12] window surrounding the diagnosis month. An incident patient in year-month t is defined to have diagnostic test Y if a person registered a qualifying diagnostic test in claims during this evaluation window. The main outcome of interest is the following:

$$\text{\% of incident patients in year X who had diagnostic test Y 3 months prior or 12 months after initial diagnosis} = \frac{\text{\# of incident patients in year X who received diagnostic test Y 3 months prior or 12 months after initial diagnosis}}{\text{\# of incident patients in year X}} \times 100$$

Note this computation built on but refined the methodology employed in previous editions of the ADR, where a diagnostic test is flagged as long as it occurred in the same calendar year as the incident diagnosis. Using a more refined evaluation window ensured that each incident case was evaluated for diagnostic tests on a [t-3,t+12] months rolling basis and ensured equal treatment for each diagnosis month. The full list of diagnostic tests for each disease is included in the Excel codebooks that accompany this ADR.

For the 2015 cohort with incident USD, we further identified imaging procedure rates within 3 months and 5 years after the incident USD diagnosis using the following steps. First, we restricted to principal diagnosis codes of USD and identified imaging procedures by checking any HCPCS codes listed in the claims. The imaging procedures included X-ray, Ultrasound, CT, MRI, and Pyelogram (excluding retrograde pyelogram).[16] Then, we additionally created a category that included any imaging procedure HCPCS codes. For each imaging procedure, the number and the percentage of patients with 0, 1, 2, 3-4, 5-9, 10-19, and 20+ imaging procedures were calculated. Further, for imaging procedures within 5 years, the number and percent of imaging per year were calculated.

➔ Prescription drugs

To compile the list of relevant drugs (based on clinical input), we selected drugs based on generic names on all drugs approved by the Food and Drug Administration (FDA).[17] The full list of prescription drugs and their pharmacological classes is included in the Excel codebooks that accompany this ADR.[18]

We then identified patients who have full and continuous enrollment in Medicare Part D throughout each year. The number and percentage of Part D-enrolled patients among all patients were calculated, and then were used to estimate the number and percentage of Part D-enrolled patients who filled at least one prescription in any of the identified relevant pharmacologic classes, and for each individual pharmacologic class. For the CDM sample, the same prescription outcomes were calculated for all patients with the disease of interest, given that all enrollees have both medical and drug coverage.

Among the incident cohort aged 65 and older, we used the same list of drugs as those analyzed for the prevalent cohort and imposed on the incident cohort an additional restriction: continuous enrollment in Medicare Parts A, B, and D in the 60 months (5 years) after initial diagnosis (for incident year 2015). We then searched for whether any of these prescriptions were filled from the month of initial diagnosis to 60 months afterwards. We then computed the number and percentage of incident patients who met this criterion, the percentage shares of first filled prescriptions by type, and the average number of months from initial diagnosis to first filled prescription.

For the 2015 cohort with incident BPH, we computed their rates of combination therapy (and other types of therapy use). We identified patients with incident BPH who filled a prescription for alpha blocker (AB) or 5-alpha reductase inhibitor (5AR) in the 60-month follow up period, and recorded the associated prescription date (denoted "ABDate" and "5ARDate", accordingly). We also identified patients with incident BPH who filled a prescription for the combination drug class 5**-**alpha reductase inhibitor/alpha blocker and the corresponding date of prescription. The number of BPH patients who met each of the following criteria in the follow up period was then counted:

- filled a prescription for alpha blocker and 5-alpha Reductase inhibitor at the same time (ABDate = 5ARDate), or filled a prescription for the combination drug class 5-alpha reductase inhibitor/alpha blocker [i.e., "combination therapy"]

- filled a prescription for alpha blocker and 5-alpha reductase inhibitor in the follow up period but at different times
- only filled a prescription for alpha blocker
- only filled a prescription for 5-alpha reductase inhibitor
- did not fill a prescription for either alpha blocker or 5-alpha reductase inhibitor

The following metrics were also calculated: the length of time from recording of incident BPH diagnosis to the first use of combination therapy; and the length of time from first use of alpha blockers to combination therapy based on "ABDate" and the start date of the combination therapy.

➔ Procedures

In computing procedure use for a given person with BPH/LUTS, USD, UI, or IC/BPS, a qualifying primary diagnosis for the disease on that procedure was required. Eligible claims refer to all inpatient institutional, outpatient, and carrier claims. For the prevalent cohort, the number and percentage of patients receiving each major procedure type were calculated. Further, the number and percentage of patients receiving any procedures were compiled. Note that given the more recent time coverage of this edition, some procedures that were introduced in recent years will be covered. The procedures analyzed for each disease were selected based on the contract team's clinical input. The full list of procedures for each disease is included in the Excel codebooks that accompany this ADR.

Among the incident cohort aged 65 and older, we used the same method and list of procedures as those analyzed for the prevalent cohort and imposed on the incident cohort an additional restriction: continuous enrollment in Medicare Parts A and B in the 60 months (5 years) after initial diagnosis (for incident year 2015). We then searched for whether any of these procedures were performed from the month of initial diagnosis to 60 months afterwards. We then computed the number and percentage of incident patients who met this criterion, the percentage shares of first procedures by type, as well as the average number of months from initial diagnosis to first procedure performed.

For the 2015 cohort with incident BPH, we computed their retreatment rates within 2 years after undergoing a minimally invasive surgical therapy (MIST) or a transurethral surgery. First, we identified the patients in the cohort who underwent any surgery within a 4-year window after the incident diagnosis of BPH. Second, we recorded the first surgery date (t0) and the second surgery date (t1). If 30 days < t1-t0 <= 730 days, then we considered the second surgery to be "retreatment within 2 years," and "no" otherwise. Retreatments within 30 days of first surgery were excluded to better isolate retreatments unrelated to complications from the first treatment. For each type of first treatment (individually and also by MIST versus transurethral surgery), we calculated their 2-year retreatment rate as the ratio of the number of patients who experienced retreatment within 2 years to the total number of patients who had first procedure of that type during the follow-up period. Note retreatments included surgeries of any type given in Table 1 of the BPH/LUTS document.

For the 2015 cohort with incident BPH, we also computed the percentage of patients with BPH who were recorded with urinary retention (including catheterization as described earlier) within 4 years and underwent any MIST and transurethral procedures within a year of the UR diagnosis. We calculated the ratio of the number of patients who had a procedure to the total number of the incident BPH population with urinary retention within 4 years, by surgery type. We also calculated the time from the urinary retention diagnosis to the first procedure, stratified by MIST and transurethral procedure type.

For the 2015 cohort with incident USD, we further computed retreatment rates within 120 days after undergoing the first surgery. We identified the patients in the cohort who underwent any surgery within a 56-month window after the incident diagnosis of USD. We recorded the first surgery date (t0) and the second surgery date (t1), and calculated the days taken between the first surgery and second surgery (t1-t0). The retreatment rate is then calculated as the ratio of the number of patients who experienced retreatment within 120 days to the total number of patients who had the first procedure. The results were stratified by the following surgery types: cystolithalopaxy, extracorporeal shock wave lithotripsy (ESWL), laparoscopic stone surgery, open stone surgery, percutaneous nephrolithotomy (PCNL), ureteroscopy, and multiple surgeries.

➔ Utilization of healthcare services

We considered four main service utilization outcomes: 1. Evaluation and Management (E&M) visits, 2. Emergency Department (ED) visits, 3. inpatient hospitalizations, and 4. observation stays.

To define E&M visits, we first flagged hospital-based outpatient and carrier claims with CPT codes from 99201 to 99499. Hospital-based outpatient claims are billed with Type of Bill = 13x. We then counted one occurrence of an HCPCS code as one E&M visit (based on revenue unit variable). E&M visits were then counted in each month in which the visits began. For each disease (BPH/USD/UI), only visits with any diagnosis for the corresponding disease were counted.

To define ED visits, we flagged claims in the outpatient and inpatient files identified via Revenue Center Code values of 0450-0459 (Emergency room) or 0981 (Professional fees - Emergency room). We then referred to the following related revenue center codes: 0450 = Emergency room - general classification; 0451 = Emergency room - EMTALA emergency medical screening services; 0452 = Emergency room - ER beyond EMTALA screening; 0456 = Emergency room-urgent care; 0459 = Emergency room - other.

We counted one occurrence of a relevant revenue center code as an ED visit. ED visits were counted in each month in which the visits began. For each disease (BPH/USD/UI), only visits from claims with primary diagnosis for the corresponding disease were counted.

To define inpatient hospitalizations, we first flagged the count of hospitalizations on inpatient hospital FFS claims. Inpatient settings included FFS claims with claim type "60." Inpatient hospital

claims with overlapping service dates were considered a single hospitalization. We then considered any claims that began the day after another claim ended and also had the same provider type as a single hospitalization. Provider types included Inpatient Hospitals; Critical Access Hospitals (CAHs); inpatient rehabilitation facilities; long term care facilities; inpatient psychiatric facilities; and other hospitals. Hospitalizations were counted in each month where the hospitalization stay (admission to discharge) overlapped with the month. For each disease (BPH/USD/UI), only hospitalizations with primary diagnosis for the corresponding disease were counted.

To define observation stays, we considered counts of inpatient and outpatient occurrences of the following related revenue center code: 0762 = Treatment or observation room - observation room. Observation stays were counted in each month in which the observation began. Only observation stays with primary diagnosis for the corresponding disease were counted.

ED visits were computed as percentage of patients with incident disease in each year who also had an ED visit within 12 months after initial diagnosis. Inpatient-hospital stays and observation stays were computed analogously. E&M visits, ED visits, inpatient-hospital stays, and observation stays were also computed on a per-incident-patient per-year basis.

For the 2015 cohort with incident BPH, we further computed their time from the initial primary care physician (PCP) visit to the first urologist visit. To classify first visits by specialty, we searched for CMS specialty codes on carrier (PB) claims for evaluation and management (E&M) visits, identified by HCPCS codes 99201-99205 and 99211-99215. For both their initial BPH diagnosis and the subsequent E&M visit, we classified specialties into “urologist” (specialty code 34), “PCP” (specialty code 01, 08, 11, 12, 17, 37, 38, or 84), “Physician Assistant [PA]” (specialty code 97), “Nurse Practitioner [NP]” (specialty code 50), “other” (all other specialty codes), or “missing” (missing specialty code). Note that if a patient was diagnosed by a urologist alongside another specialty in the initial diagnosis, we classified the patient into the “urologist” specialty category. If a patient was diagnosed by multiple specialties but not a urologist, we classified the patient into the “other” category. We then calculated the number of patients with incident BPH who saw a urologist on the second visit and the average time from their initial visit to the first urologist visit, stratified by the specialty of their initial visit (with a focus on “PCP”). If a patient were initially diagnosed by a urologist, the time to see a urologist would be set to 0.

For the 2015 cohort with incident BPH, we also computed their time from the first urologist visit to a procedure. We identified patients with a urologist visit within 3 years after the incident BPH/LUTS diagnosis. Next, we checked whether these patients had any MIST or transurethral surgeries within 2 years of the first urologist visit. We then calculated the number of patients who had a urologist visit and the average time from their earliest urologist visit to the earliest procedure, stratified by MIST and transurethral surgery.

For the 2015 incident cohort with USD, we reported the percentage of patients who had an ED or a PCP visit within 3 years after the incident diagnosis and also had a urologist visit within 730 days (2 years) after the first ED or PCP visit. ED visits were restricted to those with USD as the primary diagnosis. We identified the earliest ED or PCP visit date within 3 years after the USD diagnosis date and the earliest urologist visit within 2 years after the earliest ED or PCP visit. Next, we calculated the average time from the USD incident diagnosis date to the first ED or PCP visit and the average time from the earliest ED or PCP visit to the earliest urologist visit.

For the 2015 incident cohort with USD, we also identified ED visits (defined earlier) within 1 year/5 years. ED visits were restricted to those with USD as the primary diagnosis. We then calculated ED visit rates within 1 year/5 years after the incident diagnosis and the percentages of patients under different ED visit frequency categories. Patients were grouped into these categories: 0, 1, 2, 3, and 4+ ED visits. In addition, we calculated the average time from the USD incident diagnosis date to the first ED visit within 5 years after the diagnosis date.

➔ Healthcare expenditures

Among the prevalent cohort aged 65 and older, we flagged FFS claims from the following settings: Inpatient, Skilled Nursing Facilities, Home Health, Hospice, Outpatient, Carrier, and Durable Medical Equipment. For each condition (BPH/LUTS, USD, any UI, or UCPPS [including IC/BPS and CP/CPPS]), we considered only claims with primary diagnosis for the corresponding disease. Expenditures were reported as raw Medicare paid dollars (nominal). Expenditures were then summed across the prevalent cohort on an annual basis. We then calculated per-person per-year expenditures by dividing annual expenditures by the number of patients in the prevalent cohort in each year.

In addition, annual expenditures were stratified by inpatient services, ED services, outpatient services, physicians' office services, and all other services. Sites of service were defined based on the following sequential steps, which search for specific codes in claims across all Medicare settings:[19]

- Step 1 – Identify inpatient services
    - Inpatient (IP) Setting
        - Contains claim type for inpatient claim (60)
    - PB (Carrier) Setting
        - Contains place of service code for Hospital Inpatient (21)
- Step 2 – Identify ED services
    - Outpatient (OP) Setting
        - Contains ER Revenue Center Codes (045X and 0981).
    - PB (Carrier) Setting
        - Contains place of service code for Emergency Room (23) or any HCPCS codes for E&M services in ER (99281-99285)
- Step 3 – Identify Outpatient services
    - OP Setting

        - Contains Type of Bill for Hospital Outpatient (013X), Hospital Outpatient – ASC (083X), or Critical Access Hospital (085X). These are all bill types that indicate outpatient services provided in the hospital.
        - No ER Revenue Center Codes (045X and 0981) on claim. This restriction would exclude all ER services from the hospital-outpatient setting.
    - PB (Carrier) Setting
        - Contains place of service code for Hospital Outpatient and Ambulatory Surgical Center (19,22 and 24).
- Step 4 – Identify physicians' office services
    - PB (Carrier) Setting
        - Contains place of service code for Office (11)
- Step 5 – Sum expenditures for other services unidentified in the previous steps

For the incident cohort aged 65 and older, calculations were analogous to that of the prevalent cohort, except for the following differences. Expenditures were summed in each month for which the claim fell across patients with incident disease. We then calculated total FFS expenditures within the month of incident diagnosis and the 12 months after, across patients with incident disease in that year. Total expenditures were then scaled on a per-patient per-year basis.

All expenditures metrics were stratified by age, race/ethnicity, region, dual-eligibility status, and gender.

➔ Mortality

For the 2015 cohort with incident FG, we report mortality rate within 5 years of the incident diagnosis. We identified the death date using enrollment data, and we calculated the time between the FG incident diagnosis date to the death date. We restricted to patients that died within 5 years after the FG incident diagnosis to calculate the mortality count and rates.

A.3 Validation

To help ensure quality of the data analysis, the validation process for the 2024 ADR combined several interconnected processes, involving consistency checks, code review, clinical review, literature review, and comparison to the previous ADR. This subsection provides an overview of this multi-pronged approach.

First, we evaluated frequencies within subgroups to ensure that the counts reflected appropriate levels of grouping, all ratios and their numerator and denominator components were consistent, and all sums across subgroups equated to any aggregates reported for the equivalent overall group. Second, programming code reviews were conducted during intermediate and final output stages to ensure that calculations reflect the intended strategy. Third, content was reviewed by clinicians to identify areas of data analysis that may not meet clinical expectations. Fourth, the clinical review was complemented by comparisons to previous findings reporting similar metrics or outcomes, while bearing in mind potential differences in methodology. This involved literature search and review

based on relevant key word searches. Large discrepancies were flagged for additional review by the contract team's clinical experts. Fifth, content was compared to the latest previous ADR whenever possible, bearing in mind potential differences in methodology. In some instances, sensitivity checks were conducted to help gauge the precision of the results reported. Lastly, we developed interactive graphical charts on all outcomes to identify unusual patterns or rates and to aid comparisons described above. These graphic tools not only showed aggregate trends, but also those among subgroups. Unusual rates or trends that appeared to deviate significantly from overall trends were flagged for additional review (including the steps above).

A.4 Limitations

Medical coding changed from International Classification of Diseases (ICD)-9 to ICD-10 in 2015, with about 19 times as many procedure codes, and 5 times as many diagnosis codes in ICD-10-Clinical Modification (CM)/Procedure Coding System (PCS) than in ICD-9-CM; trends across years should be interpreted cautiously.[20] Despite the use of the extensive data for the Medicare FFS, MA, and Medicaid populations, estimates may vary among populations in databases that do not have data sharing agreements with the sponsor, such as veterans who may not be enrolled in Medicare or who receive much of their care in the Veterans Affairs (VA) healthcare system, and persons who receive care from tribal entities with access to their own healthcare resources.[21] Estimates from private insurance databases also may vary due to differences in cohorts' socioeconomic status and geographic differences that are well known to affect access to medical resources and related outcomes (see section 4).[22]

Data engineering efforts are actively pursuing ways to better capture and improve the validity of sociodemographic determinants of health, inclusive of data on race and ethnicity.[23] Like changes in ICD coding, future versions of the ADR will need to address how to compare trends across such variables with changing definitions. Further, the ability to assess longitudinal trends across a younger cohort from private insurance database to an older cohort from the Medicare database is affected by the inability to link unique persons over their transition from one system to another. Access to comprehensive data systems that span the age transition, like that of the VA, can - in part, at least - provide additional insights into how estimates vary by age. In addition, accurately capturing prevalence is further complicated by the COVID-19 pandemic, given the substantial avoidance of care observed in the healthcare system. Lastly, our prescription drugs analysis, which is based on prescriptions filled, is also challenged by the lack of information on actual prescription use.

Appendix B: Data

This appendix provides further details on the data sources used in the ADR (see Introduction for brief summary). The four data sources are: Centers for Medicare & Medicaid Services (CMS) Medicare fee-for-service (FFS) data, Medicare Advantage (MA) Encounter data, Medicaid data, and Optum's de-identified Clinformatics® Data Mart Database (CDM) data. The specific files underlying these four data sources that were used in our analyses are described below in sections B.1 (Medicare FFS), B.2 (CDM), B.3 (MA), and B.4 (Medicaid).

B.1 Medicare FFS data

The Medicare FFS age 65+ cohort is drawn from 100% of CMS Medicare FFS data, supplemented by the Master Beneficiary Summary File (MBSF) and Part D data. The FFS data compose Part A/B claims from the following settings: Inpatient Stays (IP), Outpatient Services (OP), Home Health Agencies (HHA), Skilled Nursing Facilities (SNF), Hospice Care Organizations (HS), Durable Medical Equipment (DME, used for spending analyses only), and Carrier (PB). The Part D Event (PDE) Files contain the National Drug Codes (NDC) to identify prescription medication use. The MBSF was used to generate cohorts of study (i.e., denominator) when calculating rates and demographic stratifications. Claims data were used to calculate the metrics reported in this ADR, and are grouped as institutional and non-institutional claims. PDE files were used to analyze filled prescriptions. More details on these files are provided below:

1. Enrollment and Demographic Data
    a. CMS's MBSF contains demographic and enrollment information for each Medicare beneficiary; which can be identified across each beneficiary's enrolled year. This includes information such as birth date, death date, sex, race/ethnicity, insurance coverage, and enrollment status.

2. Institutional claims
    a. Institutional claims files contain records on FFS claims submitted by various healthcare institutions for reimbursement. A separate dataset exists for each type of institutional claim: IP, HHA, SNF, HS, and OP.
    b. Each institutional claim, depending on the type of institution, has records of medical diagnostics (ICD diagnosis), procedure (ICD procedure code), FFS reimbursement amount, admission/discharge dates, dates of service, facility provider number, quantity of services, and type of visit (e.g., skilled care, home health aide, physical therapy).

3. Non-institutional claims
    a. The non-institutional claims files contain records from DME and Carrier (previously Physician [Part B] claims file) Files. The Carrier File includes FFS claims submitted by

professional providers, including physicians, physician assistants, clinical social workers, and nurse practitioners.

b. Each non-institutional claim has records of medical diagnostics (ICD diagnosis code), procedure (ICD procedure code), FFS reimbursement amount, dates of service, charges, and allowed amount.

4. Part D Event (PDE) Files
   a. The PDE files include all transactions covered by Medicare prescription drug plans. These files include information on service date, product service ID (NDC code), quantity dispensed, number of days' supply, cost, and payment.

B.2 CDM data

The privately insured age 18-64 cohort is drawn from Optum's de-identified Clinformatics® Data Mart Database (CDM). It includes paid claims and enrollment information for participants in private insurer plans of a large U.S. managed care health insurance company. The data also include information about plan members who are enrolled in both medical and prescription drug plans.

The CDM data consist of the following files: Member Eligibility Files, Inpatient Confinement Files, Medical Claims Files, Pharmacy Claims Files, Lab Test Files, and Provider Files/Provider Bridge Files. Member Eligibility Files contain information on member demographics, geographic residence, and eligibility status. Inpatient Confinement Files summarize records for each inpatient serviced in an acute care hospital or a SNF. Medical Claims Files summarize reimbursements in professional services provided across all places of services (e.g., inpatient and outpatient facilities, labs, physician office). Pharmacy Claims Files summarize prescription drug claims submitted by pharmacies in an outpatient setting. Lab Test Files provide information on lab tests. The Provider Files and Provider Bridge Files provide information on providers. More details on these files are described below.

1. Member Eligibility Files
   a. These files contain demographic information, enrollment dates, and insurance information of each member. Generally, they include information for each member such as identifier, gender, birth information, insurance coverage (plan), race, family identifier, and geographic residence.

2. Inpatient Confinement Files
   a. These files include records of each inpatient episode experienced by members occurring in an acute care hospital or SNFs. These files have records on diagnosis, payments, procedures, and costs. They include member identifier, admit and discharge dates, admit and discharge diagnosis, length of stay, procedures (CPT, ICD, Revenue codes), diagnosis (ICD, Diagnosis Related Group [DRG]), facility details, and pricing.

3. Medical Claims Files
    a. Medical claims data for inpatient and outpatient professional services, such as outpatient surgery, laboratory, and radiology, are included in these files. They include person information as well as additional information on payment, admission, diagnosis, and procedures. These files contain member identifier, procedures (CPT, ICD, Revenue codes), diagnosis (ICD, DRG), admission and discharge dates, admit types, date and place of service, pricing, and denied claims.

4. Pharmacy Claims Files
    a. These files include claims submitted by pharmacies for prescriptions filled on an outpatient basis. The files have information on member identifier, drug dispensed (NDC), brand name, generic name, quantity and date dispensed, drug strength, days' supply, dollar amounts, and pricing.

5. Lab Test Files
    a. These files contain laboratory test results for all available lab tests, within certain networks (not comprehensive). Files include person identifier, lab claim ID, lab test name, lab sample dates, information on abnormalities, Logical Observation Identifiers Names and Codes (LOINC), and the lab result.

6. Provider Files and Provider Bridge Files
    a. Provider files categorize providers by unique physicians or facilities. These files contain provider identifier, credentials, affiliations, and geographic location (state).
    b. Provider Bridge files include information on providers not included in main provider files. These files include information such as Drug Enforcement Agency number, National Provider Identifier, and multiple provider codes.

B.3 Medicare Advantage (MA) data

The MA age 65+ cohort is drawn from 100% of CMS MA data. Similar to FFS data, MA data are also supplemented by the Master Beneficiary Summary File (MBSF) and Part D data. The MA data comprise of Part C plan records from five settings: IP, OP, HHA, SNF, and Carrier. The Part D Event (PDE) files were used to analyze fill of prescription medication based on the included National Drug Codes (NDC). The MBSF was used to generate cohorts of study (i.e., denominator) when calculating rates and demographic stratifications. Encounter data were used to calculate the metrics reported in this ADR, and were grouped as institutional and non-institutional, similar to FFS data. More details on these files are described below (similar to the information provided in section B.1):

1. Enrollment and Demographic Data
    a. CMS's MBSF contains demographic and enrollment information for each Medicare beneficiary; which can be identified across each beneficiary's enrolled year. This includes information such as birth date, death date, sex, race/ethnicity, insurance coverage, and enrollment status.

2. Institutional Encounter Data
    a. Institutional encounter data files contain MA records of diagnoses and services submitted by various healthcare institutions. A separate dataset exists for each type of institutional encounter data: IP, HHA, SNF, and OP.
    b. Each institutional record, depending on the type of institution, has records of medical diagnostics (ICD diagnosis code), procedure (ICD procedure code), admission/discharge dates, dates of service, facility provider number, service provider information, and type of visit (e.g., skilled care, home health aide, physical therapy).
    c. IP and OP records are also split into individual lines; each line has revenue center code and quantity of services.

3. Non-institutional Encounter Data
    a. Non-institutional encounter data files contain MA records of diagnoses and services from Carrier files only. The Carrier File includes the records submitted by professional providers, including physicians, physician assistants, clinical social workers, and nurse practitioners.
    b. Non-institutional records include medical diagnostics (ICD diagnosis code), procedure (ICD procedure code), start/end dates, dates of service, and place of service.
    c. Carrier encounter data are also split into individual lines; each line has a HCPCS code and quantity of services.

4. Part D Event (PDE) Files
    a. The PDE files include all transactions covered by Medicare prescription drug plans. These files include information on service date, product service ID (NDC code), quantity dispensed, number of days' supply, cost, and payment.

B.4 Medicaid data

The Medicaid age 18+ cohort is drawn from 100% of CMS Medicaid data. These data include both claims and eligibility (ELG) files. Medicaid claims files from the Inpatient Stays (IP), Long-Term Care (LT), and Other (OT) settings were used. Additionally, the type of claims were restricted to Medicaid FFS and Encounter to calculate the metrics reported in this ADR.

1. Eligibility File

a. Medicaid ELG files contain information about beneficiary enrollment and eligibility. They contain information for each Medicaid beneficiary such as birth date, gender, race/ethnicity, insurance coverage, and enrollment status.

2. Inpatient File
    a. Inpatient claims files contain record on inpatient hospital facility claims and manged care encounter. Inpatient claim file has records of medical diagnosis and procedures.

3. Long-term Care File
    a. Long-term care claims files contain record on institutional long-term care facility claims and managed care encounter. Long-term care claim file has records of medical diagnosis.

4. Other File
    a. Other claims files contain records of claims and encounters that include professional, outpatient, and others that are not included in inpatient and long-term care files. Other claim file has records of medical diagnosis.

[1] https://seer.cancer.gov/statfacts/.

[2] See https://www.niddk.nih.gov/about-niddk/strategic-plans-reports/urologic-diseases-in-america.

[3] Only a small portion of the Medicaid population in our analyses is aged 65 and older (<2%).

[4] Epping, Jelena, Siegfried Geyer, and Juliane Tetzlaff. 2020. "The Effects of Different Lookback Periods on the Sociodemographic Structure of the Study Population and on the Estimation of Incidence Rates: Analyses with German Claims Data." *BMC Medical Research Methodology* 20 (1): 1-15. https://doi.org/10.1186/s12874-020-01108-6.

[5] Epping, Jelena, Siegfried Geyer, and Juliane Tetzlaff. 2020. "The Effects of Different Lookback Periods on the Sociodemographic Structure of the Study Population and on the Estimation of Incidence Rates: Analyses with German Claims Data." *BMC Medical Research Methodology* 20 (1): 1-15. https://doi.org/10.1186/s12874-020-01108-6.

[6] For Medicaid data, stratification by census regions are not shown; as state-by-state variation in data coverage and methodology means metrics across regions are not necessarily comparable.

[7] Dual eligibility has been used as a proxy for individual-level poverty, which otherwise depends on ecologic (i.e., ZIP code or other geographic level) markers of income. Kimmel, Paul L., Chyng-Wen Fwu, Kevin C. Abbott, Jonathan Ratner, and Paul W. Eggers. 2016. "Racial Disparities in Poverty Account for Mortality Differences in US Medicare Beneficiaries." *SSM-Population Health* (2): 123-129. https://doi.org/10.1016/j.ssmph.2016.02.003.

[8] United States Census Bureau, Population Division, "Annual Estimates of the Resident Population by Sex, Race, and Hispanic Origin for the United States: April 1, 2020 to July 1, 2021 (NC-EST2021-ASR6H)" (June 2022), https://www2.census.gov/programs-surveys/popest/tables/2020-2021/national/asrh/nc-est2021-asr6h.xlsx.

[9] As noted earlier, less than 2% of Medicaid beneficiaries were age 65 and older, so this cohort is dominantly age 18-64.

[10] Throughout the COVID-19 public health emergency (PHE), states were required to keep people continuously enrolled in Medicaid to receive enhanced federal funding. This continuous enrollment requirement led to a large growth in Medicaid enrollment numbers over the course of the PHE.

[11] Note 11.5% of persons had their race/ethinicity information missing in the Medicaid cohort.

[12] Utah had missing eligibility data, Florida had missing claims, and Maryland was still using ICD-9 after 2016.

[13] These codebooks are entitled, for each respective disease, "ADR-BPH-LUTS-Codebook-2024.xlsx", "ADR-USD-Codebook-2024.xlsx", "ADR-UI-Codebook-2024.xlsx", "ADR-UCPPS-Codebook-2024.xlsx", and "ADR-FG-Codebook-2024.xlsx".

[14] Agency for Healthcare Research and Quality. "Healthcare Cost & Utilization Project User Support." February 10, 2022. https://www.hcup-us.ahrq.gov/overview.jsp.

[15] Agency for Healthcare Research and Quality. "Clinical Classifications Software Refined (CCSR)." December 29, 2022. https://hcup-us.ahrq.gov/toolssoftware/ccsr/ccs_refined.jsp.

[16] See "ADR-USD-Codebook-2024.xlsx" for the qualifying HCPCS codes.

[17] This is supplemented by Medi-Span and the CDM drug lookup table.

[18] See "ADR-BPH-LUTS-Codebook-2024.xlsx", "ADR-USD-Codebook-2024.xlsx", "ADR-UI-Codebook-2024.xlsx", "ADR-UCPPS-Codebook-2024.xlsx", and "ADR-FG-Codebook-2024.xlsx".

[19] While total expenditures can be calculated based on claim-level payment variables, line-level payments will need to be used for expenditures by site of service. To ensure consistency in the sum of line-level payments with claim-level total payments, we identify site of service using the line-level codes, but always calculate payments at the claim level. For example, as long as we find any line in a carrier claim contains place of service code for ER, we would consider the total payment made to this claim to be for ED services.

[20] Centers for Disease Control and Prevention, National Center for Health Statistics. "International Classification of Diseases, (ICD-10-CM/PCS) Transition – Background." https://www.cdc.gov/nchs/icd/icd10cm_pcs_background.htm.

[21] For example, Original Medicare and Medicare Advantage participants are different in patient characteristics. The former population tends to have poorer health status on average. There is also considerable geographic variation between Original and Part C selection rates (e.g., 90% of Puerto Ricans opting for Advantage to around only 1% of Alaskans). For more discussion, see Freed, Meredith, Jeannie Fuglesten Biniek, Anthony Damico, and Tricia Neuman. "Medicare Advantage in 2022: Enrollment Update and Key Trends," Kaiser Family Foundation. https://www.kff.org/medicare/issue-brief/medicare-advantage-in-2022-enrollment-update-and-key-trends/.

[22] The limitations of race variable in the CDM data have also been documented in the literature. See Nead, Kevin T., Candice L. Hinkston, and Mackenzie R. Wehner. 2022. "Cautions When Using Race and Ethnicity in Administrative Claims Data Sets." *JAMA Health Forum* 3 (7): e221812. https://doi.org/10.1001/jamahealthforum.2022.1812.

[23] CMS Office of Minority Health. 2022. *The Path Forward: Improving Data to Advance Health Equity Solutions*. Baltimore, MD: Centers for Medicare & Medicaid Services.