Use of Natural Language Processing in a Pharmacoepidemiology Study: The Examination of Neuropsychiatric Events and Incident Use of Montelukast Among Patients with Asthma Protocol

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I. Title Page

Title	Use of Natural Language Processing in a Pharmacoepidemiology Study: The Examination of Neuropsychiatric Events and Incident Use of Montelukast Among Patients with Asthma
Research Question & Objectives	To assess the feasibility and effectiveness of using semi-structured and unstructured data sources extracted via Natural Language Processing to enhance the validity of a pharmacoepidemiology study regarding the association of neuropsychiatric events and incident montelukast use among patients with asthma.
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Conflict of Interest	None

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Abstract

Administrative claims and electronic health records (EHRs) comprise structured data traditionally used for pharmacoepidemiologic studies. However, potentially useful EHR information in the form of semi-structured and unstructured data (e.g., medical images, PDFs, voice recordings, textual data) that may provide narrative descriptions of a patient's signs and symptoms, family history, and social history offer unprecedented opportunities for improved and enhanced analyses. Advances in natural language processing (NLP), a computational linguistics technology, may harness this semi-structured and unstructured data into functional and informative data.

The following seeks to demonstrate the value, scalability, and transportability of using these varied components of claims and EHR data, including structured, semi-structured, and unstructured data defined herein as textual data, in a pharmacoepidemiology study. As a use case, this study examines the association between montelukast (MON) treatment and adverse events related to mental health for patients with asthma. Notably, while the U.S. Food and Drug Administration (FDA) now requires a Boxed Warning following extensive review of available information and expert opinions, evidence pharmacoepidemiology studies remain equivocal.

Study design: A retrospective cohort study.

Study data: This study uses de-identified Cerner EHR data linked to a national US claims data source (2015-2022). Structured, semi-structured, and unstructured data from the Cerner EHR and claims data will identify the patient cohort and characterize the patient population and outcomes. Methodology for the latter process includes creating a scalable textual semi-structured-to-structured and unstructured-to-structured data pipeline, training, tuning, and validating the annotation models, and understanding the transportability to other semi-structured and unstructured data sources.

Study cohort: Patients with asthma newly initiating MON or inhaled corticosteroids (ICS).

Study outcomes: Neuropsychiatric events (NPEs).

Study measures: Patient and disease characteristics that include, demographic, social determinants of health (SDOH), asthma-related characteristics, and neuropsychiatric treatment and events.

Statistical analysis: Descriptive and bivariate analyses will describe and compare baseline characteristics of the cohort and exposure groups. Incidence rates of neuropsychiatric outcomes will be calculated as rates per 100 person years of follow-up with 95% confidence intervals. Unadjusted and adjusted risk estimates will be examined using propensity score matching and multivariable analyses. Subgroup analyses will be conducted for age, sex, and history of a psychiatric disorder. SAS analytical software v9.4 and R version 4.1 will be used.

Amendments and Updates

Version date	Version number	Section of protocol	Amendment or update	Reason
		First draft	n/a	n/a

Rationale and Background

What is known about the condition: FDA issued several communications and recently a *Boxed Warning* about potential NPEs associated with new MON use in patients with asthma, based on several sources of information, including reports from the U.S. FDA Adverse Event Reporting System (FAERS) adverse events and the Sentinel System.[1,8-9]

What is known about the exposure of interest: Montelukast, a leukotriene-modifying agent (LTMA) is approved as monotherapy or in combination regimens for the treatment of asthma in patients 12 months or older, for the acute prevention of exercise-induced bronchoconstriction in patients 6 years or older, and for the relief of perennial allergic rhinitis in patients 6 months or older and for seasonal allergic rhinitis in patients 2 years or older.[6-7]

Gaps in knowledge: A limitation of the Sentinel analysis was reliance on outcomes included in health care claims, excluding consideration of many NPEs that would be recorded in EHR records of physician notes. In addition, in this study the use of ICD-9-CM codes for self-harm did not accurately capture intent of self-harm as do the more recent ICD-10-CM codes. Another important limitation of the original study was the inability to fully adjust for potential confounders, such as asthma severity and control, social determinants of health (SDOH), and other factors that are not available in claims data.

What is the expected contribution of this study? Using the methodological foundation of the Sansing-Foster et al study, this study seeks to understand the added value of EHR semi- and unstructured data by, for example reducing misclassification bias of covariates and identification of outcomes. This retrospective cohort study will use de-identified linked EHR and claim records. Data included in the Cerner EHR dataset will comprise both structured, and semi-structured and unstructured data elements. As part of the dataset creation, semi-structured and unstructured physician notes from the Cerner EHR will undergo a natural language process (NLP) using annotation guidelines and machine learning models to extract additional structured data elements. Overall, this study will demonstrate the feasibility of transport of using this novel methodology of extracting and augmenting data sources with semi-structured, and unstructured records for pharmacoepidemiology studies, as well as its external validity on independent data sets.

Research Question, Goals, and Objectives

This retrospective cohort study aims to utilize information from semi-structured, and unstructured data sources to enhance the validity of population-based pharmacoepidemiologic studies. Specifically, this study will examine the association of NPEs and new MON use among patients with asthma. Integral to the pharmacoepidemiology study, this research will examine the ability to scale this novel methodology among the over 100 Cerner EHR healthcare systems and transport this process to two additional independent health systems each with their own unique EHR platforms. To achieve its overarching goal, this study has the following goals:

1. Linkage of two rich national, population-based data sources that are: Cerner EHR data and a large national US claims data source

2. Characterization of the patient population with regard to asthma disease control and patient and family history of a psychiatric condition using structured, semi-structured, and unstructured patient records
3. Improved confounder adjustment with the use of propensity score matching based on patient and disease characteristics from structured, semi-structured, and unstructured data (e.g., asthma severity and control, SDOH)
4. Improved reporting and identification of outcomes related to neuropsychiatric events such as aggressive behavior, agitation, nightmares, and others as reported by the FDA through the use of semi-structured and unstructured patient records
5. Reduced misclassification bias of covariates and outcomes
6. Improved external validity by demonstrating the study methodology on an external data source

The specific study objectives are related to documenting the NLP process and examining its added value through developing a methodological process and conducting a pharmacoepidemiology study:

A. Objectives: Methodology

1. To create a usable NLP process
    a. Scalable process for the 100+ Cerner healthcare systems that require:
        – De-identification
        – Annotation models, including training, tuning, and validating
    b. Time-related costs associated with the use of NLP, i.e., training, tuning, and validating the NLP annotation models
2. To assess transportability of the trained and tuned models for two external EHR data sets

B. Objectives: Pharmacoepidemiology

3. To calculate incidence rates of neuropsychiatric events in the Cerner EHR-claims linked data with and without the addition of semi-structured and unstructured data EHR
4. To assess the risk of incident NPEs for new users of MON compared to new users of ICS monotherapy, using the core methodology of Sansing-Foster et al. (2021)[1], and covariates and outcomes from (a) claims data only and from Cerner EHR-claims linked data that include (b) structured and (c) semi-structured and unstructured data

    Secondary objectives include, examining the impact of age, sex, and history of a psychiatric disorder on risk estimates
5. To examine the relationship between severity and degree of control of asthma and the development of NPEs.[1]

[1] For example, trouble sleeping is both a consequence of poorly controlled asthma and a potential event listed by the FDA for montelukast. The inclusion of symptoms and measures of severity and control from structured data and clinical notes will allow us to explore these potential confounding effects.

Below are the study objective summary tables.

Table 1. Study Objectives Summary Table: Objective 1, Primary – Methodology: Create Usable NLP Process

Objective:	To establish a usable NLP pipeline to extract relevant entities from semi-structured and unstructured text and link this information to patients in the claims' cohort.
Methods overview:	Spark NLP, a library built on top of Apache Spark ML and developed by John Snow Labs, will be used to extract relevant clinical and sociodemographic features from unstructured patients' notes. Spark NLP provides several models that can address tasks from de-identification and named entity recognition to word embedding. The unstructured notes are available within the Cerner Real-World Data (CRWD) environment, with over 5 billion records available. Among the notes are registries for telephone consultations, outpatient appointments, progress, and discharge notes, among several others. The NLP pipeline will start with the de-identification of patients' and physicians' names, personal health information (PHI), and other personal information from notes. This process will be manually validated using a sample (size to be defined) to account for the accuracy of de-identifying the notes. Then, a step for extracting entities and relevant information (such as asthma severity, reports of aggressive behavior, and vivid dreams, among others) will be conducted. Following this extraction, these entities and relevant features will be used to create flags and be consolidated into a new dataset. After that, a record-linkage will be performed between this dataset and the claims' cohort in a data enrichment step. This NLP pipeline will concatenate processes using SQL (Structured Query Language), R and Python 3, including its powerful and reliable libraries such as PySpark, Spark NLP, among others.
Outcomes:	The main product of this NLP pipeline will be the creation of a dataset with structured information about the patient's clinical condition to enrich the claims' cohort information. Validation of the NLP models that will be used during the training and tuning will include: accuracy, precision, recall, negative predictive value, and F1 With the use of this NLP process, we expect to create a final dataset capable of providing meaningful insights into the clinical condition and evolution of patients with asthma following the use of montelukast.

Table 2. Study Objectives Summary Table: Objective 2, Primary – Methodology: Assess Transportability of NLP Process

Objective:	To assess transportability of the Named Entity Recognition pipeline through different tenants
Methods overview:	The patients' clinical notes used in this study come from different setting and sources – CE EHR, NJH and MGB databases. Because of that, and of an

	eventual difference in clinical notes composition, it is necessary to assess the capacity of the model to perform well in extracting variables of the clinical notes across the multiple tenants and data sources. To account for this issue, the models trained and tuned on the CE EHR dataset will be saved and applied to data from other tenants (specifically NJH and MGB). For NJH only, the model will be assessed in terms of accuracy, precision, recall, negative predictive value, and F1 metrics. If the performance is considered not satisfactory, a re-tuning of the model with data from this site will be done.
Outcomes:	Intermediate outcomes for model's performance assessment: accuracy, precision, recall, negative predictive value, and F1 metrics. Incidence rates of NPEs may be examined dependent on data availability (see Objective 3 outcomes). Final outcome or product of the process: A tuned model, able to perform well in recognizing entity from unstructured notes from multiple tenants.

Table 3. Study Objectives Summary Table: Objective 3, Primary – Pharmacoepidemiology: Incidence Rates

Objective:	To calculate incidence rates of neuropsychiatric events among patient with asthma who are newly treated with MON or ICS using the Cerner EHR-claims linked data with and without the addition of semi-structured and unstructured data. Specifically, this objective will identify patients using Cerner EHR-claims linked data and: 1. Calculate incidence rates of NPEs from claims data only 2. Calculate incidence rates of NPEs from Cerner EHR-claims structured data 3. Calculate incidence rates of NPEs from Cerner EHR-claims structured, semi-structured, and unstructured data
Hypothesis:	Incidence rates of NPEs will increase with the addition of structured and semi-structured and unstructured data (i.e., added value of using NLP)
Population (mention key inclusion-exclusion criteria):	Included were individuals aged between 6 and 80 years who initiated MON or ICS monotherapy during the study period (2015-2022), with continuous enrolment in health plans with both medical and drug coverage for at least 6 months prior to initial exposure (with up to 45-day gap), with existing records in both Cerner EHR structured (EHR-S) and claims datasets and valid notes in Cerner EHR semi-structured or unstructured (EHR-uS) records, and evidence of asthma diagnosis (i.e., an asthma related health-care contact) in any care setting 6 months prior to index date. Excluded were patients with prior exposure to MON, ICS, LABAs, LTRAs, zafirlukast, or zileutron, 6 months prior to index date. Exposure episodes with same day dispensing for both MON and ICS were excluded from analysis. Patients with invalid notes only were excluded.

Exposure:	MON
Comparator:	ICS monotherapy
Outcome:	Primary outcomes include hospitalization events due to self-harm (with or without E-codes, that identify self-inflicted injuries with an underlying psychiatric disorder and death by completed suicide), and other inpatient or outpatient psychiatric conditions (i.e., depressive disorder, psychotic disorder, mood disorder, anxiety disorder, obsessive-compulsive disorder and behavior, bipolar disorder, hyperactivity or aggressive behavior in children, and adult personality disorder). They also identify sleep related events (i.e., insomnia, hypersomnia, circadian rhythm disorder, parasomnia, movement disorder, undefined sleep disorder, or treatment for any sleep disorder), and other symptoms listed in the FDAs boxed warning for montelukast use (i.e., agitation, aggressive behavior or hostility, attention problems, bad or vivid dreams, depression, disorientation or confusion, feeling anxious, hallucinations, irritability, memory problems, obsessive-compulsive symptoms, restlessness, sleepwalking, stuttering, suicidal thoughts and actions, tremor or shakiness, trouble sleeping, uncontrolled muscle movements).
Time (when follow up begins and ends):	Exposure episode lengths were defined using days supplied from the outpatient pharmacy dispensing to create a sequence of continuous exposure with a gap in days supplied of up to 30 days. Follow-up began on the first day after exposure initiation and continued until the first occurrence of any of the following: comparator exposure (ICS), dispensing of oral corticosteroid, LABA, or LTRA, hospitalization unrelated to self-harm, incidence of any study outcome (NPE), disenrollment, end of treatment episode, death, or query end date.
Setting:	Outpatient or inpatient care
Main measure of effect:	Incidence rate (per 100 person years)

Table 4. Study Objectives Summary Table: Objective 4, Primary – Pharmacoepidemiology: Risk of NPE

Objective:	To examine the association between new MON use and NPEs (i.e., inpatient depressive disorder, treated outpatient depressive disorder, hospitalization for self-harm) using the Cerner EHR-claims linked data. Specifically, this objective will identify patients using Cerner EHR-claims linked data and: 1. <u>Using covariates and outcomes from claims only:</u> a. Describe the baseline characteristics of asthma patients according to treatment group i. Total sample (pre-matching) ii. Matched sample b. Estimate the risk of NPEs associated with new initiators of MON vs. ICS in matched sample i. Unadjusted

	ii. Adjusted 2. <u>Using covariates and outcomes from Cerner EHR-claims structured data only:</u> a. Describe the baseline characteristics of asthma patients according to treatment group i. Total sample (pre-matching) ii. Matched sample b. Estimate the risk of NPEs associated with new initiators of MON vs. ICS in matched sample i. Unadjusted ii. Adjusted 3. <u>Using covariates and outcomes from Cerner EHR-claims structured, semi-structured, and unstructured data:</u> a. Describe the baseline characteristics of asthma patients according to treatment group i. Total sample (pre-matching) ii. Matched sample b. Estimate the risk of NPEs associated with new initiators of MON vs. ICS in matched sample i. Unadjusted ii. Adjusted
Hypothesis:	Using unstructured, semi-structured, and structured EHR data linked to claims will provide corroborating evidence of an association between MON use and NPEs among patients with asthma. Specifically, the additional insights describing the patient population, improved confounder adjustment (propensity score matching), as well as additional outcomes from clinical notes will reduce bias and increase the likelihood of identifying a true association.
Population (mention key inclusion-exclusion criteria):	Included were individuals aged between 6 and 80 years who initiated MON or ICS monotherapy during the study period (2015-2022), with continuous enrolment in health plans with both medical and drug coverage for at least 6 months prior to initial exposure (with up to 45-day gap), with existing records in both Cerner EHR-S and claims datasets and valid notes in Cerner EHR-uS records, and evidence of asthma diagnosis (i.e., an asthma related health-care contact) in any care setting 6 months prior to index date. Excluded were patients with prior exposure to MON, ICS, LABAs, LTRAs, zafirlukast, or zileutron, 6 months prior to index date. Exposure episodes with same day dispensing for both MON and ICS were excluded from analysis. Patients with invalid notes only were excluded.
Exposure:	MON
Comparator:	ICS monotherapy
Outcome:	Primary outcomes include hospitalization events due to self-harm (with or without E-codes, that identify self-inflicted injuries with an underlying psychiatric disorder and death by completed suicide), and other inpatient or outpatient psychiatric conditions (i.e., depressive disorder, psychotic disorder, mood disorder, anxiety disorder, obsessive-compulsive disorder and behavior, bipolar disorder, hyperactivity or aggressive behavior in children, and adult

	personality disorder). They also identify sleep related events (i.e., insomnia, hypersomnia, circadian rhythm disorder, parasomnia, movement disorder, undefined sleep disorder, or treatment for any sleep disorder), and other symptoms listed in the FDAs boxed warning for montelukast use (i.e., agitation, aggressive behavior or hostility, attention problems, bad or vivid dreams, depression, disorientation or confusion, feeling anxious, hallucinations, irritability, memory problems, obsessive-compulsive symptoms, restlessness, sleepwalking, stuttering, suicidal thoughts and actions, tremor or shakiness, trouble sleeping, uncontrolled muscle movements).
Time (when follow up begins and ends):	Exposure episode lengths were defined using days supplied from the outpatient pharmacy dispensing to create a sequence of continuous exposure with a gap in days supplied of up to 30 days. Follow-up began on the first day after exposure initiation and continued until the first occurrence of any of the following: comparator exposure (ICS), dispensing of oral corticosteroid, LABA, or LTRA, hospitalization unrelated to self-harm, incidence of any study outcome (NPE), disenrollment, end of treatment episode, death, or query end date.
Setting:	Outpatient or inpatient care
Main measure of effect:	Hazard ratio

Table 5. Study Objectives Summary Table: Objective 4, Secondary – Pharmacoepidemiology: Risk of NPE by Subgroups

Objective:	To examine the impact of age (6-11, 12-17, 18+ years), sex (male vs. female), and history of psychiatric disorder (yes vs. no) on the association between treatment type and NPEs incidence in the Cerner EHR-claims linked structured, semi-structured, and unstructured data
Hypothesis:	Age, sex, and history of a psychiatric disorder influence the relationship between exposure and outcome
Population (mention key inclusion-exclusion criteria):	Included were individuals aged between 6 and 80 years who initiated MON or ICS monotherapy during the study period (2015-2022), with continuous enrolment in health plans with both medical and drug coverage for at least 6 months prior to initial exposure (with up to 45-day gap), with existing records in both Cerner EHR-S and claims datasets, and valid notes in Cerner EHR-uS records, and evidence of asthma diagnosis (i.e., an asthma related health-care contact) in any care setting 6 months prior to index date. Excluded were patients with prior exposure to MON, ICS, LABAs, LTRAs, zafirlukast, or zileutron, 6 months prior to index date. Exposure episodes with same day dispensing for both MON and ICS were excluded from analysis. Patients with invalid notes only were excluded.
Exposure:	MON (and generic)
Comparator:	ICS monotherapy (and generic)
Outcome:	Primary outcomes include hospitalization events due to self-harm (with or without E-codes, that identify self-inflicted injuries with an underlying

	psychiatric disorder and death by completed suicide), and other inpatient or outpatient psychiatric conditions (i.e., depressive disorder, psychotic disorder, mood disorder, anxiety disorder, obsessive-compulsive disorder and behavior, bipolar disorder, hyperactivity or aggressive behavior in children, and adult personality disorder). They also identify sleep related events (i.e., insomnia, hypersomnia, circadian rhythm disorder, parasomnia, movement disorder, undefined sleep disorder, or treatment for any sleep disorder), and other symptoms listed in the FDAs boxed warning for montelukast use (i.e., agitation, aggressive behavior or hostility, attention problems, bad or vivid dreams, depression, disorientation or confusion, feeling anxious, hallucinations, irritability, memory problems, obsessive-compulsive symptoms, restlessness, sleepwalking, stuttering, suicidal thoughts and actions, tremor or shakiness, trouble sleeping, uncontrolled muscle movements).
Time (when follow up begins and ends):	Exposure episode lengths are defined using days supplied from the outpatient pharmacy dispensing to create a sequence of continuous exposure with a gap in days supplied of up to 30 days. Follow-up starts on the first day after exposure initiation and continued until the first occurrence of any of the following: comparator exposure (ICS), dispensing of oral corticosteroid, LABA, or LTRA, hospitalization unrelated to self-harm, incidence of any study outcome (NPE), disenrollment, end of treatment episode, death, or query end date.
Setting:	Outpatient or inpatient care
Main measure of effect:	Hazard ratio

Table 6. Study Objectives Summary Table: Objective 5, Primary – Pharmacoepidemiology: Understand Role of Severity and Disease Control Related to Risk of NPE

Objective:	To examine the examine the relationship between severity and degree of control of asthma and the development of NPE. Specifically, this objective will aim to conduct a stratified analysis of the risk associated with exposure and outcome according to disease severity/control.
Hypothesis:	Unstructured, semi-structured, and structured EHR-claims linked data provides a more accurate estimate of disease severity and control. Stratification by disease severity and control may provide further insights into the relationship between exposure and outcomes.
Population (mention key inclusion-exclusion criteria):	Included were individuals aged between 6 and 80 years who initiated MON or ICS monotherapy during the study period (2015-2022), with continuous enrolment in health plans with both medical and drug coverage for at least 6 months prior to initial exposure (with up to 45-day gap), with existing records in both Cerner EHR-S and claims datasets and valid notes in Cerner EHR-uS records, and evidence of asthma diagnosis (i.e., an asthma related health-care contact) in any care setting 6 months prior to index date. Excluded were patients with prior exposure to MON, ICS, LABAs, LTRAs, zafirlukast, or zileutron, 6 months prior to index date. Exposure episodes with

	same day dispensing for both MON and ICS were excluded from analysis. Patients with invalid notes only were excluded.
Exposure:	MON (and generic)
Comparator:	ICS monotherapy (and generic)
Outcome:	Primary outcomes include hospitalization events due to self-harm (with or without E-codes, that identify self-inflicted injuries with an underlying psychiatric disorder and death by completed suicide), and other inpatient or outpatient psychiatric conditions (i.e., depressive disorder, psychotic disorder, mood disorder, anxiety disorder, obsessive-compulsive disorder and behavior, bipolar disorder, hyperactivity or aggressive behavior in children, and adult personality disorder). They also identify sleep related events (i.e., insomnia, hypersomnia, circadian rhythm disorder, parasomnia, movement disorder, undefined sleep disorder, or treatment for any sleep disorder), and other symptoms listed in the FDAs boxed warning for montelukast use (i.e., agitation, aggressive behavior or hostility, attention problems, bad or vivid dreams, depression, disorientation or confusion, feeling anxious, hallucinations, irritability, memory problems, obsessive-compulsive symptoms, restlessness, sleepwalking, stuttering, suicidal thoughts and actions, tremor or shakiness, trouble sleeping, uncontrolled muscle movements).
Time (when follow up begins and ends):	Exposure episode lengths were defined using days supplied from the outpatient pharmacy dispensing to create a sequence of continuous exposure with a gap in days supplied of up to 30 days. Follow-up starts on the first day after exposure initiation and continued until the first occurrence of any of the following: comparator exposure (ICS), dispensing of oral corticosteroid, LABA, or LTRA, hospitalization unrelated to self-harm, incidence of any study outcome (NPE), disenrollment, end of treatment episode, death, or query end date.
Setting:	Outpatient or inpatient care
Main measure of effect:	Hazard ratio

Methods

A. Study design

Study design: A retrospective cohort study.

Rationale for study design choice: To understand the added value of structured, semi-structured, and unstructured EHR data in a study population enriched with characteristics from semi-structured or unstructured EHR records and borrowing select methods from a prior study that used claims only data.

B. Data sources

1 Context and rationale for data sources

Claims and EHR data sources provide different views of a patient's health status. EHR data allow for a more complete condition identification and patient descriptors, while claims data offer a complete picture of healthcare encounters and medication purchases. Combining complementary data from both sources often strengthens studies that would otherwise rely on a single domain, by offering a comprehensive view of care received and an effective research framework.

In addition to providing traditionally studied structured data, EHRs have semi-structured and unstructured information with potentially critical covariates and outcomes of interest for pharmacoepidemiologic studies, such as patients' socioeconomic status, family history of disease, disease control, and other health indicators. Until recently, this information was acquired through use of techniques including data proxies and manual curation of physician notes.[2] The current advances in NLP of physician notes in EHRs offer researchers unprecedented opportunities to better understand the natural history of disease, treatment pathways, and disease outcomes in a systematic, efficient, and cost-effective manner.[3-5]

This retrospective cohort study will use de-identified linked EHR and claim records to assess the association between new MON use and the incidence of NPEs. This study is based on Sansing-Foster et al.'s (2020) original study conducted using claims data from the Sentinel Distributed Database between January 1, 2000 and September 30, 2015. Data were collected from 17 data partner sites that are large national insurers and integrated delivery care networks, medical and pharmacy data, inpatient and outpatient diagnoses and procedures, and prescription records.[1] Results of that study were equivocal with non-significant findings of increased risk of inpatient depressive disorder or self-harm. Further, the study was limited in its ability to adjust for potential confounding effects, such as of socioeconomic status or psychiatric history.

In this study, data included in the EHR dataset will comprise both structured, semi-structured, and unstructured data elements. As part of the dataset creation, semi-structured and unstructured physician notes from the EHR will undergo a natural language process using annotation guidelines and machine learning (ML) models to extract additional structured data elements. The application of state-of-the-art NLP technology is intended to improve the quality of the pharmacoepidemiology study by reducing misclassification bias and increasing the validity of its findings through more accurate characterization of patient demographic and health profiles.[3-5, 32]

To appreciate and examine the added value of data sources and types, this study cohort will be identified from a single data set, however, analyses will utilize covariates and outcomes from incrementally contributing sources (Table 8).

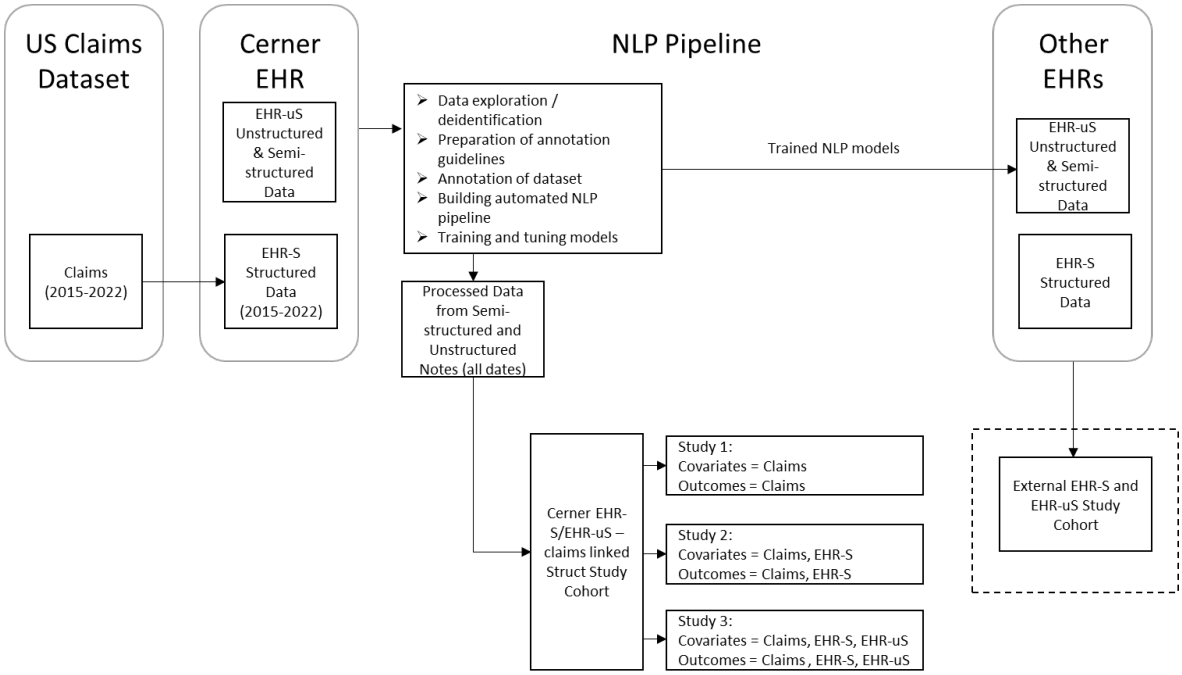
Table 7. Data sources used to define study variables and analyses

Data source / Study stage	Cohort	Propensity score matching	Covariates	Outcomes
Study 1	EHR-S–claims linked	Claims	Claims	Claims
Study 2	EHR-S–claims linked	EHR-S–claims	EHR-S–claims	EHR-S–claims
Study 3	EHR-S–claims linked	EHR-S/EHR-uS–claims	EHR-S/EHR-uS–claims	EHR-S/EHR-uS–claims

Abbreviations: EHR-S= structured electronic health records; EHR-uS= semi-structured and unstructured electronic health records.

In addition, these learnings will be applied further on an independent EHR system, to examine transportability and external validity of the study methodology.[10] The data sources included at various phases of this study are depicted in Figure 1 below.

Figure 1. Study data sources



2 Reason for selection

US claims data: Cerner Enviza has a license to use a national US claims data set, which are linked to the Cerner EHR data through a 3rd party vendor (Datavant) tokenization. Currently ~36% of patients in Cerner EHR data have matched claims data. The claims data set includes 150+ payer sources including commercial claims, Medicare Advantage, and Medicaid data from 50 states and DC and Puerto Rico, and includes medical, laboratory, and pharmacy claims as well as enrollment data.

Cerner EHR structured data: Cerner Enviza was created in 2021 through a merger of Kantar Health with Cerner, combining deep experience in epidemiology and biostatistics with an exceptional data asset. The Cerner EHR data are a de-identified data set from >120 participating US health systems. As of the first quarter 2022, there were ~100M patients with ~900M patient encounters. Key demographics include gender (52% female, 48% male), ethnicity (56% non-Hispanic, 17% Hispanic or Latino, 27% unknown), and race (63% White, 11% Black or African American, 2% Asian, 1% American Indian or Alaska Native, <1% Native Hawaiian or Other Pacific Islander, 23% other or unknown). The Cerner EHR data contain approximately 1 million patients who have been prescribed montelukast. Data from Cerner provider clients are processed through an enterprise data warehouse with a set of data capabilities sitting over the top to ensure the data are research ready. These capabilities include data standardization, concept normalization, person matching, person de-duplication, and de-identification. In addition to the Cerner data capabilities, a 3rd party vendor (Datavant) is also leveraged to tokenize the data set to be able to link to 3rd party data sources securely and anonymously such as claims and mortality data.

Cerner EHR semi-structured and unstructured data: John Snow Labs[20] is a healthcare AI company with extensive expertise in NLP. It provides state-of-the-art software and models to help healthcare and life science organizations build, deploy, and operate AI projects. The company is the developer of Spark NLP,[21] an NLP library built on top of Apache Spark, with an extension of Spark NLP for Healthcare. Spark NLP provides more than 5,000 pre-trained pipelines and models in more than 200 languages.[22] It supports over 50 types of NLP tasks and can be run locally or scaled seamlessly to a cluster. Downloaded more than 25 million times and winning multiple industry and community awards, Spark NLP is used by 32% of enterprise and 59% of healthcare organizations as the world's most widely used NLP library in the enterprise.[23] It is anticipated that tuning the NLP on the very large Cerner EHR dataset that includes curated records will increase the accuracy of the models. Training the NLP on the 100+ US sites from 44 states plus Washington D.C. represented data in Cerner EHR will increase the accuracy of the models and will enable more reliable application with similar data sets.

NJH EHR structured and un-structured data: National Jewish Health (NJH) clinical data comprise structured, semi-structured, and unstructured records for over 294,000 patients seen in the NJH outpatient clinics from February 2008 to the present. The EHR system used at NJH is Allscripts. It is anticipated that the novel methodology of using NLP to extract data from semi-structured and unstructured records will be highly transportable to the Allscripts dataset, due to its large number of sites in various settings serving highly heterogeneous populations.

MGB EHR structured and un-structured data: The Mass General Brigham (MGB) EHR data repository is based on all in- and outpatient activities of the Brigham and Women's Hospital and Massachusetts General Hospital, two major teaching hospitals with a network of outpatient clinics in the greater Boston area. It records all medical records electronically, including diagnoses, procedures, test results (lab test, imaging, biopsies etc.), prescribing and free text notes for all in and out-patient services. This dataset was chosen as an additional assessment of the transportability of the annotation model to the MGB EPIC EHR. No specific transportability measures will be calculated.

3 Strengths of data sources

US claims data: Claims data consist of 150+ payer sources including commercial, Medicare Advantage, and Medicaid data from 50 states and DC and Puerto Rico, encompassing medical, laboratory, and pharmacy claims, as well as enrolment records. Currently ~36% of patients in Cerner EHR records have matched US claims data.

Cerner EHR structured data: Cerner EHR dataset comprises de-identified structured data from >120 participating US health systems. As of the first quarter of 2022 included ~100M patient records with ~900M patient encounters. Key demographics as noted above reflect the distribution of the general population in the US. Additionally, the Cerner EHR data include approximately 1 million patients who have been prescribed MON.

Cerner EHR semi-structured and unstructured data: The Cerner EHR semi-structured and unstructured dataset contains more than 5.5 billion notes from over 60 million patients and 600 million healthcare encounters (outpatient appointments, telephone consultations, surgeries, etc.). The notes are presented as semi-structured and unstructured data and comprise clinical and sociodemographic information about patients as well as their clinical progress.

NJH EHR structured, semi-structured, and un-structured data: The Allscripts EHR dataset contains around 9 million clinical notes**.** The structured data includes demographics, diagnoses, medication history, laboratory tests, imaging reports, allergy history and other relevant information for pharmacoepidemiologic studies and has been previously used for research purposes.[10] The database has a well-defined cohort of patients with asthma, of which 10,000 have taken MON.

MGB EHR structured and un-structured data: MGB is the largest healthcare provider in Massachusetts and includes structured, semi-structured, and unstructured data using the EPIC platform. This additional EHR platform will provide further insights into the transportability of the NLP model. MGB data comprise ~1.2 million patients with approximately 750,000 of those patients having at least 1 recorded free text note.

4 Limitations of data sources

US claims data: Claims data capture only outcomes that resulted in health care claims, and cannot provide a clinical assessment of NPEs, that are likely to be more severe. Additionally, claims data do not include socioeconomic indicators (e.g., race, ethnicity, employment status), risk factors (e.g., BMI), disease severity (which was inferred by proxy), other comorbidities (e.g., insomnia, cough), or certain observable periods (medication administered during inpatient stay), which can limit the covariate adjustment. Claims data do not include uninsured patients, which reflect 12% of the population.[30] This may limit generalizability of the findings, since asthma prevalence is higher among individuals below the poverty threshold.[31]

Cerner EHR structured data: Cerner's structured EHR data offer a limited view regarding family history of disease, disease control, symptom severity, sleep and wellness measurements (exercise), or other comorbidities that may not warrant a diagnosis (e.g., snoring, stuttering). In addition, medication dispensing data are available for inpatient only.

Cerner EHR structured, semi-structured, and unstructured data linked to US claims data: A limitation of using both EHR and claims, structured and unstructured data is that only those patients with available data in both are included in the study cohort. Leveraging clinical texts is intended to reduce biases in structured data by providing missing and more accurate information, especially in this hybrid study design.[32]

NJH EHR structured, semi-structured, and unstructured data: NJH EHR data are processed using NLP models trained on a different EHR dataset (Cerner EHR) and therefore prone to several incompatibilities. Considering the size of the Cerner EHR dataset, it is anticipated that the models will achieve a high degree of accuracy. Nevertheless, a rigorous validation process will assess whether they need to be re-tuned for Allscripts data, prior to conducting the analysis.

MGB EHR structured, semi-structured, and unstructured data: Similar to the limitations for Allscripts described above, MGB data will be processed using NLP models trained on Cerner EHR data and, therefore, susceptible to possible incompatibilities. In addition, MGB transitioned from the MGB Legacy EHR System to the MGB Epic system from 2015-2017. To ensure a clean dataset on a single system (Epic), the study period at the MGB site will be restricted to the years 2018-2020. While this reduces the sample size for analyses conducted at MGB, a smaller cleaner comparison using data only from the period after the Epic transition was complete is preferable for MGB's role in the project. MGB's role is simply to serve as a validation site to look at model transportability – i.e., what are the

issues and challenges of an NLP model tuned in one EHR platform in a different population/EHR platform. In this context, power is not the primary concern and priority will be given to using a smaller cleaner cohort for assessing transportability.

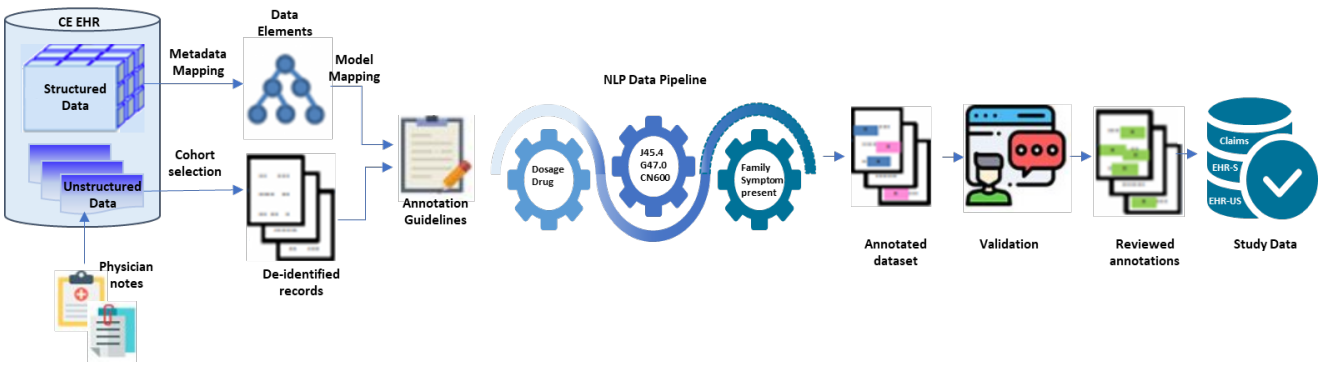
5 Data source provenance/curation:

US claims data: A 3rd party vendor (Datavant) is leveraged to tokenize the data set to enable linking of external data sources (e.g., claims and mortality data) securely and anonymously to Cerner EHR structured records.

Cerner EHR structured data: Clinical patient data are imported into the EHR from various sources using standard formats like Consolidated-Clinical Document Architecture (C-CDA), Health Level Seven version 2 (HL7V2), and Fast Healthcare Interoperability Resources version 4 (FHIR4). The origin of the data (provenance) is preserved in the EHR and can be accessed as needed. When a visit is created, data are retrieved from cloud repositories, registries, health information exchanges (HIEs), and processed through standardization, normalization, filtering, deduplication, prioritization, and presented to the provider for manual review in the Cerner Millennium EHR. Records are time-stamped and associated with an encounter, care facility, and provider identification number. Curation of data from each health system undergo data standardization, concept normalization, person matching, person de-duplication, and de-identification.

Cerner EHR semi-structured and unstructured data: See above regarding Cerner EHR structured data provenance. Spark NLP for Healthcare will be used to build fully automated pipelines that read, understand, and extract relevant structured facts from semi-structured and unstructured free text available in Cerner EHR records. Figure 2 below depicts the process of extracting, transforming, validating, and loading the semi-structured and unstructured data into the study data repository, that is described further:

Figure 2. NLP Process



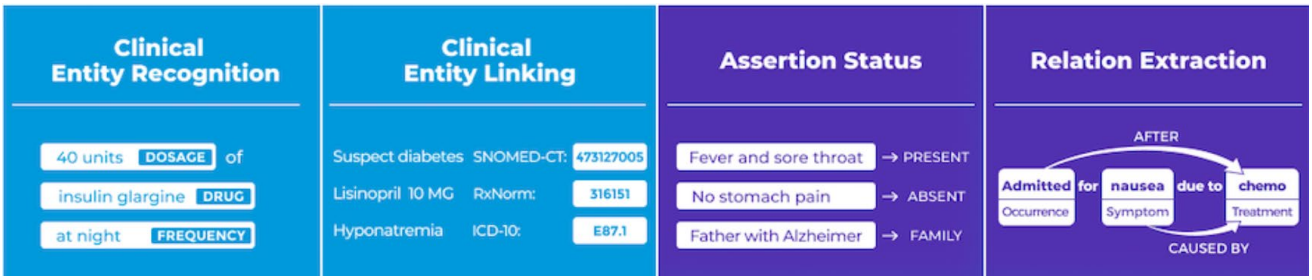
1. Exploratory data analysis and de-identification: search and identify relevant sources of semi-structured and unstructured textual data that may include clinical notes or transcribed calls from pharmacists, doctors, or patients. For example, a physician note from a medical encounter may indicate the patient's complaint, disease history, or severity: "Perennial allergy symptoms, worse recently. Sneezing, airway obstruction, watery rhinorrhoea. Eyes watering, itchy, no erythema or discharge."
2. Preparation of annotation guidelines: define data elements and models used to extract clinical facts (e.g., symptom, diagnoses, treatments, procedures), treatment

facts (e.g., drug name, dosage, route of administration, frequency, duration), and other medical facts (family history). Even though the main concepts are common in meaning, the annotations may be heterogeneous due to various standards and formats. To reduce ambiguity, annotation guidelines will clearly specify targets that map into a unified annotation schema.

3. Annotation of the dataset: filter, recognize, and classify data entities of interest from semi-structured and unstructured data (e.g., SNOMED-CT, ICD-9/10-CM, ICD-10-PCS, CPT, or RxNorm codes). A typical annotation task identifies specific text portions from document, assigns them to an entity type (e.g., treatment) and, if appropriate, adds attribute types (e.g., dosage, frequency, regimen) describing the entity.

4. Building the NLP pipeline: The pipeline will be configured by deciding which types of entities, relations, and normalization tasks should be conducted in what order. After the NLP pipeline is created, the information extraction will be fully automated. The automated NLP pipeline will use a combination of capabilities from Spark NLP for Healthcare to extract and transform data from semi-structured and unstructured records, as depicted in Figure 3 and described below:

Figure 3. Spark NLP for Healthcare



a) Clinical Entity Recognition: apply deep learning and transfer learning NLP models to extract relevant entities from semi-structured or unstructured text, such as neuropsychiatric events, social determinants of health, symptoms, diagnoses, procedures, drugs, adverse drug events, lab results, hospital admissions & discharges, demographics, etc.

b) Clinical Entity Linking: encompasses section detection, as well as sentence segmentation. Section detection is used to identify and differentiate between different sections in clinical notes. Specifically, it is important to differentiate between "Chief Compliant" versus "History of Present Illness" or "Plan" sections, because of the temporal impact of the facts they contain. Sentence segmentation is used to divide the text correctly into grammatical sentences. This is non-trivial when the documents come from scanned documents (requiring optical character recognition [OCR]), do not include punctuation, or include lab results or other numeric scores (such as PHQ-9 results).

c) Assertion Status Detection: These models determine what is being stated about each entity. For example, clinical text may include the term “asthma”, but its meaning differs wildly by the context in which it appears, for example: “patient is asthmatic”, “patient has no asthma”, “suspected asthma”, “patient has a family history of asthma”, or “used to suffer from asthma in childhood”

d) Relation Extraction: These models identify semantic relations between clinical entities, such as temporal relations that are highly relevant to this project. Specifically, this task identifies whether an event happened before, in parallel, or after another event. Another important task is to identify in the semi-structured and unstructured data the dates associated with specific events. Often a clinical note will include many dates. Therefore, identifying the date of a diagnosis or start and end dates for a prescription require strong natural language understanding capabilities.

e) Data normalization: standardize representation of medications, adverse reactions, vital signs, and demographic data into structured records that would enable the use of extracted information in downstream analysis.

a. Training and tuning the ML models on the Cerner EHR database: deep learning models will be trained and further tuned for specific cases where the pre-trained models do not reflect the exact definitions of specific features that will be used for propensity scoring (e.g., asthma control).

NJH EHR structured, semi-structured, and unstructured data: NLP models trained on the Cerner EHR database will be re-used externally on the Allscripts EHR dataset, which includes structured, semi-structured, and unstructured records. The accuracy of NLP models on Allscripts EHR will be compared with that observed on Cerner EHR to determine whether they need to be re-tuned for data collected at a different site with an independent data set.

MGB EHR structured, semi-structured, and unstructured data: As described above, NLP models trained on Cerner EHR data will also be applied on MGB EHR data to provide a second external site to examine the opportunity to transport the annotation model.

Metadata about data sources and software are presented in the following tables (Table 9, Table 10, Table 11, and Table 12).

Table 8. Metadata for Sansing-Foster et al (2021) study[1]

Data Source(s):	Sentinel Distributed Database
Study Period:	January 1, 2000, and September 30, 2015
Eligible Cohort Entry Period:	June 1, 2000, to Sept 30, 2014 - to accommodate for washout window (- 183 days= 6 months) and follow-up period (min 365 days)
Data Version (or date of last update):	v7.3.3
Data sampling/ extraction criteria:	Included were individuals aged between 6 and 80 years with continuous enrolment in health plans with both medical and drug coverage for at least 6 months before initial MON exposure (with up to 45-day gap) and evidence of asthma diagnosis (i.e., an asthma related health-care contact) in any care setting (outpatient, inpatient, ER) during the washout window. Excluded were patients with a COPD diagnosis during the washout window (6 months prior to index date) or evidence of death. Patients with comorbid allergic rhinitis, an alternative indication for MON use, were not excluded. Exposure episodes with same day dispensing (index date) for both the primary exposure (MON) and the comparator exposure (ICS) were excluded from analysis.

Type(s) of data:	Insurance medical and pharmacy data, inpatient and outpatient diagnoses and procedures, and prescription records collected from 16 data partner (DP) sites
Data linkage:	n/a
Conversion to CDM*:	n/a
Software for data management:	Sentinel Propensity Score Analysis tool, including Cohort Identification and Descriptive Analysis (CIDA) tool Type 2

Abbreviations: CDM, Common Data Model; CIDA, Cohort Identification and Descriptive Analysis; COPD, Chronic Obstructive Pulmonary Diseaes; DP, data partner; ER, Emergency Room; ICS, Inhaled corticosteroids; n/a, not applicable

Table 9. Metadata for Cerner EHR-claims linked study

Data Source(s):	US claims linked to Cerner EHR records from structured, semi-structured, and unstructured data sources
Study Period:	January 1, 2015 to May 31, 2022 (claims dataset) and all dates through September 2022 (Cerner EHR dataset)
Eligible Cohort Entry Period:	June 1, 2015 to May 31, 2021 - to accommodate for washout window (- 183 days= 6 months)
Data Version (or date of last update):	Claims - Data linkage: August 2023 - Datavant token: August 2023 - Datamart creation: August 2023 EHR - Data linkage: June 2023 - Datavant token: August 2023 - Datamart creation: September 2022
Data sampling/ extraction criteria:	Included were individuals aged between 6 and 80 years who initiated MON or ICS monotherapy during the study period (2015-2022), with continuous enrolment in health plans with both medical and drug coverage for at least 6 months prior to initial exposure (with up to 45-day gap), with existing records in both Cerner EHR and claims datasets, and valid notes in Cerner EHR semi-structured or unstructured records, and evidence of asthma diagnosis (i.e., an asthma related health-care contact) in any care setting 6 months prior to index date. Excluded were patients with prior exposure to MON, ICS, LABAs, LTRAs, zafirlukast, or zileutron, 6 months prior to index date. Exposure episodes with same day dispensing for both MON and ICS were excluded from analysis. Patients with invalid notes only were excluded.
Type(s) of data:	US claims dataset consists of 150+ payer sources including commercial claims, Medicare Advantage, and Medicaid data from 50 states and DC and Puerto Rico, and includes medical, laboratory, and pharmacy claims as well as enrolment data. Cerner EHR data is sourced from academic medical centers, as well as from community hospitals and health centers across the United States that provide a range of healthcare services including emergency, outpatient, and inpatient care. Patients are included regardless of insurance status. Cerner EHR dataset comprises de-identified structured data from >120 participating US health systems. As of the first quarter of 2022 included ~100M patient records with ~900M patient encounters, and approximately 1 million patients who have been prescribed MON. Cerner EHR dataset contains more than 5.5 billion notes from over 60 million patients and 600 million healthcare encounters (outpatient appointments, telephone consultations, surgeries, etc.). The notes are presented as semi-structured and unstructured data and comprise clinical and sociodemographic information about patients, as well as their clinical progress.

Data linkage:	US claims data are linked to the Cerner EHR data through a 3rd party vendor (Datavant) tokenization. Currently ~36% of patients in Cerner EHR data have matched US claims data.
Conversion to CDM*:	Apache Spark NLP for Healthcare, SQL, R, Python 3
Software for data analysis:	SAS v9.4, R v4.1

Abbreviations: CDM, Common Data Model; EHR, Electronic Health Records; EHR-S, Electronic Health Records – Structured ; EHR-uS, Electronic Health Records - Unstructured; ICS, Inhaled corticosteroids; LABA, long-acting beta agonist; LTRA, leukotriene receptor antagonist; MON, montelukast; n/a, not applicable; NLP, Natural Language Processing

Table 10. Metadata for Allscripts EHR

Data Source(s):	Allscripts EHR (structured, semi-structured, and unstructured)
Study Period:	January 1, 2015, and December 31, 2022 (or more recent available data)
Eligible Cohort Entry Period:	June 1, 2015, to December 31, 2022 - to accommodate for washout window (-183 days= 6 months) (or more recent available data)
Data Version (or date of last update):	To be determined upon initiation of transportability study
Data sampling/ extraction criteria:	Included were individuals aged between 6 and 80 years who initiated MON or ICS monotherapy during the study period (2015-2022), with existing records Allscripts EHR-S dataset, and valid notes in Allscripts EHR-uS records, and evidence of asthma diagnosis (i.e., an asthma related health-care contact) in any care setting 6 months prior to index date. Note: Study cohort will be examined for eligibility of continuous enrolment based on available data. Excluded were patients with prior exposure to MON, ICS, LABAs, LTRAs, zafirlukast, or zileutron, 6 months prior to index date. Exposure episodes with same day dispensing for both MON and ICS were excluded from analysis. Patients with invalid notes only were excluded.
Type(s) of data:	Electronic health records including demographics, diagnoses, medication history, laboratory tests, imaging reports, allergy history (structured data). Semi-structured and unstructured data will be processed via NLP, using models previously trained on Cerner EHR database.
Data linkage:	n/a
Conversion to CDM*:	Apache Spark NLP for Healthcare previously trained on Cerner EHR database
Software for data management:	To be determined upon transportability study initiation

Abbreviations: CDM, Common Data Model; EHR, Electronic Health Records; EHR-S, Electronic Health Records – Structured ; EHR-uS, Electronic Health Records - Unstructured; ICS, Inhaled corticosteroids; LABA, long-acting beta agonist; LTRA, leukotriene receptor antagonist; MON, montelukast; n/a, not applicable; NLP, Natural Language Processing

Table 11. Metadata for EPIC EHR

Data Source(s):	EPIC EHR (structured, semi-structured, and unstructured data sources)
Study Period:	January 1, 2018, and December 31, 2020
Eligible Cohort Entry Period:	June 1, 2018, to December 31, 2019 - to accommodate for washout window (-183 days= 6 months) and follow-up period (min 365 days)

Data Version (or date of last update):	To be determined upon initiation of transportability study
Data sampling/ extraction criteria:	Transportability will likely be assessed on a patient population similar to the inclusion and exclusion criteria used in the study
Type(s) of data:	Electronic health records including demographics, diagnoses, medication history, laboratory tests, imaging reports, allergy history (structured data). Physician notes extracted from semi-structured and unstructured data records via NLP, using models previously trained on Cerner EHR database.
Data linkage:	n/a
Conversion to CDM*:	Apache Spark NLP for Healthcare previously trained on Cerner EHR database
Software for data management:	To be determined upon transportability study initiation

Abbreviations: CDM, Common Data Model; EHR, Electronic Health Records; n/a, not applicable; NLP, Natural Language Processing

C. NLP Process - Methodology (Objectives 1 and 2)

1 Data infrastructure

Data will be in Cerner Enviza-operated Databricks environment, on top of the Amazon Web Services (AWS) infrastructure. The raw notes dataset is hosted within AWS S3 buckets. The Databricks environment will be the bridge between AWS infrastructure and the researchers.

2 Data access

Data access will be provided per Cerner Enviza's data access policies and procedure. All authors and researchers with access to the data will sign a Non-Disclosure Agreement. The access will be done through the infrastructure presented in item 1 – Data infrastructure.

3 De-Identification

There is a wide range of information in the notes' content: clinical and clinical progress patient information, as well as sociodemographic and healthcare unique identifiers of such patients—a set of data known as PHI. Although much of this information is useful for understanding the cohort's characteristics as well as providing meaningful insights into the outcomes to be assessed in this study, it is sensitive individual information and should be protected. To assure that no personal information will be available in the final dataset, a de-identification process will be conducted.

A de-identification process could be summarized as the procedures performed to identify, within a piece of text, the potentially sensitive information about patients (and healthcare professionals, if applicable), and then replace this information with semantic tags that can both hide the sensitive data and eventually keep them trackable to allow for subsequent analysis and data consolidation. During the process of replacing the data with semantic tags, a common approach is to mask the information with the category that such information represents. There are two different approaches: masking and obfuscation. Using a masking approach, the output for the note *"Jenna has asthma since she was 15 years old"* would be *"**<NAME>** has asthma since she was **<AGE>**"*. Another approach to de-identification is text obfuscation, which consists basically of replacing the sensitive information with another

meaningless piece of information from the same category. Following the same example as before, the output for the sentence "*Jenna has asthma since she was 15 years old*" using obfuscation would be "**Lorem** has asthma since she was **87** years old".

In this study, the de-identification will be performed using a model within the Spark NLP library for Python 3, most likely through the pretrained "Clinical Deidentification" model from John Snow Labs (Clinical Deidentification (johnsnowlabs.com)). The goal of this process is to ensure that sensitive information in Cerner EHR semi-structured and unstructured notes is protected before the data is made available for the next steps in the NLP pipeline.

Depending on the nature and composition of the notes, it might be important to run a spell-checker model previously to the de-identification task. The "*Medical Spell Checker"* model from John Snow Labs will be used to this task if it comes necessary. This model is also pretrained and is based on the *Levenshtein Automaton* for generating best candidates for correcting misspelled words (Medical Spell Checker (johnsnowlabs.com)).

4 Annotation

Data annotation is one of the most fundamental and important steps in building a reliable NLP tool. Given the richness of natural language structures, added by a layer of complexity due to healthcare technical terms, it becomes necessary to improve the capability of the NLP model to correctly interpret a piece of text or raw note.

There are several types of text annotation. Each of them can be useful depending on the context or objectives of the NLP model. In the development of models used for extracting certain fields from unstructured notes, one of the most common approaches is named entity recognition, in which some common structures within a text are tagged to a certain category of interest. This type of annotation is useful to improve the model's comprehension of the text's content.

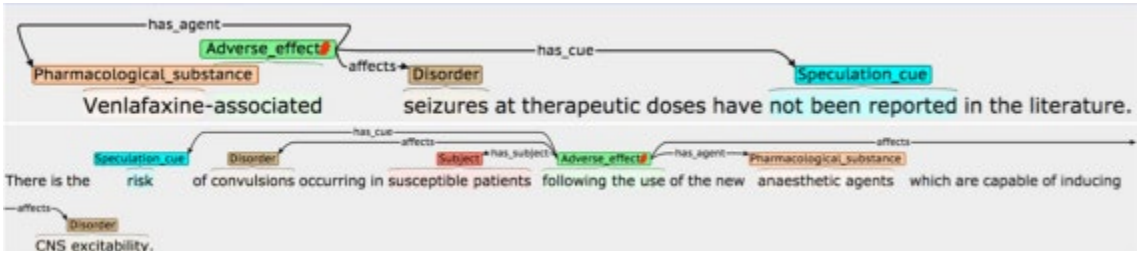
In addition to tagging entities, data annotation can enrich the entities by having assertions. Assertion labels are used to indicate an attribute of an entity. For instance, we can use the assertion "Present" to indicate that a given entity actually occurred and is referring to the patient (e. g. in the sentence "The patient reported having headaches"). Oppositely, the assertion "Absent" refers to the entities that are negated or mentioned to not have happened (e. g. in the sentence "The patient did not report having headaches"). Assertion labels could also denote whether a symptom or event occurred to patient's relatives or someone else.

Figure 4 shows an excerpt of a hypothetical note with annotations for both entities and assertions. The entities are color coded and superscripted after the relevant terms, while the assertions are on the right side of the tagged entities. In the example presented in Figure 4, the assertions were *Absent, Past, Hypothetical, Family, SomeoneElse, Possible, Planned, and Allergy*. It is not possible to define exactly the assertions for this study because the development of the annotation guidelines involves the interaction of the annotation team with a representative sample of data and the establishment of a mutually agreed taxonomy for named entity recognition, relations, and assertions.

Figure 4. Annotation with examples of entity recognition and assertion labels

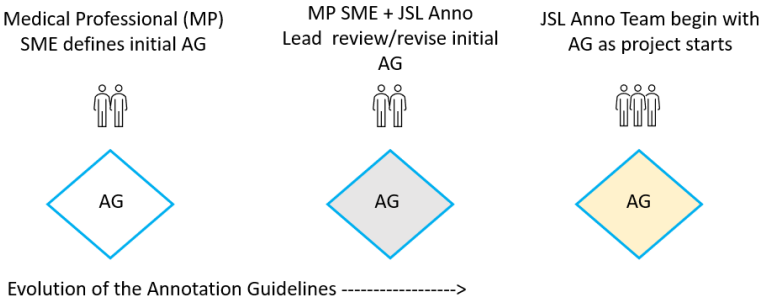
Finally, to provide even more contextual information for the NLP tasks, data annotation employs relation tagging, enabling entities to be linked within the annotation. It is especially useful for rich texts in the healthcare sector. With this approach, it is possible to denote the correlation between a drug and an adverse event or even positive outcomes, which will provide a more meaningful context for the NLP tasks downstream. Figure 5 shows an illustrative example of the relation tagging process, with the arrows representing the relation between the entities.

Figure 5. Example of relation tagging annotation process.



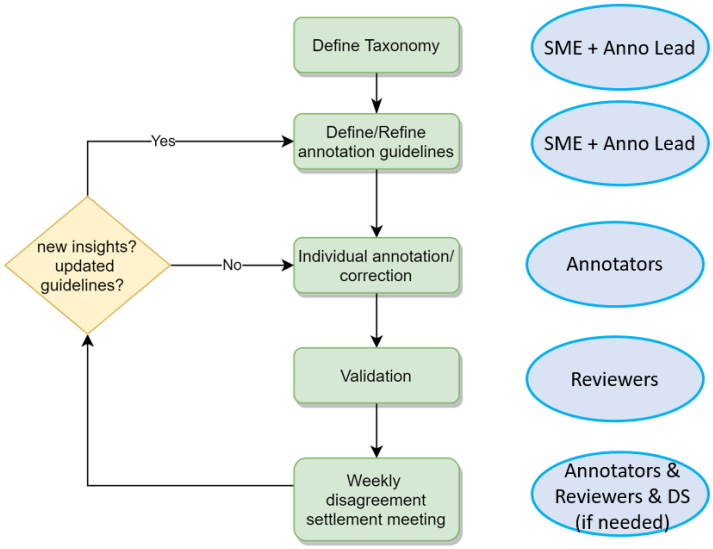
For this project, an initial Annotation Guideline (AG) will be developed by John Snow Labs medical annotation team and another team of Subject Matter Experts (SME) from Cerner Enviza – composed by asthma specialists and psychiatrists. This AG will contain the entities, assertions, and relations for extracting the correct elements from the unstructured notes (see item F – Variables). Then, after a review of this initial AG (Figure 6), it will proceed to the annotation workflow with continuous improvement, represented by Figure 7. The AG will help the annotation team to conduct the annotation of the text within the notes. When edgy or ambiguous cases arise, the SME team will be contacted to define the best approach and the proper corrections or clarifications for the AG. All the process for annotation will follow the four-eye principle, meaning that the annotation must be manually defined or approved by at least two people.

Figure 6. Initial annotation guidelines definition



Abbreviations: AG, Annotation Guidelines; JSL Anno, John Snow Labs Annotation team; MP, Medical Professional; SME, Subject-Matter Expert.

Figure 7. Workflow of annotation guidelines application and improvements



Anno: Annotation team; DS: Data Scientist.

5 Named entity recognition model

Finally, a pre-trained Named Entity Recognition Deep Learning (NER-DL) model will be used to extract the relevant features from the notes. To this end, the outputs from the annotation process will be used to fit the data onto the model, allowing it to learn how to properly recognize the relevant variables for this study within the semi-structured and unstructured records (see item F – Variables). Although the specific model for running and extracting the information from the text is still to be defined (because the selection of the best model rely on many factors such as data characteristics and the model's performance – see item 6 – Validation), it is likely that the "*Detect Diagnosis, Symptoms, Drugs, Labs and Demographics (ner_jsl_enriched)*" model from John Snow Labs will be among the strategies adopted (https://nlp.johnsnowlabs.com/2020/04/22/ner_jsl_enriched_en.html).

In the downstream of this pipeline, the NER-DL model will output, in a structured manner, the variables of interest for this project—possibly in a dataset with a flag for each entity or variable to be extracted from the notes. This dataset will then be used to enrich the cohort of

structured data, which will be further assessed in terms of the defined outcomes and objectives defined in this protocol.

6 Validation

It is anticipated that training the NLP models on the very large and accurate Cerner EHR dataset will increase the performance of the models. The models will be trained and further tuned in an adoptive manner. The NLP pipeline has built-in capabilities to assemble various tools to maximize the quality of the output. A two-step quality validation process will be employed to assess the reliability of the models used to extract data from semi-structured and unstructured records. NLP primarily serves as a method for information extraction rather than a standalone solution.

First, the trained models will be automatically assessed using a comparable set of performance metrics for the overall model and per class and retuned if necessary. The performance assessment will primarily be based in the macro F1-score, which takes the average of the F1 scores for each of the classes and categories addressed by the model. The F1 scores for each individual class encompass important metrics such as true positive and negative rates, precision, and recall, making the macro F1 score an effective overall indicator of the model's performance. However, to further refine the model and enhance its performance, a breakdown of additional metrics will also be conducted. This additional analysis can provide insights into potential areas for improvement and help understand factors contributing to any deviation from the expected or desired macro F1-score. These additional metrics are defined below, along with the definitions for the F1 score and other relevant features for assessing the model's and pipeline's performance.

The metrics are based on the relationship between true and false label predictions of the model:

- True positive (tp) – the number of true positives classified by the model (correct identification)
- True negative (tn) – the number of true negatives classified by the model (correct rejection)
- False negative (fn) – the number of false negatives classified by the model (missed identification)
- False positive (fp) – the number of false positives classified by the model (false identification)
- Accuracy – the ratio of correctly predicted observations in the total observations.

$$Accuracy = \frac{tp + tn}{total\ population}$$

- Precision / Positive predicted value (PPV) – the proportion of positively predicted labels among that are actually correct. Perfect precision corresponds to no false positives.

$$Precision\ or\ PPV = \frac{tp}{tp + fp}$$

- Recall / Sensitivity – the score representing the model's ability to correctly predict positive labels out of actual positive observations. Perfect recall corresponds to no false negatives.

$$Recall\ or\ Sensitivity = \frac{tp}{tp + fn}$$

- Selectivity / Specificity – the proportion of negative predicted labels among the labels that are truly incorrect.

$$Specificity = \frac{tn}{fp + tn}$$

- NPV (negative predictive value) – the probability that the negatively predicted labels are truly incorrect.

$$NPP = \frac{tn}{tn + fn}$$

- F1 score – the weighted average of precision and recall metrics. This score is a measure of performance defined as:

$$F1\ score\ = \frac{2}{\frac{1}{recall} \times \frac{1}{precision}} = 2 \times \frac{precision\ \times recall}{precision + recall} = \frac{tp}{tp\ + \frac{1}{2}(fp + fn)}$$

- F0.5 score – an F1 score adjusted for the importance of recall to precision (β = adjusted score importance).

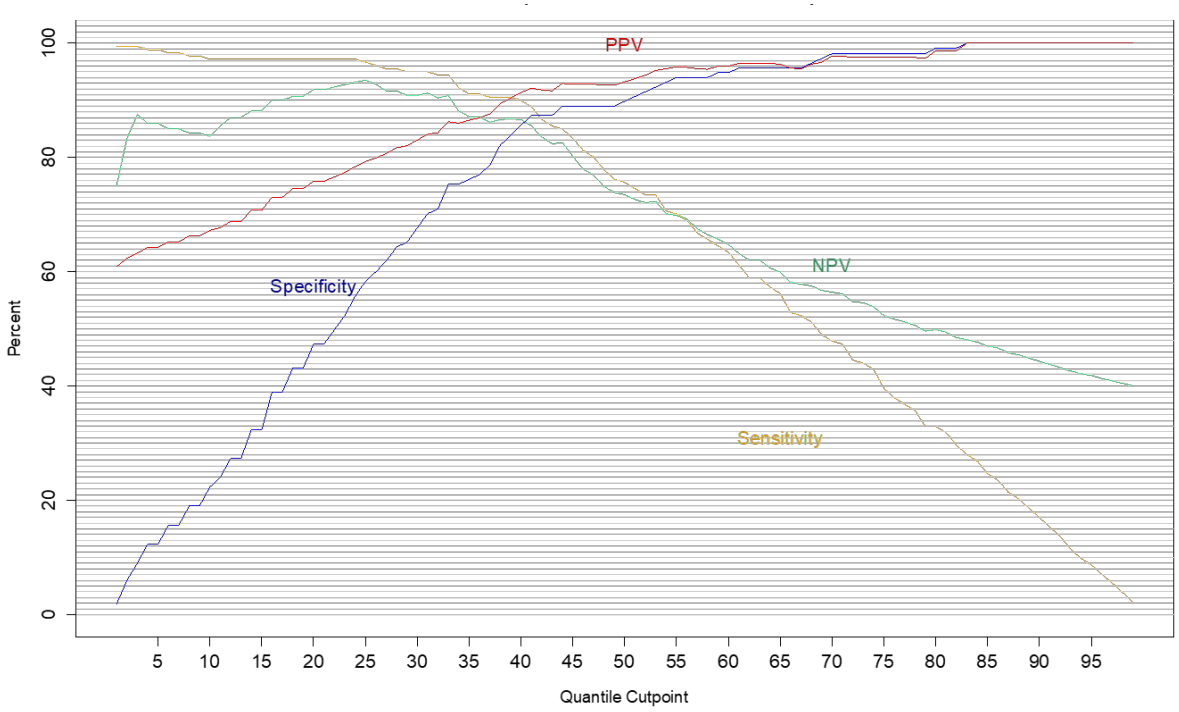
$$F0.5\ score\ = (1 + \beta^2) \times \frac{precision\ \times recall}{(\beta^2\ \times precision) + recall} = \frac{(1 + \beta^2)tp}{(1 + \beta^2)tp\ + \beta^2(fn + fp)}$$

- Macro-F1 score – a single metric summarizing each class's performance. Since it is built on top of the F1 scores for each category (class) assessed, this metric is not susceptible to class imbalance. Threshold and deviations in this score will be used to assess the model's overall performance.

$$Macro\ F1\ score = \frac{\sum_{i=1}^{n} F1\ Score_i}{n}$$

Graphical visualizations of these metrics will be used to improve and ease the understanding of their dynamics. For example, quantile cut points of predicted probability (i.e., the probability of being a 'case' according to the model) may be presented (see example below Figure 8).

Figure 8 Example of NLP model performance metrics



The use of these metrics will be applied in the following scenarios:

1. Measurement of performance metrics, on a blind evaluation data set.
2. Performance measurements of trained models using specific subsets of the available features. For example, performance metrics will be evaluated on the entire feature set, only on features from structured data, and only on features extracted from semi-structured and unstructured data. This step is essential to objectively quantity the differential value resulted from adding information from semi-structured and unstructured text, compared with the current common practice of only leveraging structured data when building such models.
3. Performance measurements on models that assess the confidence values returned by NLP models, provided by Spark NLP for Healthcare for every model. This will enable an objective evaluation of the trade-off between the value added of additional data sources and the reduction in accuracy that is inherent when using AI to interpret semi-structured and unstructured data.

Second, qualitative validation will be done through manual sampling comparison and expert review and verification executed by asthma specialists and psychiatrists with extensive clinical experience, to assess conformance to expected plausible values. Domain knowledge is necessary to successfully navigate clinical narratives. The sampling will be stratified by the confidence level returned by the NLP models. To facilitate validation, information extracted from semi-structured and unstructured text will be visually represented in a human-readable way, as depicted in the figure below. To provide such a clinician-friendly way to rapidly validate and share feedback on the models' accuracy, we will leverage John Snow Lab's Annotation Lab,[20] a data annotation tool that supports combining manual data labelling, automated pre-annotation by models, automated pre-annotation by rules, and automated model training to apply feedback from human annotators (see section 6 - Validation for more

details). Potential issues will be flagged for review by the data quality team and will be resolved. The decisions made to clean the data by either further tuning of models or eliminating ambiguous records will be documented. New annotations may be included for other elements added to the definition of the model.

7 Efficiency assessment

All the resources needed throughout the entire process for querying and handling the data of the unstructured notes will be documented. This includes, but is not limited to computational resource consumption and time spent running the steps involved in this pipeline; hours spent by annotators and SME in the annotation process; number of notes annotated; hours necessary to validate and test the model within new data; etc.

By the end of this project, with these resource consumption estimates, we aim to assess the efficiency of the entire pipeline—in terms of total resource consumption per note extracted, also weighted by the model's performance in terms of accuracy. The idea of this assessment is to provide an insight on how this process can be helpful to generate new health-related evidence and its scalability.

8 Transportability

As stated earlier, the notes come from different sources – CE EHR (Cerner), NJH (Allscripts), and MGB (EPIC) databases. Because of that, it is likely that the notes from each of these sources differs from the others in terms of data disposal or even the way that these clinical notes are created and structured. To account for this difference and build a tool able to present good transportability, the models trained and tuned on the CE EHR dataset will be saved and applied to data residing in other institutions, namely NJH and MGB.

In NJH, the model will be assessed for accuracy of the NLP with measures that include precision, recall, and F1 metrics (see Validation). The decision to train/tune the model will depend on the detailed metrics on the test (i.e., Cerner) dataset. Ideally, in such scenario, the performance difference should not exceed by 10% of the rated value of the model. If it exceeds, the likely cause is that the original dataset the model was trained on is significantly different from the Cerner's dataset, and thus, that is a clear trigger to start fine-tuning. The initial baseline for evaluating model performance will be the macro-f1 score with a threshold set to 0.8. Fine-tuning will depend on the model's performance. For re-tuning proposes, if it comes necessary, the amount of data to be used is expected to be much lesser than training a new model from scratch.

MGB data will be used to account for the operability of using this pipeline — whether it will run properly or not — and eventually assess which changes would be necessary for it to run adequately.

D. Study cohort - Pharmacoepidemiology (Objectives 3 to 5)

1 Inclusion criteria

Inclusion in the study population requires fulfilling all of the following criteria (Table 14):

1. Patients present *ever* in both EHR and claims data sets (medical and Rx)

2. ***Claims***: New initiation of MON or ICS monotherapy from 01 July 2015 to 30 June 2022 (most complete data[2]) 2022 = INDEX DATE [3]
3. ***Claims***: Continuous enrolment with both medical and drug coverage 6 months (183 d) prior to index date (with up to 45-day gap in coverage)
4. ***Claims***: Aged between 6 and 80 years at index date[4]
5. ***Claims*** / ***EHR-S***: Patients with at least 1 asthma diagnosis
   - In any care setting
   - Claims: index – 6 months (-183 d); EHR: prior to index[5]

2 Exclusion criteria[6]

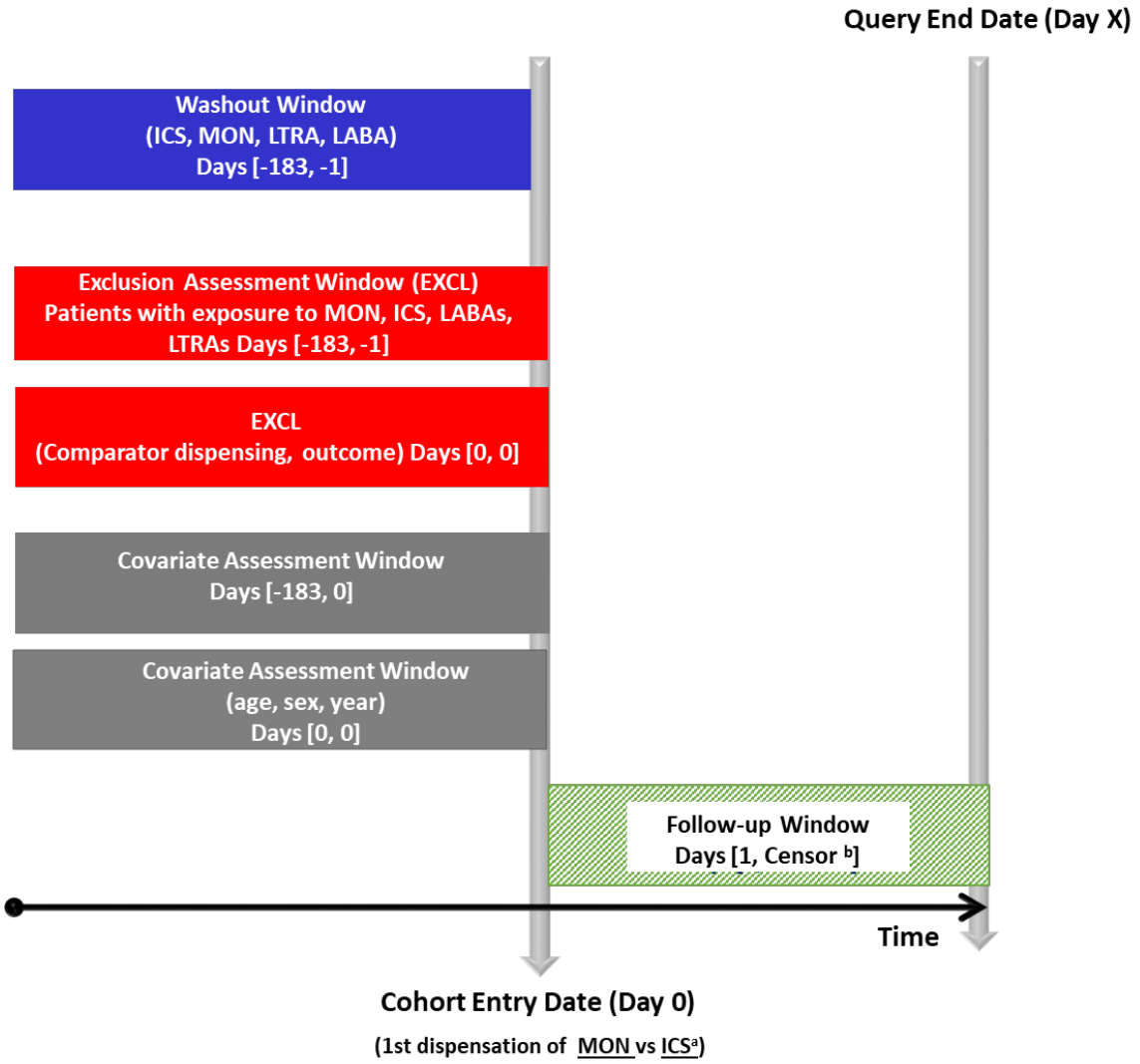
Patients who meet any of the following criteria are excluded from the study (Table 15):

1. ***Claims***: Exposure to (dispensing) MON, ICS, long-acting beta agonists (LABAs), leukotriene receptor antagonists (LTRAs), zafirlukast, or Zileuton within 6 months prior to index date
2. ***Claims***: Concomitant first exposure to MON and ICS
3. ***EHR-uS***: Patients with only invalid notes[7] as defined by any of the following criteria:
   a. Null content
   b. Scanned documents

The study design and flow diagrams (Figure 9 and Figure 10) below are based on these inclusion and exclusion criteria.

[2] Note that claims data has a 3-month lag regarding completeness of records.
[3] A flag for those who used albuterol in past 6 months for validation of asthma diagnosis will be created.
[4] Upper age limit is used due to HIPAA data limitations whereby ages are top-coded.
[5] Diagnosis codes in EHR are not necessarily reported at each encounter, therefore restricting the cohort to patients who received an asthma diagnosis in the EHR 6 months prior to index would likely result in selection bias.
[6] Unlike the Sansing-Foster et al study, patients with COPD are not excluded. Recommendations of subject matter experts are noted that there is an asthma-COPD overlap and that approximately 15-20% of patients with asthma smoke, therefore differentiating between patients with asthma and those with COPD.
[7] Based on expert recommendation of JSL we will include all notes regardless of number of characters.

Figure 9. Study Design

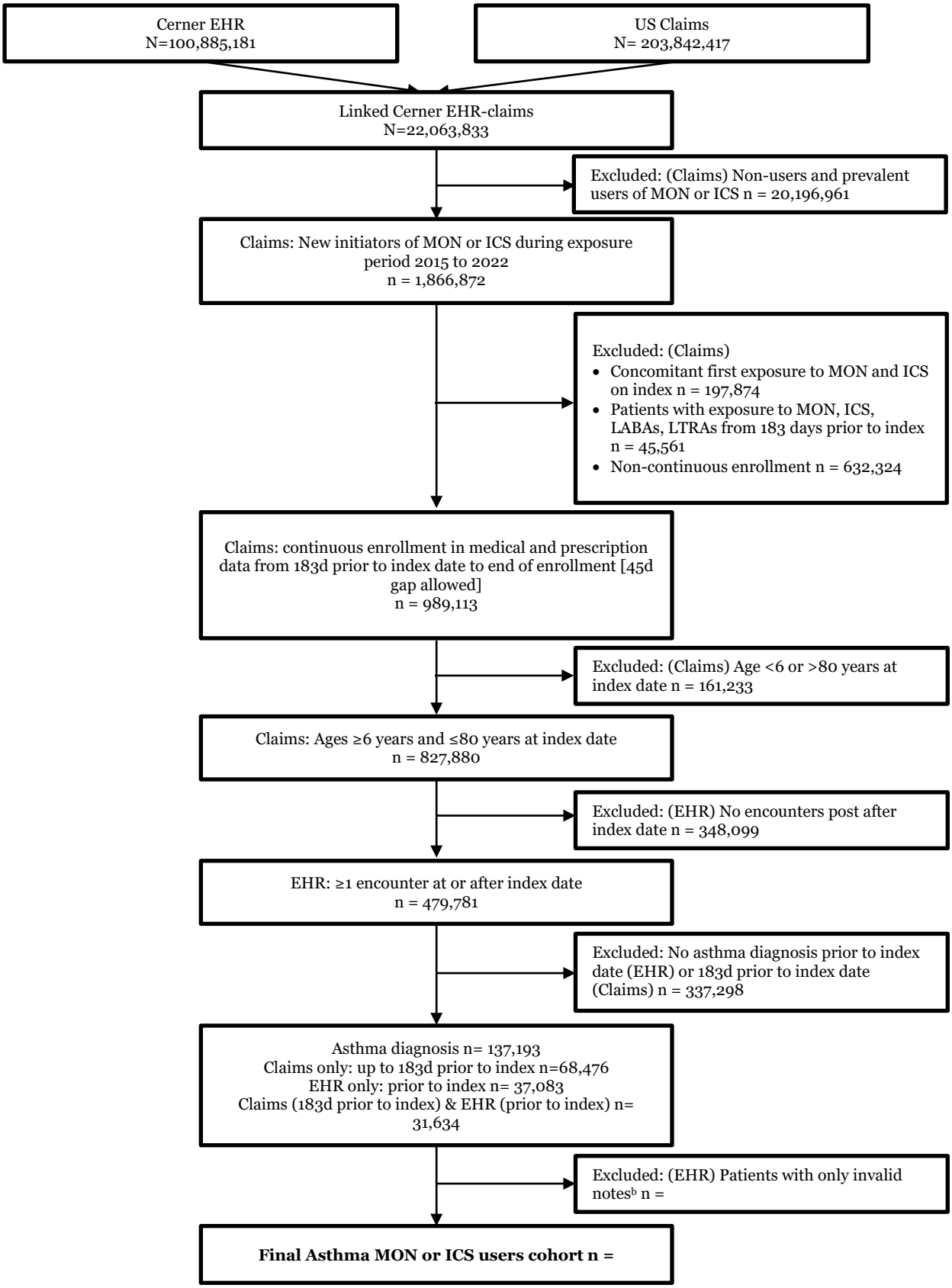


[a] Treatment episode is considered a 30-day gap period.

[b] Censoring includes patients who has one of the following events on day 0 to end of follow-up: exposure end date, dispensing of comparator drug, dispensing of a non-montelukast LTMA, LABA, oral corticosteroid, or a combination ICS/LABA product, occurrence of any study outcome, asthma-related hospitalization (asthma diagnosis in the primary position or in the secondary position concomitant with a primary diagnosis of any respiratory disease or viral infection – dependent on availability of data), death, study end date, or disenrollment.

Abbreviations: EXCL, exclusion assessment window; ICS, inhaled corticosteroid; LABA, long-acting beta agonist; LTRA, leukotriene receptor antagonist; MON, montelukast.

Figure 10. Study flow diagram[a]



[a] Study sample sizes are estimates.
[b] Invalid notes may include notes that are null, or scanned documents.
Abbreviations: EHR, Electronic Health Records; ICS, Inhaled corticosteroids; LABA, long-acting beta agonist; LTRA, leukotriene receptor antagonist; MON, montelukast

Table 12. Operational Definition of Time 0 (index date) and other primary time anchors

Time anchor	Description	Number of entries	Type of entry	Assessment window	Care Setting / PDX	Code Type	Incident with respect to…	Measurement characteristics/ validation	Source of algorithm/data
Index date exposure* (time 0)	First valid treatment episode with MON for asthma during the study period.	Single	Index date	[-183, -1]	Any	Rx	MON	No exposure to MON or ICS, LABAs, or LTRAs (including generic) 6 months prior to index date.	(exposure comparator Rx) (washout criteria) Claims
Index date comparator* (time 0)	First valid incident treatment episode with ICS for asthma during the study period.	Single	Index date	[-183, -1]	Any	Rx	MON	No exposure to MON or ICS, LABAs, or LTRAs (including generic) 6 months prior to index date.	(exposure comparator Rx) (washout criteria) Claims
Exposure episode	Days supplied continuously with MON or ICS until QED	Single	Duration	[0, QED]	N/A	Rx	MON, ICS	30 days extension	Claims (Rx & continuous supply)
Event Date (ED)	Date of the first NPE during the follow-up period	Single	Incident date	[1, ED]	IP, OP, Any PDX	Dx, Rx	MON	Temporality of exposure-outcome cannot be assessed, so outcome assessment begins at index+1	Claims, EHR-S, and EHR-uS
Matched control	Event date of NPE for case that the control is MED	Single	Incident date	[1, MED]	IP, OP, Any PDX	Dx, Rx	ICS	Temporality of exposure-outcome cannot be assessed, so outcome assessment begins at index+1	Claims, EHR-S, and EHR-uS

Abbreviations: Dx=diagnosis, ED=event date, EHR-S= structured electronic health records; EHR-uS= semi-structured and unstructured electronic health records; ER=emergency room, GP=general practitioner, ICD9/10=International Classification of Diseases 9th/10th revision, ICS=inhaled corticosteroids, IP=inpatient, ID=index date, LABA=long acting beta agonist, LTRA=leukotriene receptor antagonist, MED=matched event date, MON=montelukast, NDC=National Drug Codes, NPE=neuropsychiatric events, OP=Outpatient, PDX=diagnosis position, QED=querry end date, Rx=prescription drug.
Note: * While claims data indicate pharmacy dispensation of Rx, EHR data reflects prescription of medication. A flag will be created for those who used albuterol 6 months prior to index date, to validate asthma diagnosis

Table 13. Operational Definitions of Inclusion Criteria

Criterion	Details	Order of application	Assessment window	Care Settings/ Dx position	Code Type	Applied to study populations:	Measurement characteristics/ validation	Source for algorithm/data
Age ≥6 years and ≤80 years	Age at index year. Age is stratified in the following groups: 6-11, 12-17, and 18+ years.	At index date	[0, 0]	n/a	n/a	All	Calculated from date of birth and index date	Claims
Asthma diagnosis[a]	Evidence asthma diagnosis (at least one asthma-related healthcare encounter) in any care setting	Prior to index date	Claims: [-183, 0] EHR: prior to index	n/a	Dx	Individuals older than 6 years of age and ≤80 years of age	Include only those asthma Dx codes in which MON and ICS monotherapy are both viable options for initial treatment	Claims or EHR-S
Exposure*	Initiation of MON or ICS monotherapy, including their generic formulations for asthma treatment	Index date	[0,0]	n/a	Rx, Dx	Treated asthma	First exposure of MON or ICS (an generics) and no other concurrent asthma drugs	Claims
Continuous enrolment	Patients that were continuously enrolled in health plans with medical and drug coverage 6 months prior to index date	After selection of index date	[-183, -1]	n/a	n/a	Exposure and comparator cohorts	A gap in coverage of up to 45 days is allowed	Claims

[a] Diagnosis codes in EHR are not necessarily reported at each encounter, therefore restricting the cohort to patients who received an asthma diagnosis in the EHR 6 months prior to index would likely result in selection bias.
Abbreviations: Dx=diagnosis, EHR-S=electronic health records structured data, ICS=inhaled corticosteroids, MON=montelukast, Rx=prescription drug.
Note: While claims data indicate pharmacy dispensation of Rx, EHR data reflects prescription of medication. Upper age limit of 80 years is used due to HIPAA data limitations. For validation purposes, a flag will be created when asthma diagnosis was encountered in conjunction with albuterol use.

Table 14. Operational Definitions of Exclusion Criteria

Criterion	Details	Order of application	Assessment window	Care Settings	Code Type	Diagnosis position	Applied to study populations:	Measurement characteristic/ validation	Source for algorithm/ data
MON and ICS dispensed concomitantly	Index episodes with both the exposure and comparator dispensed on the same day	Index date	[0,0]	n/a	Rx, Dx	Primary asthma Dx	Exposure & comparator	MON index date = ICS index date for the same patient; NDC	Claims
Prior use of asthma drugs	Dispensation of MON, ICS, LABAs, LTRAs, zafirlukast, or Zileuton within 6 months prior to index	Washout window	[-183, 0]	n/a	Rx	Primary	Exposure & Comparator	NDC	Claims
Invalid notes	Patients with all invalid notes defined as null content, or scanned documents	Study period	[-183, QED]	n/a	n/a	n/a	Exposure & Comparator	Patient notes	EHR-uS

Abbreviations: Dx=diagnosis, EHR-uS=electronic health records unstructured data, ICD9/10=International Classification of Diseases 9th/10th revision, ICS=inhaled corticosteroids, LABA=long acting beta agonist, LTRA=leukotriene receptor antagonist, MON=montelukast, NDC=National Drug Codes, QED=querry end date, Rx=prescription drug.

E. Follow-up period

The index date serves as the cohort entry date.

Follow-up for events will being on day one[8] of the cohort entry date and end at the earliest of any of the following: exposure end date, dispensing of comparator drug, dispensing of a non-montelukast LTMA, LABA, oral corticosteroid, or a combination ICS/LABA product, occurrence of any study outcome, asthma-related hospitalization (asthma diagnosis in the primary position or in the secondary position concomitant with a primary diagnosis of any respiratory disease or viral infection – dependent on availability of data), death, study end date, or disenrollment, as described in Figure 11 below.

Controls will be matched on NPE date, the date of the NPE for the cases to whom they are matched. Follow-up is considered at the end of censoring as described above, however, truncation at 365 days may be considered as per Sansing-Foster (2021).[1]

Figure 11. Operational Definitions of Follow Up

Follow up start	Day 0	
Follow up end[a]	**Select all that apply**	**Specify**
Date of outcome	Yes	Occurrence of outcome of interest
Date of death	Yes	Death[c]
End of observation in data	Yes	End of records in database, disenrollment for >45 days
Day X following index date *(specify day)*	No	365 days[b]
End of study period (specify date)	Yes	31 Dec 2022
End of exposure *(specify operational details, e.g. stockpiling algorithm, grace period)*	Yes	>30 days gap in asthma treatment with MON or ICS
Date of add to/switch from exposure *(specify algorithm)*	Yes	Dispensing of comparator drug, dispensing of a non montelukast LTMA, LABA, oral corticosteroid, or a combination ICS/LABA product,
Other date *(specify)*	Yes	Asthma-related hospitalization (asthma diagnosis in the primary or secondary position, or unknown position with a respiratory condition or viral infection as primary position,)

[a] Follow up ends at the first occurrence of any of the censoring criteria.
[b] In the original study, post-hoc analyses were conducted truncating the follow-up period to 1 year after treatment, which did not substantially change the results.[1]
[c] Mortality data (i.e., month and year of death) is available in claims and EHR-S datasets (day of death is imputed as 1st day of the month of death)
Abbreviations: ICS, Inhaled corticosteroid; LABA, long acting beta agonist; LTRA, leukotriene receptor antagonist; MON, Montelukast

[8] As noted by subject matter experts, reaction to montelukast can be immediate, however, temporality of exposure prior to outcome cannot be determined therefore exposure time begins on index+1.

F. Variables

1 Exposure variables

Operational definitions of exposure values are listed in Table 16.

Context and rationale for exposure(s) of interest: Patients entered the base cohort based on initiation of MON or ICS as monotherapy. This allowed identification of newly treated patients with asthma. The exposure of interest, MON, and the comparator of interest, ICS, were defined using medications data from claims that are coded with National Drug Codes (NDCs). New use of MON or ICS monotherapy was defined as patients with who did not receive MON, ICS, long-acting beta agonists (LABAs), or leukotriene receptor antagonists (LTRAs) in the 6 months prior to the first qualifying dispensing (Time 0). Only the first treatment episode meeting these requirements was analysed (i.e., patients were not allowed to re-enter the cohort).

Generic and brand names and NDCs used to define the exposure (MON) and comparator (ICS) drugs, are listed in Appendix C. Medications and relevant NDCs used to define the washout criteria are in Appendix D.

Algorithm to define duration of exposure effect: Exposure episode lengths were defined using days supplied from the outpatient pharmacy dispensing to create a sequence of continuous exposure with an allowed gap in days supplied of up to 30 days between dispensing.

Table 15. Operational Definitions of Exposure

Exposure group name(s)*	Detail	Assessment Window	Care Setting	Code Type	Diagnosis position	Applied to study populations:	Incident with respect to…	Measurement characteristics / validation	Source of algorithm/ data
MON	New user of MON supplied continuously with <30 days gap	[0, QED]	N/A	Rx	n/a	Exposure	MON	NDC codes	Claims
ICS	New user* of ICS supplied continuously with <30 days gap	[0, QED]	N/A	Rx	n/a	Comparator	ICS	NDC codes	Claims

Abbreviations: ICS=inhaled corticosteroids, MON=montelukast, NDC=National Drug Codes, Rx=prescription drug, QED=querry end date.

2 Outcome variables

Context and rationale for outcome(s) of interest: The association between new MON use and NPEs is of interest because of findings from prior studies.[1]

Outcomes are assessed based on follow-up period after treatment initiation until censoring criteria occurs: dispensing of ICS, LABAs, or LTRAs, or MON (for comparator cohort), end of treatment episode, asthma-related hospitalization with asthma diagnosis in the primary, secondary position, or unknown position with a respiratory condition or viral infection as primary position, death, query end date, disenrollment, or when study outcome occurs.

Primary outcomes of interest are diagnoses, medications dispensed or prescribed, symptoms, or other healthcare utilizations related to an NPE. NPEs are based on those listed in FDAs boxed warning for children who experience behavior or mood-related changes while taking montelukast:

- Agitation, including aggressive behaviour or hostility
- Attention problems
- Bad or vivid dreams
- Depression
- Disorientation or confusion
- Feeling anxious
- Hallucinations (seeing or hearing things that are not really there)
- Irritability
- Memory problems
- Obsessive-compulsive symptoms
- Restlessness
- Sleepwalking
- Stuttering
- Suicidal thoughts and actions
- Tremor or shakiness
- Trouble sleeping
- Uncontrolled muscle movements

As noted above (see Study design), structured EHR data and claims data typically do not capture symptoms. Therefore, pharmacoepidemiology studies such as the Sentinel System claims study conducted by Sansing-Foster et al. (2020) utilized diagnosis codes, hospital utilization, and treatment codes to evaluation risk of adverse events from montelukast exposure. In this study, NLP techniques will be implemented to access symptoms and reports of these outcomes from semi-structured and unstructured data.

Outcomes will be incrementally used in each study 1 through 3 as noted in the column, 'Source of data' in Table 17, below.

Table 16. Operational Definitions of Outcomes

Outcome name	Details	Primary outcome?	Type of outcome	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Outcome measurement characteristics/ Validation[g]	Source of data
Neuropsychiatric event										
Depressive disorder	Dx of depressive disorder	Yes	Binary (yes/no)	[1, ED]	Any	Dx	Primary	Exposure & Comparator	ICD9/10 code for depression (F32-F34)	Claims, EHR-S
Hospitalization for depressive disorder	Dx of depression in the admitting diagnosis/reason for visit on an inpatient claim or EHR billing diagnosis (e.g., primary)	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Primary	Exposure & Comparator	ED=IP admin date ICD9/10 code (F32-F34) for depression	Claims, EHR-S
Treated depressive disorder	Combination of Dx of depressive disorder AND	Yes	Binary (yes/no)	[1, ED]	Outpatient	Dx	Any	Exposure & Comparator	ED=First component date ICD9/10 code for depression (F32-F34)	Claims, EHR-S
	Psychotherapy within 30 days of the depression diagnosis OR			[-30, ED]	Outpatient	Dx	Any		Psychotherapy codes	Claims, EHR-S
	Antidepressant use within 30 days of the depression diagnosis [a]			[-30, ED]	n/a	Rx	n/a		NCD codes for antidepressants	Claims
Self-harm	Dx for self-harm	Yes	Binary (yes/no)	[1, ED]	Any	Dx	Any	Exposure & Comparator	ICD9/10 codes self-harm (T14.91, X71 – X83, Y21 – Y33) for any of the following: poisoning, toxicity with non-medical substance, asphyxiation, open wound to elbow, wrist, forearm.	Patrick et. al Algorithm [c] Claims, EHR-S
Hospitalization for self-harm [b]	Combination of Dx for self-harm, including events of undetermined intent AND	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Any	Exposure & Comparator	ED=IP admin date ICD9/10 codes (T14.91, X71 – X83, Y21 – Y33) for any of the following: poisoning, toxicity with non-medical substance, asphyxiation, open wound to elbow, wrist, forearm	Patrick et. al Algorithm [c] Claims, EHR-S

Outcome name	Details	Primary outcome?	Type of outcome	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Outcome measurement characteristics/ Validation[g]	Source of data
	Dx of NP disorder on the same day			[1, ED]	Inpatient	Dx	Any		ICD9/10 codes (F20 – F29, F30 – F39, F40 – F48, F60 – F69) for any of the following: depression, personality disorder, mania, adjustment reaction, unspecified non-psychotic mental disorder (same day).	
Hospitalization for self-harm with E-codes [c]	Combination of Dx for self-harm AND	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Any	Exposure & Comparator	ED=IP admin date ICD9/10 codes self-harm (T14.91, X71 – X83, Y21 – Y33) for any of the following: poisoning, toxicity with non-medical substance, asphyxiation, open wound to elbow, wrist, forearm.	Modified self-harm algorithm Swain et. al [d] Claims, EHR-S
	Dx of NP disorder on the same day OR				Inpatient, Outpatient, ER	Dx	Any		ICD9/10 codes for NP disorder (F20 – F29, F30 – F39, F40 – F48, F60 – F69) for any of the following: depression, personality disorder, mania, adjustment reaction, unspecified non-psychotic mental disorder (same day). In addition to IP Dx's, the modified algorithm included these diagnoses in OP or ER.	
	Suicide and self-harm with E-code				Any	E-code	Any		E-codes (E950-E958) to capture additional cases of self-harm.	
Psychotic disorder	Dx of psychotic disorder	Yes	Binary (yes/no)	[1, ED]	Any	Dx	Primary	Exposure & Comparator	ICD9/10 codes for psychotic disorder (F20 – F29)	Claims, EHR-S
Hospitalization for psychotic disorder	Dx of psychotic disorder in the primary position on an inpatient claim.	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Primary	Exposure & Comparator	ED=IP admin date ICD9/10 codes for psychotic disorder (F20 – F29)	Claims, EHR-S
Treated psychotic disorder	Combination of Dx of psychotic disorder AND	Yes	Binary (yes/no)	[1, ED]	Outpatient	Dx	Any	Exposure & Comparator	ED=First component date ICD9/10-CM codes (F20 – F29)	Claims, EHR-S
	Psychotherapy within 30 days of diagnosis OR			[-30, ED]	Outpatient	Dx	Any		Psychotherapy codes	Claims

Outcome name	Details	Primary outcome?	Type of outcome	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Outcome measurement characteristics/ Validation[g]	Source of data
	Antipsychotic drugs use within 30 days of diagnosis [d]			[-30, ED]	n/a	Rx	n/a		NCD codes for antipsychotic drugs Psychotherapy codes	Claims
Mood disorder	Dx of mood disorder	Yes	Binary (yes/no)	[1, ED]	Any	Dx	Primary	Exposure & Comparator	ICD9/10-CM codes (F30 – F39)	Claims, EHR-S
Hospitalization for mood disorder	Dx of mood disorder in the primary position on an inpatient claim	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Primary	Exposure & Comparator	ED=IP admin date ICD9/10-CM codes (F30 – F39)	Claims, EHR-S
Treated mood disorder	Combination of Dx of mood disorder AND	Yes	Binary (yes/no)	[1, ED]	Outpatient	Dx	Any	Exposure & Comparator	ED=First component date ICD9/10-CM codes (F30 – F39)	Claims, EHR-S
	Psychotherapy within 30 days of diagnosis OR			[-30, ED]	Outpatient		Any		Psychotherapy codes	Claims
	Selected group of psychotropic drugs use within 30 days of the diagnosis [d]			[-30, ED]	n/a	n/a	n/a		NCD codes for Selected group of psychotropic drugs	Claims
Anxiety disorder	Dx of anxiety disorder	Yes	Binary (yes/no)	[1, ED]	Any	Dx	Primary	Exposure & Comparator	ICD9/10-CM codes (F40 – F48, F41.0, F41.3, F41.8, F41.9)	Claims, EHR-S
Hospitalization for anxiety disorder	Dx of anxiety disorder in the primary position on an inpatient claim	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Primary	Exposure & Comparator	ED=IP admin date ICD9/10-CM codes (F40 – F48, F41.0, F41.3, F41.8, F41.9)	Claims, EHR-S
Treated anxiety disorder	Combination of Dx of anxiety disorder AND	Yes	Binary (yes/no)	[1, ED]	Outpatient	Dx	Any	Exposure & Comparator	ED=First component date ICD9/10-CM codes (F40 – F48, F41.0, F41.3, F41.8, F41.9)	Claims, EHR-S
	Psychotherapy within 30 days of diagnosis OR			[-30, ED]	Outpatient		Any		Psychotherapy codes	Claims
	Selected group of psychotropic drugs use within 30 days of the diagnosis [d]			[-30, ED]	n/a	n/a	n/a		NCD codes for Selected group of psychotropic drugs	Claims
Obsessive-compulsive disorder	Dx of obsessive-compulsive disorder	Yes	Binary (yes/no)	[1, ED]	Any	Dx	Primary	Exposure & Comparator	ICD9/10-CM codes (F42, F60.5; R46.81)	Claims, EHR-S

Outcome name	Details	Primary outcome?	Type of outcome	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Outcome measurement characteristics/ Validation[g]	Source of data
Hospitalization for obsessive-compulsive disorder and behavior	Dx of obsessive-compulsive disorder and behavior in the primary position on an inpatient claim	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Primary	Exposure & Comparator	ED=IP admin date ICD9/10-CM codes (F42, F60.5; R46.81)	Claims, EHR-S
Treated obsessive-compulsive disorder and behavior	Combination of Dx of obsessive-compulsive disorder and behavior AND	Yes	Binary (yes/no)	[1, ED]	Outpatient	Dx	Any	Exposure & Comparator	ED=First component date ICD9/10-CM codes (F42, F60.5; R46.81)	Claims, EHR-S
	Psychotherapy within 30 days of diagnosis OR			[-30, ED]	Outpatient		Any		Psychotherapy codes	Claims
	Selected group of psychotropic drugs use within 30 days of the diagnosis [d]			[-30, ED]	n/a	n/a	n/a		NCD codes for Selected group of psychotropic drugs	Claims
Manic episode or bipolar disorder	Dx of manic episode or bipolar disorder	Yes	Binary (yes/no)	[1, ED]	Any	Dx	Primary	Exposure & Comparator	ICD9/10-CM codes (F06, F30, F31)	Claims, EHR-S
Hospitalization for manic episode or bipolar disorder	Dx of manic episode or bipolar disorder in the primary position on an inpatient claim.	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Primary	Exposure & Comparator	ED=IP admin date ICD9/10-CM codes (F30, F31)	Claims, EHR-S
Treated manic episode or bipolar disorder	Combination of Dx of manic episode or bipolar disorder AND	Yes	Binary (yes/no)	[1, ED]	Outpatient	Dx	Any	Exposure & Comparator	ED=First component date ICD9/10-CM codes (F30, F31)	Claims, EHR-S
	Psychotherapy within 30 days of diagnosis OR			[-30, ED]	Outpatient		Any		Psychotherapy codes	Claims
	Selected group of psychotropic drugs use within 30 days of the diagnosis [d]			[-30, ED]	n/a	n/a	n/a		NCD codes for Selected group of psychotropic drugs	Claims
Hyperactivity/ aggressive behavior/harming others	Dx of hyperactivity/ aggressive behavior/ harming others	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Primary	Exposure & Comparator	ICD9/10-CM codes (R45); ADHD (F90); Conduct disorders (F91); Emotional disorders w/ onset specific to childhood (F93);	Claims, EHR-S

Outcome name	Details	Primary outcome?	Type of outcome	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Outcome measurement characteristics/ Validation[g]	Source of data
									Disorders of social functioning w/ onset specific to childhood/adolescence (F94); Other behavioral and emotional disorders w/ onset childhood/adolescence (F98); DMDD (F34.81)	
Hospitalization for hyperactivity/ aggressive behavior/harming others	Dx of hyperactivity/ aggressive behavior/ harming others	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Primary	Exposure & Comparator	ED=IP admin date ICD9/10-CM codes (R45); ADHD (F90); Conduct disorders (F91); Emotional disorders w/ onset specific to childhood (F93); Disorders of social functioning w/ onset specific to childhood/adolescence (F94); Other behavioral and emotional disorders w/ onset childhood/adolescence (F98); DMDD (F34.81)	Claims, EHR-S
Treatment for hyperactivity/ aggressive behavior/ harming others	Combination of Dx of hyperactivity/ aggressive behavior/ harming others AND	Yes	Binary (yes/no)	[1, ED]	Outpatient	Dx	Any	Exposure & Comparator	ED=First component date ICD9/10-CM codes (R45); ADHD (F90); Conduct disorders (F91); Emotional disorders w/ onset specific to childhood (F93); Disorders of social functioning w/ onset specific to childhood/adolescence (F94); Other behavioral and emotional disorders w/ onset childhood/adolescence (F98); DMDD (F34.81)	Claims, EHR-S
	Psychotherapy within 30 days of diagnosis OR			[-30, ED]	Outpatient		Any		Psychotherapy codes	Claims
	Selected group of psychotropic drugs use within 30 days of the diagnosis [d]			[-30, ED]	n/a	n/a	n/a		NCD codes for Selected group of psychotropic drugs	Claims

Outcome name	Details	Primary outcome?	Type of outcome	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Outcome measurement characteristics/ Validation[g]	Source of data
Adult personality disorder	Dx of adult personality disorder	Yes	Binary (yes/no)	[1, ED]	Any	Dx	Primary	Exposure & Comparator	ICD9/10-CM codes (F60-F69)	Claims, EHR-S
Hospitalization for adult personality disorder	Dx of adult personality disorder in the primary position on an inpatient claim	Yes	Binary (yes/no)	[1, ED]	Inpatient	Dx	Primary	Exposure & Comparator	ED=IP admin date ICD9/10-CM codes (F60-F69)	Claims, EHR-S
Treated adult personality disorder	Combination of Dx of adult personality disorder AND	Yes	Binary (yes/no)	[1, ED]	Outpatient	Dx	Any	Exposure & Comparator	ED=First component date ICD9/10-CM codes (F60-F69)	Claims, EHR-S
	Psychotherapy within 30 days of diagnosis OR			[-30, ED]	Outpatient		Any		Psychotherapy codes	Claims
	Selected group of psychotropic drugs use within 30 days of the diagnosis [d]			[-30, ED]	n/a	n/a	n/a		NCD codes for selected group of psychotropic drugs	Claims
Sleep-related event										
Insomnia	Dx for insomnia and sleep deprivation	Yes	Binary (yes/no)	[1, ED]	n/a	Dx	n/a	Exposure & Comparator	ICD9/10-CM codes (G47.0, F51.0, Z72.820)	Claims, EHR-S
Hypersomnia	Dx for Hypersomnia	Yes	Binary (yes/no)	[1, ED]	n/a	Dx	n/a	Exposure & Comparator	ICD9/10-CM codes (G47.1, F51.1)	Claims, EHR-S
Circadian rhythm disorder	Dx for circadian rhythm disorder	Yes	Binary (yes/no)	[1, ED]	n/a	Dx	n/a	Exposure & Comparator	ICD9/10-CM codes (G47.2)	Claims, EHR-S
Parasomnia	Dx for parasomnias, including sleepwalking, sleep terrors and nightmare disorder	Yes	Binary (yes/no)	[1, ED]	n/a	Dx	n/a	Exposure & Comparator	ICD9/10-CM codes (G47.5, F51.3, F51.4, F51.5)	Claims, EHR-S
Movement disorder	Dx for sleep related movement disorders and restless legs syndrome	Yes	Binary (yes/no)	[1, ED]	n/a	Dx	n/a	Exposure & Comparator	ICD9/10-CM codes (G47.6, G25.81)	Claims, EHR-S
Other and undefined sleep disorder	Dx for Other and undefined sleep disorder	Yes	Binary (yes/no)	[1, ED]	n/a	Dx	n/a	Exposure & Comparator	ICD9/10-CM codes (G47.8, G47.9, F51.8, F51.9)	Claims, EHR-S
Treatment for sleep disorders	Selected group of psychotropic drugs use	Yes	Binary (yes/no)	[1, ED]	n/a	Rx	n/a		NCD codes for sleep problems [e] (Include doxepin, estazolam, eszopiclone, flurazepam, melatonin, suvorexant, temazepam, trazodone,	Claims

Outcome name	Details	Primary outcome?	Type of outcome	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Outcome measurement characteristics/ Validation[g]	Source of data
									triazolam, ramelteon, zaleplon, and zolpidem.)	
Symptoms and other outcomes[f]										
Aggressive behavior or hostility	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Agitation	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Attention problems	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Bad or vivid dreams	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Confusion/ Disorientation	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Depression	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Disorientation or confusion	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Dream abnormalities	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Feeling anxious	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Hallucinations	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Irritability	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Memory problems	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Obsessive-compulsive symptoms	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Restlessness	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Sleepwalking	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS

Outcome name	Details	Primary outcome?	Type of outcome	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Outcome measurement characteristics/ Validation[g]	Source of data
Stuttering	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Suicidal thinking and actions	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Tremor or shakiness	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Trouble sleeping	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS
Uncontrolled muscle movements	Evidence of symptom	Yes	Binary (yes/no)	[1, ED]	n/a	Unknown	n/a	Exposure & Comparator	TBD	EHR-uS

Abbreviations: Dx=diagnosis, ED=event date, EHR-S=electronic health records structured data, EHR-uS=electronic health records unstructured data, ER=emergency room, ICD9/10=International Classification of Diseases 9th revision, ICD9/10=International Classification of Diseases 10th revision, ICS=inhaled corticosteroids, IP=inpatient, ID=index date, MON=montelukast, NDC=National Drug Codes, NP=neuropsychiatric, NPE=neuropsychiatric events, OP=Outpatient, PDX=diagnosis position, Rx=prescription drug, TBD=to be determined
Note: while claims data indicate pharmacy dispensation of Rx, EHR data reflects prescription of medication
[a] The following antidepressants were considered when identifying treated outpatient depression: amitriptyline, amoxapine, bupropion, citalopram, clomipramine, desipramine, desvenlafaxine, doxepin, duloxetine, escitalopram, fluoxetine, fluvoxamine, imipramine, isocarboxazid, levomilnacipran, maprotiline, mirtazapine, naltrexone, nefazodone, nortriptyline, olanzapine/fluoxetine, paroxetine, perphenazine/amitriptyline, phenelzine, selegiline, sertraline, tranylcypromine sulfate, trazodone trimipramine maleate, venlafaxine, vilazodone, and vortioxetine hydrobromide.
[b] Self-harm was defined as a combination of inpatient, outpatient, or emergency room discharge diagnosis of poisoning, toxicity of nonmedical substance, asphyxiation or an open wound to the elbow/wrist/forearm, and an inpatient discharge diagnosis of depression, personality disorder, mania, adjustment reaction, or an unspecified nonpsychotic mental disorder on the same day.[12]
[c] The algorithm for self-harm used in the original analysis was modified from a validated algorithm with a positive predictive value of 73%. Specifically, the following outpatient and emergency room discharge diagnoses were added: of poisoning, toxicity of nonmedical substance, asphyxiation, or an open wound to the elbow/wrist/forearm. The un-modified algorithm included these diagnoses only in the inpatient setting. To capture additional cases of self-harm, the original study analysed a composite outcome of the self-harm outcomes plus E-codes (E950-E958).[24]
[d] Selected groups of medicines, including sedatives and hypnotics, antidepressants, antipsychotics, and sleep medications.
[e] Sleep medications include doxepin, estazolam, eszopiclone, flurazepam, melatonin, suvorexant, temazepam, trazodone, triazolam, ramelteon, zaleplon, and zolpidem.
[f] Depending on data availability in clinician notes, further stratification by symptom severity or age group (e.g. pediatric vs. adult manifestations) may be considered for analyses.
[g] Codes are not limited to ICD-10 rather all relevant codes (e.g., ICD-9, SNOMED, LOINC) will be used to identify exposure measures. Further, additional treatments, diagnosis, and procedures may be included upon inspection of the dataset.

3 Covariates

Context and rationale for covariates: Covariates will be used to adjust for their confounding effect on the exposure-outcome relationship. These covariates will likely be used to calculate baseline propensity scores using logistic regression.

For the various data source-dependent studies (see Study design), covariates will be utilized as per availability in that specific data source (see Table 18 and Table 19).

Table 17. Operational Definitions of Covariates Related to Sociodemographic Characteristics, Health Status and Utilization

Characteristic (used in PSM)	Details	Type of variable	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Measurement characteristics/ validation	Source for algorithm/ data
Sociodemographic characteristics									
Age	Mean age at index dispensing date	Continuous	[0,0]	n/a	n/a	n/a	Exposure & Comparator	Calculated based on year at birth Compared with value in EHR-S	Claims, EHR-S
	Age strata	Categorical (e.g., 6-11, 12-17,18+							
Sex	Gender	Categorical (e.g., male, female)	[0,0]	n/a	n/a	n/a	Exposure & Comparator	Compared with value in EHR-S	Claims, EHR-S
Year	Year of treatment initiation with MON or ICS	Discrete	[0,0]	n/a	Rx	n/a	Exposure & Comparator	n/a	Claims
Race	CDC categories	Categorized as white, black, etc.	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	EHR-S
Ethnicity	CDC categories	Categorized as Hispanic or Latino or non-Hispanic or Latino	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	EHR-S
Insurance status	Encounter status at index	Categorized as Government vs non-government	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	Claims
Education[a]	Current study type	TBD	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	EHR-uS
Employment[a]	Current employment	TBD	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	EHR-uS
Exercise[a]	Current description of behavior	TBD	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	EHR-uS

Characteristic (used in PSM)	Details	Type of variable	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Measurement characteristics/ validation	Source for algorithm/ data
State	Current state of residence	Categorized as 50 states, DC, or US territories	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	EHR-S
Language[a]	Spoken language	Categorized as English, Spanish, or Other	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	Claims, EHR-S, or EHR-uS
Urban residence[a]	Current urban residence indicator	Categorized as Urban or rural	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	Claims, EHR-S, or EHR-uS
Current health status									
Comorbidity index[13]	CCI score	Continuous	[-183,0]	Any	Dx	Any	Exposure & Comparator	Calculated based on selected comorbidities observed during the washout window	Claims, EHR-S
Allergic rhinitis (any type)	Dx	*Binary* (yes/no)	[-183, 0]	Any	Dx	Any	Exposure & Comparator	ICD9/10 or other condition codes	Claims, EHR-S
COPD	Dx	*Binary* (yes/no)	[-183, 0]	Any	Dx	Any	Exposure & Comparator	ICD9/10 or other condition codes	Claims, EHR-S
Other respiratory disorder	Other than asthma, allergic rhinitis, or COPD	*Binary* (yes/no)	[-183, 0]	Any	Dx	Any	Exposure & Comparator	ICD9/10 or other condition codes	Claims, EHR-S
Psychiatric disorder	Use of any psychiatric and psychotropic drugs	*Binary* (yes/no)	[-183, 0]	Any	Rx	n/a	Exposure & Comparator	Evaluate dispensing and days supplied.	Claims (days supplied), EHR-S (Rx)
	Any self-harm incident			Inpatient	Dx	Any		ICD codes Self-harm is also an outcome, members are excluded if it occurred on index date.	
	Any other psychiatric event			Any	Dx	Any		ICD9/10 or other codes	
	Psychotherapy	*Binary* (yes/no)	[-183, 0]	n/a	n/a	n/a	Exposure & Comparator	n/a	EHR-uS

Characteristic (used in PSM)	Details	Type of variable	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Measurement characteristics/ validation	Source for algorithm/ data
Alcohol use[a]	Current status	*TBD*	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	EHR-uS
Marijuana use[a]	Current status	*TBD*	[0,0][b]	n/a	n/a	n/a	Exposure & Comparator	n/a	EHR-uS
Substance abuse[a]	History of substance abuse	*Binary* (yes/no)	[-183, 0][b]	Any	n/a	Any	Exposure & Comparator	ICD9/10 or other codes	Claims, EHR-S, EHR-uS
Type 2 diabetes mellitus	Dx for type 2 diabetes mellitus	Binary (yes/no)	[-183, 0]	n/a	*Dx*	n/a	Exposure & Comparator	ICD9/10 or other codes	Claims, EHR-S
Overweight and obesity	BMI	Continuous	[-183, 0]	n/a	*n/a*	n/a	Exposure & Comparator	ICD9/10 or other codes	EHR-S
Ischemic heart diseases	Dx for ischemic heart diseases	Binary (yes/no)	[-183, 0]	n/a	*Dx*	n/a	Exposure & Comparator	ICD9/10 or other codes	Claims, EHR-S
Gastro-esophageal reflux disease	Dx for GERD, including medicines used to treat reflux disease	Binary (yes/no)	[-183, 0]	n/a	*Dx, Rx*	n/a	Exposure & Comparator	ICD9/10 or other codes	Claims (Dx), EHR-S (Dx, Rx)
Dermatitis and eczema	Dermatitis and eczema symptom	Binary (yes/no)	[-183, 0]	n/a	*n/a*	n/a	Exposure & Comparator	ICD9/10 or other codes	EHR-S
Cough	Cough symptom	Binary (yes/no)	[-183, 0]	n/a	*n/a*	n/a	Exposure & Comparator	ICD9/10 or other codes	EHR-S
Snoring	Snoring symptom	Binary (yes/no)	[-183, 0]	n/a	*n/a*	n/a	Exposure & Comparator	ICD9/10 or other codes	EHR-S
Depression	History of depression	*Binary* (yes/no)	[-183, 0]	Any	n/a	Any	Exposure & Comparator	ICD9/10 or condition codes	Claims, EHR-S
Self-harm	History of self-harm	*Binary* (yes/no)	[-183, 0]	Any	n/a	Any	Exposure & Comparator	ICD9/10 or condition codes	Claims, EHR-S
Psychotic disorder	History of psychotic disorder	*Binary* (yes/no)	[-183, 0]	Any	n/a	Any	Exposure & Comparator	ICD9/10 or condition codes	Claims, EHR-S
Mood disorder	History of mood disorder	*Binary* (yes/no)	[-183, 0]	Any	n/a	Any	Exposure & Comparator	ICD9/10 or condition codes	Claims, EHR-S
Anxiety disorder	History of anxiety disorder	*Binary* (yes/no)	[-183, 0]	Any	n/a	Any	Exposure & Comparator	ICD9/10 or condition codes	Claims, EHR-S
Obsessive-compulsive disorder and behavior	History of obsessive-compulsive disorder and behavior	*Binary* (yes/no)	[-183, 0]	Any	n/a	Any	Exposure & Comparator	ICD9/10 or condition codes	Claims, EHR-S
Bipolar disorder	History of bipolar disorder	*Binary* (yes/no)	[-183, 0]	Any	n/a	Any	Exposure & Comparator	ICD9/10 or condition codes	Claims, EHR-S

Characteristic (used in PSM)	Details	Type of variable	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Measurement characteristics/ validation	Source for algorithm/ data
Any Sleep disorders	Dx for any sleep disorder	Binary (yes/no)	[-183, 0]	n/a	*Dx*	n/a	Exposure & Comparator	ICD9/10 or condition codes	EHR-S
Sleep disorders not due to a substance or known physiological condition	Dx for any sleep disorder not due to a substance or known physiological condition	Binary (yes/no)	[-183, 0]	n/a	*Dx*	n/a	Exposure & Comparator	ICD9/10 or condition codes	EHR-S
Family history									
Family history of a psychiatric disorder[a]	Indication of a psychiatric disorder within family	Binary (yes/no)	[-183,0]	n/a	Dx	n/a	Exposure & Comparator	TBD	EHR-uS
Family history of a sleep disorder[a]	Indication of sleep disorder within family	Binary (yes/no)	[-183,0]	n/a	Dx	n/a	Exposure & Comparator	TBD	EHR-uS
Current prescription medication status									
Antihistamines	Prescriptions for each of the selected regimens	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes Sedating (promethazine, diphenhydramine, hydroxyzine) Non-sedating (cetirizine, fexofenadine, loratadine)	Claims
Opioid analgesics	Prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Sedatives and hypnotics	Prescriptions for each of the selected regimens	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes (temazepam, Zolpidem, eszopiclone)	Claims
Antipsychotics	Prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Antilipemic agents	Dispensed prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Ace inhibitors	Dispensed prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims

Characteristic (used in PSM)	Details	Type of variable	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Measurement characteristics/ validation	Source for algorithm/ data
Gastric medications, including medicines used to treat reflux disease	Dispensed prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Glucocorticoids	Dispensed prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Antirheumatics	Prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Muscle relaxants	Prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Decongestants (nasal, systemic)	Prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Anti-inflammatories (inhalation, nasal, topical)	Prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Bronchodilators (inhalation, oral, xanthine-derivative, anticholinergic)	Prescriptions for any drugs in this class AND separate reporting for vilanterol	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Metformin	Prescriptions	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Levothyroxine	Prescriptions	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
Antitussives and expectorants	Prescriptions for any drugs in this class	Binary (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NCD codes	Claims
HCRU									
Emergency visit	History of any ER visit for any reason	Binary (yes/no)	[-183, 0]	ER	Dx	Any	Exposure & Comparator	Any Dx	Claims
Hospitalization	History of any hospitalization for any reason	Binary (yes/no)	[-183, 0]	Inpatient	Dx	Any	Exposure & Comparator	Any Dx	Claims

Notes: Dx=Diagnosis; ER=emergency room; EHR-S=Electronic health records-structured; EHR-uS=Electronic health records-unstructured and semi-structured; HRCU=Healthcare resource utilizaiton; PSM=Propensity score matching; Rx=Prescription; TBD=To be determined

[a] Variables are dependent on availability in the Cerner EHR.

[b] Data may reflect avialalbe data (i.e., most current characteristics) and not that at index date

Table 18. Operational Definitions of Covariates Related to Asthma Severity and Control

Characteristic (used in PSM)	Details	Type of variable	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations:	Measurement characteristics/ validation	Source for algorithm/ data
Asthma ER	Asthma related ER visit	*Binary (yes/no)*	[-183, 0]	ER	Dx	*n/a*	Exposure & Comparator	Asthma ICD9/10 or other codes Asthma severity codes	Claims
Hospitalization for asthma (primary)	Inpatient asthma Dx primary position	*Binary* (yes/no)	[-183, 0]	Inpatient	*Dx*	*Primary*	Exposure & Comparator	Asthma ICD9/10 or other codes Asthma severity codes	Claims
Hospitalization with asthma (secondary)	Inpatient asthma Dx secondary position or unknown position with a respiratory condition or viral infection as primary	*Binary* (yes/no)	[-183, 0]	Inpatient	*Dx*	*Secondary or unknown*	Exposure & Comparator	Asthma ICD9/10 or other codes Asthma severity codes	Claims
Asthma outpatient visits	>2 outpatient visits with asthma Dx (on different days)	*Binary* (yes/no)	[-183, 0]	Outpatient	*Dx*	*n/a*	Exposure & Comparator	Asthma ICD9/10 or other codes Asthma severity codes	Claims
Severe asthma	Diagnosis of severe asthma	*Binary (yes/no)*	[-183, 0]	n/a	*Dx*	n/a	Exposure & Comparator	Asthma ICD10 or other codes[a]	EHR-S
FEV1 % predicted	Lung function test FEV1 %predicted: most recent, lowest, and highest values in past 6 months	*Numeric*	[-183, 0]	n/a	*lab*	n/a	Exposure & Comparator	Lab result FEV1 %predicted: most recent, lowest, and highest values in past 6 months[b]	EHR-S
Oral corticosteroid use	Use of at least 2 oral corticosteroid drugs in past 6 months	Categorized as: no use, at least 1, at least 2, at least 3	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NDC codes (dispensing and days supplied for 2 drugs)	Claims
Short-acting beta-agonists use (rescue)	Use of short-acting beta-agonists *(4 or more in past year =) >2 in past 6 months*	*Binary* (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NDC codes (dispensing and days supplied for 2 drugs)	Claims
Short-acting anticholinergic agents use (rescue)	Use of short-acting anticholinergic agents *>2 in past six months*	*Binary* (yes/no)	[-183, 0]	n/a	*Rx*	n/a	Exposure & Comparator	NDC codes (dispensing and days supplied for 2 drugs)	Claims

Notes: Dx=Diagnosis; EHR-S=Electronic health records-structured; EHR-uS=Electronic health records-unstructured and semi-structured; ER=emergency room; HRCU=Healthcare resource utilizaiton; PSM=Propensity score matching; Rx=Prescription; TBD=To be determined

[a] The utility of asthma severity codes is expected to low due to poor use by clinicians (anectdotal evidence), utility in this study will be examined following data management.

[b] Data for FEV1 will be collected and completeness and utility will be examined. Further, additional treatments, diagnosis, and procedures may be included upon inspection of the dataset.

G. Data analysis

1 Context and rationale for analysis plan

This pharmacoepidemiologic study comprises three analyses (Studies #1 through #3) based on the Sansing-Foster et al (2020) study that use incrementally contributing source data (see Study design). Study 1 will establish baseline estimates for these study cohorts. Specifically, Study 1 includes covariates and outcomes reported in the US claims dataset only. To maintain comparability with the reference analysis, it will employ a propensity score matching (PSM) analysis of initiators of MON (primary exposure) matched to initiators of ICS monotherapy (comparator exposure). Study 2 will enhance this analysis, by using Cerner EHR structured data, thereby examining the differential value of utilizing additional confounders and outcomes. Finally, in Study 3 unstructured and semi-structured data will be added and its additional value assessed.

2 Propensity Score Estimation

In Study 1, the following covariates will be assessed in the PSM analysis: age, financial status, sex, year at treatment initiation with MON or ICS, combined comorbidity score, history of psychiatric disorders (including use of psychiatric and psychotropic drugs, self-harm, and any psychiatric event), history of sleep disorders, diagnosis of other respiratory disorder, proxy for asthma severity, history of asthma medication use.

In addition to the covariates used in the Study 1, Study 2 covariates will also include: race, ethnicity, state, language, urban residence, specific comorbidities (e.g., overweight and obesity, dermatitis and eczema, cough, snoring, and sleep disorders), asthma severity, history of specific psychiatric (i.e., psychotic disorder, mood disorder, anxiety disorder, obsessive-compulsive disorder and behavior, bipolar disorder) or sleep disorders, treatment history by classes of drugs and regimens, HCRU/history of ER visits and hospitalizations for any indication. These covariates will be included to improve comparability of the MON exposed and control cohorts in relation to comorbidities and use of various other prescription medicines that could bias the comparison. Study 3 will potentially include additional covariates such as: family history of psychiatric disorder, SDOH indicators (e.g., education, employment).

The covariates will be evaluated 6 months prior to the index dispensing date. Please see Table 20, Table 21 for additional details regarding the operational definition of covariates, and Appendix E for an exhaustive list of codes defining the covariates used in the PSM analysis.

Matching: We will use a 1:1 matching ratio based on propensity score. Members in the exposed and comparator cohorts will be nearest neighbour matched without replacement to an exposed member using a matching caliper of 0.050. To confirm that the match was successful, the new cohorts will be compared on the covariates of interest. Standardized differences of <0.2 will be applied to ascertain success in controlling for these potential confounders.[14-17] Should the match prove to be insufficient, alternative methods of controlling for covariates will be considered.

3 Descriptive analyses

Descriptive statistics will be reported for all study variables to describe the baseline characteristics of the asthma patient population. For this analysis, frequencies and percentages will be reported for categorical variables, while means, standard deviations (SD), and ranges (minimum, maximum) will be reported for continuous or discrete variables.

By analysing unstructured and semi-structured data sources, Study 3 will describe additional baseline sociodemographic and clinical characteristics of asthma patients such as socioeconomic indicators or social determinants of health (e.g., education, employment, exercise), as well as additional disease and treatment characteristics (e.g., involvement with psychotherapy, alcohol use, marijuana use, substance abuse, family history of a psychiatric disorder, family history of a sleep disorder).

4 Bivariate analyses

Unadjusted group comparisons will compare differences in baseline covariates between treatment groups (MON vs. ICS) and will evaluate success in the PSM, using Chi-square tests (categorical variables) and analyses of variance (ANOVA) tests (continuous variables). Two-tailed p-values <0.05 will be considered statistically significant. Study 3 will enhance the confounder adjustment with the use of PSM based on additional baseline covariates resulting from analysing unstructured and semi-structured data (education, employment, exercise, involvement with psychotherapy, alcohol use, marijuana use, substance abuse, family history of a psychiatric disorder, family history of a sleep disorder).

5 Incidence rates

Study 1 will investigate incidence rates for the following NPEs: inpatient depressive disorder, treated outpatient depressive disorder, and self-harm. Incidence rates per patient per year will be calculated by dividing the number of incident NPEs by the total person years of observation. The total number of person-years will be calculated by summing for all patients the number of years between the index date and the date of the event or the end of follow-up date, if the patient does not experience the event. Estimated rates per 100 person years of follow-up and exact 95% CIs for each event will be calculated.

In addition to the NPEs analysed in Study 1, Study 2 outcomes will report the incidence of other neuropsychiatric or sleep related disorders identified in claims linked to EHR structured data. Within these broader diagnostic groups, more granular incident diagnoses will be reported related to sleep or mental health disorders. Treatment for NPEs will be identified by incident prescriptions for psychotropic medicines within 30 days from the NP diagnosis, including sedatives and hypnotics, antidepressants, and antipsychotics. Sleep related events will be identified during the follow-up period based on medicines commonly used in the US to treat sleep problems, such as insomnia (eszopiclone, doxepin, melatonin, temazepam, trazodone, zolpidem). Appendices E through G present an exhaustive list of diagnoses and medication considered for this analysis. By using group-level outcomes and the global outcome, we control for the potential effect of multiple testing, (i.e., by testing that the observed associations retain statistical significance at group-level).

Study 3 will potentially include additional outcomes resulting from analysing unstructured data from physician notes, such as: agitation, aggressive behaviour or hostility, attention problems, bad or vivid dreams, depression, disorientation or confusion, feeling anxious, hallucinations, irritability, memory problems, obsessive-compulsive symptoms, restlessness,

sleepwalking, stuttering, suicidal thoughts and actions, tremor or shakiness, trouble sleeping, uncontrolled muscle movements.

6 Unadjusted risk estimates

Study 1 will employ a Kaplan-Meier Estimator Analysis to calculate unadjusted risk estimates separately for inpatient depressive disorder, treated outpatient depressive disorder, and self-harm, 365 days after index date. In addition to the NPEs analysed in the Study 1, Study 2 outcomes will calculate separately the unadjusted risk of other neuropsychiatric (psychotic disorder, mood disorder, anxiety disorder, obsessive-compulsive disorder and behaviour, bipolar disorder) or sleep related disorders (insomnia, hypersomnia, circadian rhythm disorder, parasomnia, movement disorder, undefined sleep disorder, and treatment for sleep problems) within 365 days of initial exposure to MON or ICS, using a Kaplan-Meier Estimator to analyse data from claims linked to EHR structured records.

Study 3 will employ a Kaplan-Meier Estimator Analysis to calculate separately the unadjusted risk estimates of additional outcomes identified as NPEs (e.g., aggressive behaviour or hostility, restlessness, irritability, dream abnormalities, suicidal thinking and behaviour, memory problems, attention problems, stuttering, tremor, confusion/ disorientation, hallucinations, attention problems, etc.), with 365 days after treatment initiation with MON vs. ICS.

7 Multivariable analyses

Multivariable analyses will employ Cox proportional hazards regression to estimate hazard ratios (HR) and understand time to outcome events in MON patients vs. ICS patients. Unmatched analyses, 1:1 conditional matched analysis (both matched pairs are censored if one experiences the event), and 1:1 unconditional matched analysis will be conducted for each NPE of interest. Study 1 will estimate the risk of the following NPEs: inpatient depressive disorder, treated outpatient depressive disorder, and hospitalization for self-harm. Study 2 will assess the risk of additional mental health disorders (i.e., psychotic disorder, mood disorder, bipolar disorder, anxiety or related disorder, obsessive-compulsive disorder and behaviour, adult personality disorder) and sleep disorders (insomnia, hypersomnia, circadian rhythm disorder, parasomnia, movement disorder, undefined sleep disorder, treatment for sleep problems), by analysing data from claims and structured Cerner EHR records. Study 3 of the study will also include additional outcomes identified as NPEs (e.g., aggressive behaviour or hostility, restlessness, irritability, dream abnormalities, suicidal thinking and behaviour, memory problems, attention problems, stuttering, tremor, disorientation, hallucinations, attention problems, etc.) after treatment initiation with MON or ICS, resulting from harnessing information from unstructured and semi-structured records in Cerner EHR.

8 Subgroup analyses

Study 3 will further analyse the association between the exposure and outcome by the following subgroups: history of a psychiatric disorder (yes vs. no), age group (6-11, 12-17, 18+ years), sex (female vs. male). Of note, the subgroup analysis by the periods before and after the montelukast Drug Safety Communications and labelling changes (pre: 2000-2007, post: 2008-2015) conducted in the original study will not be replicated in the present study which will include data between 2015 and 2022.[1] For subgroup analyses, patients from the matched population will be rematched within their subgroups using their original propensity scores.

Study 3 will conduct subgroup analyses using additional data extracted via NLP from unstructured, and semi-structured sources to examine the impact of race, source of

insurance (commercial vs. Medicaid), family history of a psychiatric disorder, and other potential factors that may impact the association between the treatment type (MON vs. ICS) and NPEs incidence and reporting.

9 Sensitivity analyses

In Study 3, methodology for clustered data will be employed to examine the effect of specific sites or physician reporting on risk estimates.[19]

10 Statistical software

The present study will use SAS analytical software v9.4 and R version 4.1.

H. Data management

This retrospective cohort study will use de-identified linked Cerner EHR and claim records to assess the association between new MON use and incident NPEs. Data included in the Cerner EHR dataset will comprise both structured, semi-structured, and unstructured data elements. The research team will operate a secure, state-of-the-art, computing facility.

Cerner EHR data are stored in an enterprise data warehouse governed by rigorous rules regarding access and maintenance. A 3rd party vendor (Datavant) will tokenize the data set to enable linking to 3rd party data sources (e.g., US claims and mortality data) securely and anonymously.

Spark NLP for Healthcare will be used to build fully automated pipelines that read, understand, and extract relevant structured records from semi-structured and unstructured free text in Cerner EHR data. The information extraction will be fully automated, after the NLP pipeline is configured by deciding which types of entities, relations, and normalization tasks should be conducted in what order. The deep learning models will be trained and tuned on the Cerner EHR dataset that is anonymized and curated to be research ready. The NLP ensemble line is a secured, privacy preserving platform for processing clinical texts at scale, to enable sharing and reuse of valuable health information derived from semi-structured and unstructured data.

The Data Manager will securely download study data to the servers in the computing cluster via secure SFTP. Data location, contents and data use agreements will be logged. Data access is controlled using individual passwords issues only to individuals with proper clearance and authorization. All data will be transmitted to programmers' workstations in an encrypted state. Backups will be compliant with the latest standards for data security. Study staff will be required to complete the security training prior to being allowed to work on any data and will be regularly re-certified. SAS v9.4 and R version 4.1 software will be used to analyse the data.

I. Quality Control

The data sources and collection procedures have been validated using extensive quality control procedures, as described further. The Cerner EHR dataset is stored in the enterprise data warehouse and processed through a set of data capabilities sitting over the top, to ensure a high grade of data curation for research purposes. These capabilities include data standardization, concept normalization, person matching, person de-duplication, and de-identification. Code lists used to identify patients, medications, and to define outcomes will

be verified by expert advisors and documented in the study protocol, statistical analysis plan (SAP), and final report.

J. Study size and feasibility

This protocol describes a core study design based on the Sansing-Foster et al[1] study with further additions of EHR structured, semi-, and unstructured data. The Sansing-Foster et al. study had a sample size of 513,519 asthma patients treated with MON and 1,332,531 asthma patients treated with ICS identified using claims data from 2000-2015.

A minimum of 176 patients per subgroup is needed to detect a small effect size (Cohen's d=0.3) among the groups in bivariate analyses (Table 20). The generally accepted power ≥0.8 aims to achieve at least 80% chance of detecting a significant difference between groups. Given the Cerner EHR sample of 1 million MON patients, with an estimated 36% claims linkage rate, we are confident that this study would have adequately power in the analysis to capture significant differences between subjects of interest. Upon further application of eligibility criteria and selection based on the study period, a power analysis will be conducted to ensure adequate sample for the Cox proportional hazards regression.

Table 19. Target sample sizes

Sample Size per exposure subgroup (n)	Effect Size (Cohen's d)	Power
176	0.3	80%
235	0.3	90%
410	0.3	99%

Strengths and Limitations

This study explores methodological issues related to large scale use of NLP in pharmacoepidemiologic studies. For example, the confidence of data extracted via NLP models and whether tuning is required on a site basis or across the whole data set, as well as addressing matters of time and burden when using NLP. The transportability of this process to two external EHR systems allow for a broader assessment of real-world application of this process.

The pharmacoepidemiology study itself evaluates the differential value in pharmacoepidemiology research resulting from augmenting structured data with semi-structured and unstructured data sources extracted from clinical notes via NLP. First and foremost, inherent in a retrospective observational study, algorithms to define exposures, outcomes, eligibility criteria, and covariates are imperfect and may be misclassified. This study hopes to reduce such bias with the addition of information that are not typically reported in structured data.

However, recording of outcomes and comorbid conditions (covariates) in the EHR may vary by patient characteristic. For example, patients presenting with more severe symptoms are more likely to receive testing, thereby resulting in ascertainment and/or selection bias. Utilization of unstructured data to further characterize patients and symptoms will likely reduce these biases. Particularly concerning is that several research studies have found that physician notes may be biased, using words like "aggressive" and "agitated" more often with

Black patients[28, 29]. The use of SDOH variables in the EHR will allow for improved assessment of potential confounding or modification that may occur.

Second, similar to the Sansing-Foster et al (2020) study, MON treatment initiators are compared with ICS treatment initiators and not with untreated patients who may carry a different risk from exposure.

Third, some NPEs may be resolved without a healthcare encounter due to treatment discontinuation, and therefore not captured. Additionally, if NP manifestations are less severe initially, there may be a delay in seeking care, which may obviate certain outcomes.

Fourth, prescriptions for certain classes of medications may be associated with various indications. For instance, antidepressants may be prescribed for primary insomnia, anxiety, or depression. Therefore, the results should be interpreted with caution in view of misclassification bias. However, by linking claims data with EHR data augmented from semi-structured and unstructured records, a more granular measurement of adverse outcomes may be possible. Fifth, the censoring algorithm excludes patients who have experienced one of the observed outcomes, therefore only the first event of interest will be captured within the analysis, which may reduce the range of longitudinal observation. For example, a patient that has experienced inpatient depression would not be observed further for self-harm incidents.

- Big and over-granular taxonomy in an NLP project can limit its delivery in several ways. One of the main issues is the increased complexity of the model, which can make it more difficult to train and deploy. Additionally, the increased number of entities can also lead to a slower annotation process and it is prone to human mistakes. And finally, a large taxonomy can also lead to increased difficulty in interpreting the model's output, which can make it more difficult to understand and use the results.
- Incorrect DEID. During the DE-identification process, some of the context information in the data can be lost, which can hinder the annotation process and the training of an NLP model.
- The proper work of Assertion and RE models depends on the proper work of NER models because NER models provide the necessary information for assertion and RE models to make inferences and extract relationships. If the NER model is not working correctly, it can lead to errors or inaccuracies in the output of the assertion and RE models.
- Annotation of assertions and later training of the Assertion model is done considering the context within the sentence, and not document-wide. For example, if we have an assertion for adverse events to be placed to a Symptom entity, we can only place this assertion to the Symptom when in the same sentence it is stated that it is an adverse event or it is due to the drug or happened after the drug.
- Big sample data can limit the proper training of a relation extraction (RE) model because RE models typically rely on the proximity of entities to extract relationships between them. This means that the two entities to be related must be close to each other, often within one or two sentences, for the RE model to be able to extract the relationship correctly.

Furthermore, even though the patients included in this study were required to have a continuous supply of both MON and ICS, some patients may not have adhered to the

prescribed therapy. Additionally, only patients with medical and drug coverage were included in this study, therefore results cannot be generalized to the uninsured population.

Protection of human subjects

This study was conducted as part of the Sentinel surveillance activities under the auspices of the Food and Drug Administration, and, therefore, was not under the purview of institutional review boards.

This study will involve anonymized structured data, which according to applicable legal requirements do not contain information subject to privacy laws. Additionally, data extracted from clinicians' notes will follow a rigorous process of de-identification, to remove any other distinguishing information. The working data files will contain no identifying information, apart from the unique ID number.

All parties will comply with all applicable laws, including laws regarding the implementation of organizational and technical measures, to ensure protection of patient personal data throughout the study. Such measures include omitting directly identifiable data in any analysis, reports, publications, or other disclosures.

This study will be executed in accordance with International Society for Pharmacoepidemiology (ISPE) Guidelines for Good Pharmacoepidemiology Practices (GPP) and applicable regulatory requirements, as well as with scientific purpose, value and rigor and follow generally accepted research practices described in Good Practices for Outcomes Research issued by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR).

Reporting of adverse events

The proposed study is observational research that makes secondary use of data collected as part of routine care. The project does not involve any intervention, alteration in standard clinical care or use of any procedure in patients. Therefore, there will be no adverse events related to the study itself.

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Appendices

A. Abbreviations

AI	Artificial Intelligence
C-CDA	Consolidated-Clinical Document Architecture
CI	Confidence interval
CDM	Common data model
CERNER HER	Cerner Electronic Health Records
CHOC	Children's Hospital Orange County
COPD	Chronic Obstructive Pulmonary Disease
DSC	Drug Safety Communication
Dx	Diagnosis
DP	Data partner
ED	Event date
HER	Electronic health records
EHR-S	Electronic health records structured
EHR-uS	Electronic health records semi-structured or unstructured
ER	Emergency room
FAERS	FDA Adverse Event Reporting System
FDA	U.S. Food and Drug Administration
FEV1	Forced expiratory volume
FHIR4	Fast Healthcare Interoperability Resources version 4
GPP	Guidelines for Good Pharmacoepidemiology Practices
HIE	Health information exchange
HL7v2	Health Level Seven version 2
HR	Hazard ratio
ICD9	International Classification of Diseases - Clinical Modification 9th revision (2012)
ICD10	International Classification of Diseases - Clinical Modification 10th revision (2015)
ICS	Inhaled corticosteroids
ID	Index date
ISPE	International Society for Pharmacoepidemiology
IP	Inpatient
IRB	Institutional Review Board
ISPOR	International Society for Pharmacoeconomics and Outcomes Research
ISPE	International Society for Pharmaceutical Engineering
JSL	John Snow Labs
KP	Kaiser Permanente

LABA	Long-acting beta agonist
LTMA	Leukotriene-modifying agent
LTRA	Leukotriene receptor antagonist
MED	Matched event date
MGB	Mass General Brigham
MON	Montelukast
NDC	National drug code
NER	Named Entity Recognition
NER-DL	Named Entity Recognition Deep Learning
NJH	National Jewish Health
NLP	Natural Language Processing
NP	Neuropsychiatric
NPE	Neuropsychiatric event
OCR	Optical character recognition
OP	Outpatient
OR	Odds ratio
PDX	Position diagnosis
PHQ-9	Patient Health Questionnaire
PSA	Propensity Score Analysis
PSM	Propensity Score Matching
QED	Query end date
QP	Query period
Rx	Drug prescription/dispensation
RWE	Real world evidence
SD	Standard deviation
SDD	Sentinel Distributed Database
SDOH	Social determinants of health
SES	Socioeconomic status
SME	Subject matter expert
SOP	Standard operating procedures

B. Asthma codes for cohort eligibility[a]

Code	Description
ICD-10-CM-Asthma	
J45	Asthma
	Atopic Asthma
	Non-Allergic Asthma
	Idiosyncratic Asthma
	Hay Fever With Asthma
	Allergic Bronchitis Nos
	Extrinsic Allergic Asthma
	Intrinsic Non-Allergic Asthma
J45.2	Mild Intermittent Asthma
J45.20	Allergic Rhinitis With Asthma
	Allergic (Predominantly) Asthma
J45.21	Mild Intermittent Asthma With (Acute) Exacerbation
J45.22	Mild Intermittent Asthma With Status Asthmaticus
J45.3	Mild Persistent Asthma
J45.30	Mild Persistent Asthma Nos
	Mild Persistent Asthma, Uncomplicated
J45.31	Mild Persistent Asthma With (Acute) Exacerbation
J45.32	Mild Persistent Asthma With Status Asthmaticus
J45.4	Moderate Persistent Asthma
J45.40	Moderate Persistent Asthma Nos
	Moderate Persistent Asthma, Uncomplicated
J45.41	Moderate Persistent Asthma With (Acute) Exacerbation
J45.42	Moderate Persistent Asthma With Status Asthmaticus
J45.5	Severe Persistent Asthma
J45.50	Severe Persistent Asthma Nos
	Severe Persistent Asthma, Uncomplicated
J45.51	*Severe Persistent Asthma With (Acute) Exacerbation
J45.52	Severe Persistent Asthma With Status Asthmaticus
J45.9	Other And Unspecified Asthma
J45.90	Late Onset Asthma
	Unspecified Asthma
	Childhood Asthma Nos
	Asthmatic Bronchitis Nos
J45.901	Unspecified Asthma With (Acute) Exacerbation
J45.902	Unspecified Asthma With Status Asthmaticus
J45.909	Asthma Nos
	Unspecified Asthma, Uncomplicated
J45.99	Other Asthma
J45.990	Exercise Induced Bronchospasm
J45.991	Cough Variant Asthma
J45.998	Other Asthma
CPT (HCPCS Level I)-Asthma	
1038F	Persistent Asthma
	Persistent Asthma (Mild, Moderate Or Severe)
	Persistent Asthma Mild Moderate Or Severe Asthma

	Persistent Asthma (Mild, Moderate Or Severe) (Asthma)
	Persistent Asthma (Mild, Moderate Or Severe) (Asthma)
	Persistent Asthma (Mild, Moderate Or Severe) (Asthma)
1039F	Intermittent Asthma
	Intermittent Asthma (Asthma)
	Intermittent Asthma (Asthma)
	Intermittent Asthma (Asthma)
ICD-9-CM-Asthma	
493	Asthma
493.0	Extrinsic Asthma
493.00	Extrinsic Asthma, Unspecified
493.01	Extrinsic Asthma With Status Asthmaticus
493.02	Extrinsic Asthma With (Acute) Exacerbation
493.1	Intrinsic Asthma
493.10	Intrinsic Asthma, Unspecified
493.11	Intrinsic Asthma With Status Asthmaticus
493.12	Intrinsic Asthma With (Acute) Exacerbation
493.2	Chronic Obstructive Asthma
493.20	Chronic Obstructive Asthma, Unspecified
493.21	Chronic Obstructive Asthma With Status Asthmaticus
493.22	Chronic Obstructive Asthma With (Acute) Exacerbation
493.8	Other Forms Of Asthma
493.82	Cough Variant Asthma
493.9	Asthma, Unspecified
493.90	Asthma, Unspecified Type, Unspecified
493.91	Asthma, Unspecified Type, With Status Asthmaticus
493.92	Asthma, Unspecified Type, With (Acute) Exacerbation
HCPCS (Level II)-MS-DRG-Asthma	
G9432	Asthma Well-Controlled Based On The Act, C-Act, Acq, Or Ataq Score And Results Documented
G9434	Asthma Not Well-Controlled Based On The Act, C-Act, Acq, Or Ataq Score, Or Specified Asthma Control Tool Not Used, Reason Not Given
202	Bronchitis & Asthma W/ Cc/Mcc
203	Bronchitis & Asthma W/O Cc/Mcc

[a] Additional treatments, diagnosis, and procedures may be included upon inspection of the dataset.

C. List of Generic and Brand Drug Names Used to Define Exposures (MON) and Comparator (ICS)[a]

Code	Description	Brand[b]
	Montelukast	
000060117	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Singulair
00006011701	Montelukast 10 Mg Oral Tablet	Singulair
00006011704	Montelukast 10 Mg Oral Tablet	Singulair
00006011707	Montelukast 10 Mg Oral Tablet	Singulair
00006011712	Montelukast 10 Mg Oral Tablet	Singulair
00006011715	Montelukast 10 Mg Oral Tablet	Singulair
00006011727	Montelukast 10 Mg Oral Tablet	Singulair
00006011728	Montelukast 10 Mg Oral Tablet	Singulair
00006011730	Montelukast 10 Mg Oral Tablet	Singulair
00006011731	Montelukast 10 Mg Oral Tablet	Singulair
00006011740	Montelukast 10 Mg Oral Tablet	Singulair
00006011754	Montelukast 10 Mg Oral Tablet	Singulair
00006011780	Montelukast 10 Mg Oral Tablet	Not available
000060275	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Singulair
00006027501	Montelukast 5 Mg Chewable Tablet	Singulair
00006027504	Montelukast 5 Mg Chewable Tablet	Singulair
00006027507	Montelukast 5 Mg Chewable Tablet	Singulair
00006027515	Montelukast 5 Mg Chewable Tablet	Singulair
00006027527	Montelukast 5 Mg Chewable Tablet	Singulair
00006027528	Montelukast 5 Mg Chewable Tablet	Singulair
00006027530	Montelukast 5 Mg Chewable Tablet	Singulair
00006027531	Montelukast 5 Mg Chewable Tablet	Singulair
00006027540	Montelukast 5 Mg Chewable Tablet	Singulair
00006027554	Montelukast 5 Mg Chewable Tablet	Singulair
00006027582	Montelukast 5 Mg Chewable Tablet	Singulair
000060711	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Singulair
00006071101	Montelukast 4 Mg Chewable Tablet	Singulair
00006071104	Montelukast 4 Mg Chewable Tablet	Singulair
00006071107	Montelukast 4 Mg Chewable Tablet	Singulair
00006071112	Montelukast 4 Mg Chewable Tablet	Singulair
00006071115	Montelukast 4 Mg Chewable Tablet	Singulair
00006071127	Montelukast 4 Mg Chewable Tablet	Singulair
00006071128	Montelukast 4 Mg Chewable Tablet	Singulair
00006071130	Montelukast 4 Mg Chewable Tablet	Singulair
00006071131	Montelukast 4 Mg Chewable Tablet	Singulair
00006071140	Montelukast 4 Mg Chewable Tablet	Singulair
00006071154	Montelukast 4 Mg Chewable Tablet	Singulair
00006071168	Montelukast 4 Mg Chewable Tablet	Not available
00006071174	Montelukast 4 Mg Chewable Tablet	Not available
000061711	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
00006171131	Montelukast 4 Mg Chewable Tablet	Singulair

Code	Description	Brand[b]
00006171154	Montelukast 4 Mg Chewable Tablet	Singulair
000063841	Montelukast Sodium 4Mg/1 Oral Granule	Not available
00006384101	Montelukast 4 Mg Granules	Singulair
00006384104	Montelukast 4 Mg Granules	Singulair
00006384107	Montelukast 4 Mg Granules	Singulair
00006384114	Montelukast 4 Mg Oral Granules	Singulair
00006384130	Montelukast 4 Mg Oral Granules	Singulair
000069117	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
00006911731	Montelukast 10 Mg Oral Tablet	Singulair
00006911754	Montelukast 10 Mg Oral Tablet	Singulair
00006911780	Montelukast 10 Mg Oral Tablet	Singulair
000069275	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
00006927531	Montelukast 5 Mg Chewable Tablet	Singulair
00006927554	Montelukast 5 Mg Chewable Tablet	Singulair
00006927582	Montelukast 5 Mg Chewable Tablet	Singulair
000540259	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
00054025913	Montelukast 10 Mg Oral Tablet	Not available
00054025922	Montelukast 10 Mg Oral Tablet	Not available
00054025931	Montelukast Sodium - Montelukast Sodium Tablet	Not available
000540288	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
00054028813	Montelukast 4 Mg Chewable Tablet	Not available
00054028822	Montelukast 4 Mg Chewable Tablet	Not available
00054028829	Montelukast 4 Mg Chewable Tablet	Not available
000540289	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
00054028913	Montelukast 5 Mg Chewable Tablet	Not available
00054028922	Montelukast 5 Mg Chewable Tablet	Not available
00054028929	Montelukast 5 Mg Chewable Tablet	Not available
000937424	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
00093742456	Montelukast 4 Mg Chewable Tablet	Not available
00093742498	Montelukast 4 Mg Chewable Tablet	Not available
000937425	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
00093742556	Montelukast 5 Mg Chewable Tablet	Not available
00093742598	Montelukast 5 Mg Chewable Tablet	Not available
000937426	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
00093742610	Montelukast 10 Mg Oral Tablet	Not available
00093742656	Montelukast 10 Mg Oral Tablet	Not available
00093742698	Montelukast 10 Mg Oral Tablet	Not available
000937487	Montelukast Sodium 4Mg/1 Oral Granule	Not available
00093748719	Montelukast 4 Mg Oral Granules	Not available
00093748756	Montelukast 4 Mg Oral Granules	Not available
001439649	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
00143964909	Montelukast 10 Mg Oral Tablet	Not available
00143964910	Montelukast 10 Mg Oral Tablet	Not available
00143964930	Montelukast 10 Mg Oral Tablet	Not available
001439650	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
00143965009	Montelukast 5 Mg Chewable Tablet	Not available

Code	Description	Brand[b]
00143965010	Montelukast 5 Mg Chewable Tablet	Not available
00143965030	Montelukast 5 Mg Chewable Tablet	Not available
001439651	Montelukast 4Mg/1 Oral Tablet, Chewable	Not available
00143965109	Montelukast 4 Mg Chewable Tablet	Not available
00143965110	Montelukast 4 Mg Chewable Tablet	Not available
00143965130	Montelukast 4 Mg Chewable Tablet	Not available
00247198830	Montelukast 10 Mg Oral Tablet	Singulair
003785201	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
00378520110	Montelukast 10 Mg Oral Tablet	Not available
00378520177	Montelukast 10 Mg Oral Tablet	Not available
00378520193	Montelukast 10 Mg Oral Tablet	Not available
003785204	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
00378520405	Montelukast 4 Mg Chewable Tablet	Not available
00378520477	Montelukast 4 Mg Chewable Tablet	Not available
00378520493	Montelukast 4 Mg Chewable Tablet	Not available
003785205	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
00378520505	Montelukast 5 Mg Chewable Tablet	Not available
00378520577	Montelukast 5 Mg Chewable Tablet	Not available
00378520593	Montelukast 5 Mg Chewable Tablet	Not available
003786040	Montelukast Sodium 4Mg/500Mg Oral Granule	Not available
00378604017	Montelukast 4 Mg Oral Granules	Not available
00378604093	Montelukast 4 Mg Oral Granules	Not available
00603462202	Montelukast 10 Mg Oral Tablet	Not available
00603462216	Montelukast 10 Mg Oral Tablet	Not available
006034653	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
00603465302	Montelukast 4 Mg Chewable Tablet	Not available
00603465316	Montelukast 4 Mg Chewable Tablet	Not available
00603465328	Montelukast 4 Mg Chewable Tablet	Not available
00603465332	Montelukast 4 Mg Chewable Tablet	Not available
006034654	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
00603465402	Montelukast 5 Mg Chewable Tablet	Not available
00603465416	Montelukast 5 Mg Chewable Tablet	Not available
00603465428	Montelukast 5 Mg Chewable Tablet	Not available
00603465432	Montelukast 5 Mg Chewable Tablet	Not available
006034655	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
00603465502	Montelukast 10 Mg Oral Tablet	Not available
00603465516	Montelukast 10 Mg Oral Tablet	Not available
00603465528	Montelukast 10 Mg Oral Tablet	Not available
00603465532	Montelukast 10 Mg Oral Tablet	Not available
00603465534	Montelukast 10 Mg Oral Tablet	Not available
00615561405	Montelukast 10 Mg Oral Tablet	Singulair
00615561431	Montelukast 10 Mg Oral Tablet	Singulair
00615561439	Montelukast 10 Mg Oral Tablet	Singulair
00615561463	Montelukast 10 Mg Oral Tablet	Singulair
006157748	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
00615774805	Montelukast 10 Mg Oral Tablet	Not available

Code	Description	Brand[b]
00615774839	Montelukast 10 Mg Oral Tablet	Not available
006157983	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
00615798305	Montelukast 10 Mg Oral Tablet	Not available
00615798339	Montelukast 10 Mg Oral Tablet	Not available
007815554	Montelukast 4Mg/1 Oral Tablet, Chewable	Not available
00781555405	Montelukast 4 Mg Chewable Tablet	Not available
00781555406	Montelukast 4 Mg Chewable Tablet	Not available
00781555413	Montelukast 4 Mg Chewable Tablet	Not available
00781555431	Montelukast 4 Mg Chewable Tablet	Not available
00781555464	Montelukast 4 Mg Chewable Tablet	Not available
00781555492	Montelukast 4 Mg Chewable Tablet	Not available
007815555	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
00781555505	Montelukast 5 Mg Chewable Tablet	Not available
00781555506	Montelukast 5 Mg Chewable Tablet	Not available
00781555513	Montelukast 5 Mg Chewable Tablet	Not available
00781555531	Montelukast 5 Mg Chewable Tablet	Not available
00781555564	Montelukast 5 Mg Chewable Tablet	Not available
00781555592	Montelukast 5 Mg Chewable Tablet	Not available
007815560	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
00781556006	Montelukast 10 Mg Oral Tablet	Not available
00781556013	Montelukast 10 Mg Oral Tablet	Not available
00781556031	Montelukast 10 Mg Oral Tablet	Not available
00781556092	Montelukast 10 Mg Oral Tablet	Not available
009046310	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
00904631061	Montelukast 10 Mg Oral Tablet	Not available
009046529	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
00904652961	Montelukast 10 Mg Oral Tablet	Not available
009046808	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
00904680806	Montelukast 10 Mg Oral Tablet	Not available
00904680861	Montelukast 10 Mg Oral Tablet	Not available
013668079	Montelukast Sodium 4 Mg/1 Tablet, Chewable	Montelukast Sodium
013668080	Montelukast Sodium 5 Mg/1 Tablet, Chewable	Montelukast Sodium
013668081	Montelukast Sodium 10 Mg/1 Tablet	Montelukast Sodium
016729119	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
021695221	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Singulair
021695565	Montelukast Sodium 5 Mg/1 Tablet, Chewable	Singulair
024236860	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Singulair
033261969	Montelukast Sodium Oral 20120803 Tablet, Film Coated	Montelukast Sodium ## Fda
042254263	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
042291621	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
042291622	Montelukast Sodium 4 Mg/1 Tablet, Chewable	Montelukast Sodium
042291623	Montelukast Sodium 5 Mg/1 Tablet, Chewable	Montelukast Sodium

Code	Description	Brand[b]
043063380	Montelukast Sodium 10 Mg/1 Tablet	Montelukast Sodium
043063381	Montelukast Sodium 4 Mg/1 Tablet, Chewable	Montelukast Sodium
049999533	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Singulair
049999884	Montelukast Sodium 5 Mg/1 Tablet, Chewable	Singulair
049999952	Montelukast Sodium 4 Mg/1 Tablet, Chewable	Singulair
051079223	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
052125005	Montelukast Sodium 5 Mg/1 Granule	Singulair
052125006	Montelukast Sodium 10 Mg/1 Granule	Singulair
052343037	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
054458890	Montelukast Oral 20131004 Tablet, Film Coated	Montelukast
055111593	Montelukast Sodium 4 Mg/1 Tablet, Chewable	Montelukast Sodium
055111594	Montelukast Sodium 5 Mg/1 Tablet, Chewable	Montelukast Sodium
055111725	Montelukast Sodium 10 Mg/1 Tablet, Coated	Montelukast Sodium
055111763	Montelukast Sodium 4 Mg/1 Granule	Montelukast Sodium
055289961	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Singulair
055289989	Montelukast Sodium 4 Mg/1 Tablet, Chewable	Singulair
062175204	Montelukast Sodium 4 Mg/1 Tablet, Chewable	Montelukast Sodium
062175205	Montelukast Sodium 5 Mg/1 Tablet, Chewable	Montelukast Sodium
062175210	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
065862567	Montelukast Sodium 4 Mg/1 Tablet, Chewable	Montelukast Sodium
065862568	Montelukast Sodium 5 Mg/1 Tablet, Chewable	Montelukast Sodium
065862574	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
066116503	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
066993416	Montelukast Sodium 4 Mg/1 Granule	Montelukast Sodium
068001248	Montelukast Sodium Oral 20140313 Tablet, Film Coated	Montelukast Sodium ## Fda
068084619	Montelukast Sodium 5 Mg/1 Tablet, Chewable	Montelukast Sodium
068084620	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
068084638	Montelukast Sodium 4 Mg/1 Tablet, Chewable	Montelukast Sodium
068462392	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
068645466	Montelukast Sodium 10 Montelukast Sodium	Human Prescription Drug
12280004290	Montelukast 10 Mg Oral Tablet	Singulair
12634082471	Montelukast 10 Mg Oral Tablet	Singulair
13411015101	Montelukast 10 Mg Oral Tablet	Singulair
13411015103	Montelukast 10 Mg Oral Tablet	Singulair
13411015106	Montelukast 10 Mg Oral Tablet	Singulair
13411015109	Montelukast 10 Mg Oral Tablet	Singulair
13411015115	Montelukast 10 Mg Oral Tablet	Singulair

Code	Description	Brand[b]
13411016001	Montelukast 5 Mg Chewable Tablet	Singulair
13411016003	Montelukast 5 Mg Chewable Tablet	Singulair
13411016006	Montelukast 5 Mg Chewable Tablet	Singulair
13411016009	Montelukast 5 Mg Chewable Tablet	Singulair
13411016015	Montelukast 5 Mg Chewable Tablet	Singulair
136680079	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
13668007905	Montelukast 4 Mg Chewable Tablet	Not available
13668007930	Montelukast 4 Mg Chewable Tablet	Not available
13668007974	Montelukast 4 Mg Chewable Tablet	Not available
13668007990	Montelukast 4 Mg Chewable Tablet	Not available
136680080	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
13668008005	Montelukast 5 Mg Chewable Tablet	Not available
13668008030	Montelukast 5 Mg Chewable Tablet	Not available
13668008074	Montelukast 5 Mg Chewable Tablet	Not available
13668008090	Montelukast 5 Mg Chewable Tablet	Not available
136680081	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
13668008105	Montelukast 10 Mg Oral Tablet	Not available
13668008130	Montelukast 10 Mg Oral Tablet	Not available
13668008132	Montelukast 10 Mg Oral Tablet	Not available
13668008174	Montelukast 10 Mg Oral Tablet	Not available
13668008190	Montelukast 10 Mg Oral Tablet	Not available
136680531	Montelukast Sodium 4Mg/500Mg Oral Granule	Not available
13668053111	Montelukast 4 Mg Oral Granules	Not available
13668053153	Montelukast 4 Mg Oral Granules	Not available
13668053194	Montelukast 4 Mg Oral Granules	Not available
167290119	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
16729011910	Montelukast 10 Mg Oral Tablet	Not available
16729011915	Montelukast 10 Mg Oral Tablet	Not available
16729011917	Montelukast 10 Mg Oral Tablet	Not available
216950221	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
21695022130	Montelukast 10 Mg Oral Tablet	Singulair
216950565	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
21695056530	Montelukast 5 Mg Chewable Tablet	Singulair
23490801803	Montelukast 10 Mg Oral Tablet	Singulair
242360860	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Singulair
24236086002	Montelukast 10 Mg Oral Tablet	Singulair
24236086019	Montelukast 10 Mg Oral Tablet	Singulair
26053039101	Montelukast 5 Mg Chewable Tablet	Not available
272410015	Montelukast Sodium 4Mg/1 Oral Granule	Not available
27241001531	Montelukast 4 Mg Oral Granules	Not available
272410016	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
27241001603	Montelukast 4 Mg Chewable Tablet	Not available
27241001609	Montelukast 4 Mg Chewable Tablet	Not available
272410017	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
27241001703	Montelukast 5 Mg Chewable Tablet	Not available
27241001709	Montelukast 5 Mg Chewable Tablet	Not available

Code	Description	Brand[b]
272410018	Montelukast Sodium 10Mg/1 Oral Tablet, Coated	Not available
27241001803	Montelukast 10 Mg Oral Tablet	Not available
27241001809	Montelukast 10 Mg Oral Tablet	Not available
27241001890	Montelukast 10 Mg Oral Tablet	Not available
293000220	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
29300022001	Montelukast 10 Mg Oral Tablet	Not available
29300022010	Montelukast 10 Mg Oral Tablet	Not available
29300022013	Montelukast 10 Mg Oral Tablet	Not available
29300022019	Montelukast 10 Mg Oral Tablet	Not available
293000221	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
29300022110	Montelukast 4 Mg Chewable Tablet	Not available
29300022113	Montelukast 4 Mg Chewable Tablet	Not available
29300022119	Montelukast 4 Mg Chewable Tablet	Not available
293000222	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
29300022210	Montelukast 5 Mg Chewable Tablet	Not available
29300022213	Montelukast 5 Mg Chewable Tablet	Not available
29300022219	Montelukast 5 Mg Chewable Tablet	Not available
317220726	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
31722072601	Montelukast 10 Mg Oral Tablet	Not available
31722072610	Montelukast 10 Mg Oral Tablet	Not available
31722072630	Montelukast 10 Mg Oral Tablet	Not available
31722072631	Montelukast 10 Mg Oral Tablet	Not available
31722072632	Montelukast 10 Mg Oral Tablet	Not available
31722072690	Montelukast 10 Mg Oral Tablet	Not available
317220727	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
31722072701	Montelukast 4 Mg Chewable Tablet	Not available
31722072710	Montelukast 4 Mg Chewable Tablet	Not available
31722072730	Montelukast 4 Mg Chewable Tablet	Not available
31722072731	Montelukast 4 Mg Chewable Tablet	Not available
31722072732	Montelukast 4 Mg Chewable Tablet	Not available
31722072790	Montelukast 4 Mg Chewable Tablet	Not available
317220728	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
31722072801	Montelukast 5 Mg Chewable Tablet	Not available
31722072810	Montelukast 5 Mg Chewable Tablet	Not available
31722072830	Montelukast 5 Mg Chewable Tablet	Not available
31722072831	Montelukast 5 Mg Chewable Tablet	Not available
31722072832	Montelukast 5 Mg Chewable Tablet	Not available
31722072890	Montelukast 5 Mg Chewable Tablet	Not available
332610969	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
33261096900	Montelukast 10 Mg Oral Tablet	Not available
33261096930	Montelukast 10 Mg Oral Tablet	Not available
33261096960	Montelukast 10 Mg Oral Tablet	Not available
33261096990	Montelukast 10 Mg Oral Tablet	Not available
333420102	Montelukast 10Mg/1 Oral Tablet	Not available
33342010207	Montelukast 10 Mg Oral Tablet	Not available
33342010210	Montelukast 10 Mg Oral Tablet	Not available

Code	Description	Brand[b]
33342010212	Montelukast 10 Mg Oral Tablet	Not available
33342010215	Montelukast 10 Mg Oral Tablet	Not available
33342010239	Montelukast 10 Mg Oral Tablet	Not available
333420110	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
33342011007	Montelukast 4 Mg Chewable Tablet	Not available
33342011010	Montelukast 4 Mg Chewable Tablet	Not available
33342011012	Montelukast 4 Mg Chewable Tablet	Not available
33342011015	Montelukast 4 Mg Chewable Tablet	Not available
33342011039	Montelukast 4 Mg Chewable Tablet	Not available
33342011044	Montelukast 4 Mg Chewable Tablet	Not available
333420111	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
33342011107	Montelukast 5 Mg Chewable Tablet	Not available
33342011110	Montelukast 5 Mg Chewable Tablet	Not available
33342011112	Montelukast 5 Mg Chewable Tablet	Not available
33342011115	Montelukast 5 Mg Chewable Tablet	Not available
33342011139	Montelukast 5 Mg Chewable Tablet	Not available
33342011144	Montelukast 5 Mg Chewable Tablet	Not available
422540263	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
42254026330	Montelukast 10 Mg Oral Tablet	Not available
42254026390	Montelukast 10 Mg Oral Tablet	Not available
42254026430	Montelukast 5 Mg Chewable Tablet	Not available
42254041630	Montelukast 4 Mg Chewable Tablet	Not available
422910621	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
42291062110	Montelukast 10 Mg Oral Tablet	Not available
42291062130	Montelukast 10 Mg Oral Tablet	Not available
42291062155	Montelukast 10 Mg Oral Tablet	Not available
42291062190	Montelukast 10 Mg Oral Tablet	Not available
422910622	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
42291062210	Montelukast 4 Mg Chewable Tablet	Not available
42291062230	Montelukast 4 Mg Chewable Tablet	Not available
42291062290	Montelukast 4 Mg Chewable Tablet	Not available
422910623	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
42291062310	Montelukast 5 Mg Chewable Tablet	Not available
42291062330	Montelukast 5 Mg Chewable Tablet	Not available
42291062390	Montelukast 5 Mg Chewable Tablet	Not available
427080042	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
42708004230	Montelukast 10 Mg Oral Tablet	Not available
430630380	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
430630381	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
43063038121	Montelukast 4 Mg Chewable Tablet	Not available
43063038130	Montelukast 4 Mg Chewable Tablet	Not available
430630762	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
43063076230	Montelukast 10 Mg Oral Tablet	Not available
433530252	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
43353025230	Montelukast 10 Mg Oral Tablet	Not available
43353025260	Montelukast 10 Mg Oral Tablet	Not available

Code	Description	Brand[b]
433530879	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
43353087909	Montelukast 10 Mg Oral Tablet	Not available
43353087930	Montelukast 10 Mg Oral Tablet	Not available
499990533	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Singulair
49999053330	Montelukast 10 Mg Oral Tablet	Singulair
49999053390	Montelukast 10 Mg Oral Tablet	Singulair
499990884	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Singulair
49999088430	Montelukast 5 Mg Chewable Tablet	Singulair
49999088490	Montelukast 5 Mg Chewable Tablet	Singulair
499990952	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Singulair
49999095230	Montelukast 4 Mg Chewable Tablet	Singulair
50090131100	Montelukast 10 Mg Oral Tablet	Not available
50090131101	Montelukast 10 Mg Oral Tablet	Not available
50090131200	Montelukast 5 Mg Chewable Tablet	Not available
50090131201	Montelukast 5 Mg Chewable Tablet	Not available
50090131300	Montelukast 5 Mg Chewable Tablet	Not available
50090131301	Montelukast 5 Mg Chewable Tablet	Not available
50090136800	Montelukast 4 Mg Chewable Tablet	Not available
50090136801	Montelukast 4 Mg Chewable Tablet	Not available
500902176	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
50090217600	Montelukast 10 Mg Oral Tablet	Not available
50090217601	Montelukast 10 Mg Oral Tablet	Not available
50090223000	Montelukast 4 Mg Chewable Tablet	Not available
50090223001	Montelukast 4 Mg Chewable Tablet	Not available
50090227000	Montelukast 10 Mg Oral Tablet	Not available
50090227001	Montelukast 10 Mg Oral Tablet	Not available
500902480	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
50090248000	Montelukast 10 Mg Oral Tablet	Not available
50090248001	Montelukast 10 Mg Oral Tablet	Not available
500902619	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
50090261900	Montelukast 5 Mg Chewable Tablet	Not available
50090261901	Montelukast 5 Mg Chewable Tablet	Not available
500902921	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
50090292100	Montelukast 4 Mg Chewable Tablet	Not available
50090292101	Montelukast 4 Mg Chewable Tablet	Not available
500904705	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
50090470500	Montelukast 5 Mg Chewable Tablet	Not available
50090470501	Montelukast 5 Mg Chewable Tablet	Not available
500904919	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
50090491900	Montelukast 10 Mg Oral Tablet	Not available
500905403	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
50090540300	Montelukast 10 Mg Oral Tablet	Not available
500905774	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
50090577400	Montelukast 5 Mg Chewable Tablet	Not available
50090577401	Montelukast 5 Mg Chewable Tablet	Not available
502680556	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available

Code	Description	Brand[b]
502680573	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
50268057311	Montelukast 4 Mg Chewable Tablet	Not available
50268057315	Montelukast 4 Mg Chewable Tablet	Not available
502680574	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
50268057411	Montelukast 5 Mg Chewable Tablet	Not available
50268057415	Montelukast 5 Mg Chewable Tablet	Not available
502680575	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
50268055615	Montelukast 10 Mg Oral Tablet	Not available
50268057511	Montelukast 10 Mg Oral Tablet	Not available
50268057515	Montelukast 10 Mg Oral Tablet	Not available
510790223	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
51079022301	Montelukast 10 Mg Oral Tablet	Not available
51079022320	Montelukast 10 Mg Oral Tablet	Not available
511280501	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
51128050101	Montelukast 10 Mg Oral Tablet	Not available
51128050102	Montelukast 10 Mg Oral Tablet	Not available
51128050103	Montelukast 10 Mg Oral Tablet	Not available
511280502	Montelukast 4Mg/1 Oral Tablet, Chewable	Not available
51128050201	Montelukast 4 Mg Chewable Tablet	Not available
51128050202	Montelukast 4 Mg Chewable Tablet	Not available
51128050203	Montelukast 4 Mg Chewable Tablet	Not available
511280503	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
51128050301	Montelukast 5 Mg Chewable Tablet	Not available
51128050302	Montelukast 5 Mg Chewable Tablet	Not available
51128050303	Montelukast 5 Mg Chewable Tablet	Not available
51129139801	Montelukast 10 Mg Oral Tablet	Singulair
51129147801	Montelukast 5 Mg Chewable Tablet	Singulair
51129160401	Montelukast 5 Mg Chewable Tablet	Singulair
51927465600	Montelukast Sodium Powder	Not available
521250005	Montelukast Sodium 5Mg/1 Oral Granule	Singulair
52125000502	Singulair - Montelukast Sodium Granule	Not available
521250006	Montelukast Sodium 10Mg/1 Oral Granule	Singulair
52125000602	Singulair - Montelukast Sodium Granule	Not available
523430035	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
52343003505	Montelukast 4 Mg Chewable Tablet	Not available
52343003530	Montelukast 4 Mg Chewable Tablet	Not available
52343003590	Montelukast 4 Mg Chewable Tablet	Not available
523430036	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
52343003605	Montelukast 5 Mg Chewable Tablet	Not available
52343003630	Montelukast 5 Mg Chewable Tablet	Not available
52343003690	Montelukast 5 Mg Chewable Tablet	Not available
523430037	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
52343003730	Montelukast 10 Mg Oral Tablet	Not available
52343003790	Montelukast 10 Mg Oral Tablet	Not available
52343003799	Montelukast 10 Mg Oral Tablet	Not available
530021441	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available

Code	Description	Brand[b]
53002144103	Montelukast 10 Mg Oral Tablet	Not available
532170357	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
53217035730	Montelukast 5 Mg Chewable Tablet	Not available
538080690	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
53808069001	Montelukast 10 Mg Oral Tablet	Not available
538080920	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
53808092001	Montelukast 10 Mg Oral Tablet	Not available
538080995	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
53808099501	Montelukast 10 Mg Oral Tablet	Not available
544580890	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
54458089010	Montelukast 10 Mg Oral Tablet	Not available
545694605	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Singulair
54569460500	Montelukast 10 Mg Oral Tablet	Singulair
54569460501	Montelukast 10 Mg Oral Tablet	Singulair
545694736	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Singulair
54569473600	Montelukast 5 Mg Chewable Tablet	Singulair
54569473602	Montelukast 5 Mg Chewable Tablet	Singulair
545695167	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Singulair
54569516700	Montelukast 4 Mg Chewable Tablet	Singulair
54569516702	Montelukast 4 Mg Chewable Tablet	Singulair
54569634800	Montelukast 10 Mg Oral Tablet	Not available
54569634801	Montelukast 10 Mg Oral Tablet	Not available
54569634900	Montelukast 5 Mg Chewable Tablet	Not available
54569634901	Montelukast 5 Mg Chewable Tablet	Not available
54569643000	Montelukast 4 Mg Chewable Tablet	Not available
54569643001	Montelukast 4 Mg Chewable Tablet	Not available
548683283	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
54868328300	Montelukast 10 Mg Oral Tablet	Singulair
54868328301	Montelukast 10 Mg Oral Tablet	Singulair
54868328302	Montelukast 10 Mg Oral Tablet	Singulair
548684630	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
54868463000	Montelukast 4 Mg Chewable Tablet	Singulair
548684847	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
54868484700	Montelukast 5 Mg Chewable Tablet	Singulair
548686361	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
54868636100	Montelukast 10 Mg Oral Tablet	Not available
54868636101	Montelukast 10 Mg Oral Tablet	Not available
548686362	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
54868636200	Montelukast 5 Mg Chewable Tablet	Not available
548686363	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
54868636300	Montelukast 4 Mg Chewable Tablet	Not available
54868636301	Montelukast 4 Mg Chewable Tablet	Not available
551110593	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
55111059305	Montelukast 4 Mg Chewable Tablet	Not available
55111059330	Montelukast 4 Mg Chewable Tablet	Not available
55111059378	Montelukast 4 Mg Chewable Tablet	Not available

Code	Description	Brand[b]
55111059379	Montelukast 4 Mg Chewable Tablet	Not available
55111059390	Montelukast 4 Mg Chewable Tablet	Not available
551110594	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
55111059405	Montelukast 5 Mg Chewable Tablet	Not available
55111059430	Montelukast 5 Mg Chewable Tablet	Not available
55111059478	Montelukast 5 Mg Chewable Tablet	Not available
55111059479	Montelukast 5 Mg Chewable Tablet	Not available
55111059490	Montelukast 5 Mg Chewable Tablet	Not available
551110725	Montelukast Sodium 10Mg/1 Oral Tablet, Coated	Not available
55111072501	Montelukast 10 Mg Oral Tablet	Not available
55111072510	Montelukast 10 Mg Oral Tablet	Not available
55111072530	Montelukast 10 Mg Oral Tablet	Not available
55111072578	Montelukast 10 Mg Oral Tablet	Not available
55111072579	Montelukast 10 Mg Oral Tablet	Not available
55111072590	Montelukast 10 Mg Oral Tablet	Not available
55111072594	Montelukast 10 Mg Oral Tablet	Not available
551110763	Montelukast Sodium 4Mg/1 Oral Granule	Not available
55111076303	Montelukast 4 Mg Oral Granules	Not available
55111076307	Montelukast 4 Mg Oral Granules	Not available
551540849	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
55154084904	Montelukast 10 Mg Oral Tablet	Not available
55154084907	Montelukast 10 Mg Oral Tablet	Not available
551544380	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
55154438000	Montelukast 10 Mg Oral Tablet	Not available
551544794	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
55154479400	Montelukast 10 Mg Oral Tablet	Not available
551545028	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
55154502800	Montelukast 10 Mg Oral Tablet	Singulair
551545029	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
55154502900	Montelukast 5 Mg Chewable Tablet	Singulair
551547638	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
55154763800	Montelukast 10 Mg Oral Tablet	Not available
551548075	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
55154807500	Montelukast 10 Mg Oral Tablet	Not available
552890961	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Singulair
55289096115	Montelukast 10 Mg Oral Tablet	Singulair
55289096130	Montelukast 10 Mg Oral Tablet	Singulair
552890989	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Singulair
55289098921	Montelukast 4 Mg Chewable Tablet	Singulair
55289098930	Montelukast 4 Mg Chewable Tablet	Singulair
55289099021	Montelukast 5 Mg Chewable Tablet	Singulair
55289099030	Montelukast 5 Mg Chewable Tablet	Singulair
55887012090	Montelukast 5 Mg Chewable Tablet	Singulair
55887039030	Montelukast 10 Mg Oral Tablet	Singulair
572370212	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
57237021230	Montelukast 4 Mg Chewable Tablet	Not available

Code	Description	Brand[b]
57237021290	Montelukast 4 Mg Chewable Tablet	Not available
572370213	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
57237021330	Montelukast 5 Mg Chewable Tablet	Not available
57237021390	Montelukast 5 Mg Chewable Tablet	Not available
572370255	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
57237025530	Montelukast 10 Mg Oral Tablet	Not available
57237025590	Montelukast 10 Mg Oral Tablet	Not available
581185560	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
58118556000	Montelukast 10 Mg Oral Tablet	Not available
58118556003	Montelukast 10 Mg Oral Tablet	Not available
58118556008	Montelukast 10 Mg Oral Tablet	Not available
58118556009	Montelukast 10 Mg Oral Tablet	Not available
596510329	Montelukast Sodium 4Mg/1 Oral Granule	Not available
59651032905	Montelukast 4 Mg Oral Granules	Not available
59651032930	Montelukast 4 Mg Oral Granules	Not available
597460358	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
59746035801	Montelukast 4 Mg Chewable Tablet	Not available
59746035805	Montelukast 4 Mg Chewable Tablet	Not available
59746035810	Montelukast 4 Mg Chewable Tablet	Not available
59746035812	Montelukast 4 Mg Chewable Tablet	Not available
59746035830	Montelukast 4 Mg Chewable Tablet	Not available
59746035832	Montelukast 4 Mg Chewable Tablet	Not available
59746035890	Montelukast 4 Mg Chewable Tablet	Not available
597460359	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
59746035901	Montelukast 5 Mg Chewable Tablet	Not available
59746035905	Montelukast 5 Mg Chewable Tablet	Not available
59746035910	Montelukast 5 Mg Chewable Tablet	Not available
59746035912	Montelukast 5 Mg Chewable Tablet	Not available
59746035930	Montelukast 5 Mg Chewable Tablet	Not available
59746035932	Montelukast 5 Mg Chewable Tablet	Not available
59746035990	Montelukast 5 Mg Chewable Tablet	Not available
597620030	Montelukast Sodium 10 Mg/1 Tablet, Film Coated	Montelukast Sodium
59762003001	Montelukast 10 Mg Oral Tablet	Not available
59762003002	Montelukast 10 Mg Oral Tablet	Not available
597620045	Montelukast Sodium 4 Mg/1 Tablet, Chewable	Montelukast Sodium
59762004501	Montelukast 4 Mg Chewable Tablet	Not available
59762004502	Montelukast 4 Mg Chewable Tablet	Not available
597620046	Montelukast Sodium 5 Mg/1 Tablet, Chewable	Montelukast Sodium
59762004601	Montelukast 5 Mg Chewable Tablet	Not available
59762004602	Montelukast 5 Mg Chewable Tablet	Not available
60312011715	Montelukast 10 Mg Oral Tablet	Singulair
60312011728	Montelukast 10 Mg Oral Tablet	Singulair
60312011731	Montelukast 10 Mg Oral Tablet	Singulair
60312011754	Montelukast 10 Mg Oral Tablet	Singulair

Code	Description	Brand[b]
60312011780	Montelukast 10 Mg Oral Tablet	Singulair
60312027501	Montelukast 5 Mg Chewable Tablet	Singulair
60312027502	Montelukast 5 Mg Chewable Tablet	Singulair
60312027503	Montelukast 5 Mg Chewable Tablet	Singulair
60312027504	Montelukast 5 Mg Chewable Tablet	Singulair
60312027582	Montelukast 5 Mg Chewable Tablet	Singulair
60312071101	Montelukast 4 Mg Chewable Tablet	Singulair
60312071102	Montelukast 4 Mg Chewable Tablet	Singulair
60312071103	Montelukast 4 Mg Chewable Tablet	Singulair
60312071104	Montelukast 4 Mg Chewable Tablet	Singulair
60312075900	Montelukast 4 Mg Chewable Tablet	Not available
60312076000	Montelukast 5 Mg Chewable Tablet	Not available
60312076100	Montelukast 10 Mg Oral Tablet	Not available
605053562	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
60505356203	Montelukast 10 Mg Oral Tablet	Not available
60505356208	Montelukast 10 Mg Oral Tablet	Not available
60505356209	Montelukast 10 Mg Oral Tablet	Not available
605053573	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
60505357303	Montelukast 4 Mg Chewable Tablet	Not available
60505357308	Montelukast 4 Mg Chewable Tablet	Not available
60505357309	Montelukast 4 Mg Chewable Tablet	Not available
605053574	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
60505357403	Montelukast 5 Mg Chewable Tablet	Not available
60505357408	Montelukast 5 Mg Chewable Tablet	Not available
60505357409	Montelukast 5 Mg Chewable Tablet	Not available
607230004	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
60723000403	Montelukast 4 Mg Chewable Tablet	Not available
60723000409	Montelukast 4 Mg Chewable Tablet	Not available
60723000450	Montelukast 4 Mg Chewable Tablet	Not available
607230005	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
60723000503	Montelukast 5 Mg Chewable Tablet	Not available
60723000509	Montelukast 5 Mg Chewable Tablet	Not available
60723000550	Montelukast 5 Mg Chewable Tablet	Not available
607230010	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
60723001003	Montelukast 10 Mg Oral Tablet	Not available
60723001009	Montelukast 10 Mg Oral Tablet	Not available
60723001050	Montelukast 10 Mg Oral Tablet	Not available
61786028702	Montelukast 10 Mg Oral Tablet	Not available
61786028719	Montelukast 10 Mg Oral Tablet	Not available
617860958	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
61786095819	Montelukast 10 Mg Oral Tablet	Not available
619190009	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
61919000930	Montelukast 10 Mg Oral Tablet	Not available
61919000990	Montelukast 10 Mg Oral Tablet	Not available
619190097	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
61919009730	Montelukast 5 Mg Chewable Tablet	Not available

Code	Description	Brand[b]
621750204	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
62175020432	Montelukast 4 Mg Chewable Tablet	Not available
62175020443	Montelukast 4 Mg Chewable Tablet	Not available
62175020446	Montelukast 4 Mg Chewable Tablet	Not available
621750205	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
62175020532	Montelukast 5 Mg Chewable Tablet	Not available
62175020543	Montelukast 5 Mg Chewable Tablet	Not available
62175020546	Montelukast 5 Mg Chewable Tablet	Not available
621750210	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
62175021032	Montelukast 10 Mg Oral Tablet	Not available
62175021043	Montelukast 10 Mg Oral Tablet	Not available
62175021046	Montelukast 10 Mg Oral Tablet	Not available
631870216	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
63187021630	Montelukast 10 Mg Oral Tablet	Not available
631870289	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
63187028930	Montelukast 10 Mg Oral Tablet	Not available
631870430	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
63187043030	Montelukast 10 Mg Oral Tablet	Not available
63187043060	Montelukast 10 Mg Oral Tablet	Not available
63187043090	Montelukast 10 Mg Oral Tablet	Not available
631870550	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
63187055030	Montelukast 4 Mg Chewable Tablet	Not available
63187055060	Montelukast 4 Mg Chewable Tablet	Not available
63187055090	Montelukast 4 Mg Chewable Tablet	Not available
631870626	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
63187062630	Montelukast 5 Mg Chewable Tablet	Not available
63187062660	Montelukast 5 Mg Chewable Tablet	Not available
63187062690	Montelukast 5 Mg Chewable Tablet	Not available
631870692	Montelukast Sodium 10Mg/1 Oral Tablet, Coated	Not available
63187069230	Montelukast 10 Mg Oral Tablet	Not available
63187069260	Montelukast 10 Mg Oral Tablet	Not available
63187069290	Montelukast 10 Mg Oral Tablet	Not available
631870751	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
63187075130	Montelukast 4 Mg Chewable Tablet	Not available
63187075160	Montelukast 4 Mg Chewable Tablet	Not available
63187075190	Montelukast 4 Mg Chewable Tablet	Not available
631870781	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
63187078114	Montelukast 10 Mg Oral Tablet	Not available
63187078130	Montelukast 10 Mg Oral Tablet	Not available
63187078160	Montelukast 10 Mg Oral Tablet	Not available
63187078190	Montelukast 10 Mg Oral Tablet	Not available
631870896	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
63187089630	Montelukast 5 Mg Chewable Tablet	Not available
63187089660	Montelukast 5 Mg Chewable Tablet	Not available
63187089690	Montelukast 5 Mg Chewable Tablet	Not available
636291639	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available

Code	Description	Brand[b]
63629163901	Montelukast 10 Mg Oral Tablet	Singulair
63629163902	Montelukast 10 Mg Oral Tablet	Singulair
63629163903	Montelukast 10 Mg Oral Tablet	Singulair
636292979	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
63629297901	Montelukast 4 Mg Chewable Tablet	Singulair
636293701	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
63629370101	Montelukast 5 Mg Chewable Tablet	Singulair
636294855	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
63629485501	Montelukast 4 Mg Chewable Tablet	Not available
63629485502	Montelukast 4 Mg Chewable Tablet	Not available
636294886	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
63629488601	Montelukast 10 Mg Oral Tablet	Not available
63629488602	Montelukast 10 Mg Oral Tablet	Not available
63629488603	Montelukast 10 Mg Oral Tablet	Not available
63629488604	Montelukast 10 Mg Oral Tablet	Not available
63629488605	Montelukast 10 Mg Oral Tablet	Not available
63629488606	Montelukast 10 Mg Oral Tablet	Not available
636294978	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
636298106	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
63629810601	Montelukast 10 Mg Oral Tablet	Not available
63629810602	Montelukast 10 Mg Oral Tablet	Not available
636298235	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
63629823501	Montelukast 5 Mg Chewable Tablet	Not available
642050655	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
64205065530	Montelukast 10 Mg Oral Tablet	Not available
64725030303	Montelukast 10 Mg Oral Tablet	Singulair
651620732	Montelukast 10Mg/1 Oral Tablet	Not available
65162073203	Montelukast 10 Mg Oral Tablet	Not available
65162073209	Montelukast 10 Mg Oral Tablet	Not available
65162073211	Montelukast 10 Mg Oral Tablet	Not available
651620771	Montelukast 4Mg/1 Oral Tablet, Chewable	Not available
65162077103	Montelukast 4 Mg Chewable Tablet	Not available
651620772	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
65162077203	Montelukast 5 Mg Chewable Tablet	Not available
658620567	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
65862056705	Montelukast 4 Mg Chewable Tablet	Not available
65862056730	Montelukast 4 Mg Chewable Tablet	Not available
65862056790	Montelukast 4 Mg Chewable Tablet	Not available
658620568	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
65862056805	Montelukast 5 Mg Chewable Tablet	Not available
65862056830	Montelukast 5 Mg Chewable Tablet	Not available
65862056890	Montelukast 5 Mg Chewable Tablet	Not available
658620574	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
65862057410	Montelukast 10 Mg Oral Tablet	Not available
65862057419	Montelukast 10 Mg Oral Tablet	Not available
65862057430	Montelukast 10 Mg Oral Tablet	Not available

Code	Description	Brand[b]
65862057490	Montelukast 10 Mg Oral Tablet	Not available
66105016402	Montelukast 10 Mg Oral Tablet	Singulair
66105016403	Montelukast 10 Mg Oral Tablet	Singulair
66105016406	Montelukast 10 Mg Oral Tablet	Singulair
66105016409	Montelukast 10 Mg Oral Tablet	Singulair
66105016410	Montelukast 10 Mg Oral Tablet	Singulair
661160503	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
66116050330	Montelukast 10 Mg Oral Tablet	Not available
66267036830	Montelukast 5 Mg Chewable Tablet	Singulair
66267036930	Montelukast 10 Mg Oral Tablet	Singulair
66336053830	Montelukast 4 Mg Chewable Tablet	Not available
66336053930	Montelukast 5 Mg Chewable Tablet	Not available
66336054030	Montelukast 10 Mg Oral Tablet	Not available
669930416	Montelukast Sodium 4Mg/1 Oral Granule	Not available
66993041630	Montelukast 4 Mg Oral Granules	Not available
66993041681	Montelukast 4 Mg Oral Granules	Not available
670460468	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
67046046807	Montelukast 10 Mg Oral Tablet	Not available
67046046814	Montelukast 10 Mg Oral Tablet	Not available
67046046815	Montelukast 10 Mg Oral Tablet	Not available
67046046820	Montelukast 10 Mg Oral Tablet	Not available
67046046821	Montelukast 10 Mg Oral Tablet	Not available
67046046828	Montelukast 10 Mg Oral Tablet	Not available
67046046830	Montelukast 10 Mg Oral Tablet	Not available
67046046860	Montelukast 10 Mg Oral Tablet	Not available
67228039703	Montelukast 10 Mg Oral Tablet	Not available
67228039705	Montelukast 10 Mg Oral Tablet	Not available
67228039706	Montelukast 10 Mg Oral Tablet	Not available
67296025601	Montelukast 4 Mg Chewable Tablet	Singulair
67296025701	Montelukast 10 Mg Oral Tablet	Singulair
67544059131	Montelukast 10 Mg Oral Tablet	Singulair
67801030503	Montelukast 10 Mg Oral Tablet	Singulair
67801030535	Montelukast 10 Mg Oral Tablet	Singulair
680010248	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68001024803	Montelukast 10 Mg Oral Tablet	Not available
68001024804	Montelukast 10 Mg Oral Tablet	Not available
68001024805	Montelukast 10 Mg Oral Tablet	Not available
680010361	Montelukast 10Mg/1 Oral Tablet	Not available
68001036103	Montelukast 10 Mg Oral Tablet	Not available
68001036104	Montelukast 10 Mg Oral Tablet	Not available
68001036105	Montelukast 10 Mg Oral Tablet	Not available
680711561	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
68071156103	Montelukast 10 Mg Oral Tablet	Not available
680711652	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
68071165209	Montelukast 10 Mg Oral Tablet	Not available
680711755	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available

Code	Description	Brand[b]
68071175509	Montelukast 5 Mg Chewable Tablet	Not available
680712425	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
68071242509	Montelukast 10 Mg Oral Tablet	Not available
680712486	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
68071248609	Montelukast 5 Mg Chewable Tablet	Not available
680713355	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68071335509	Montelukast 10 Mg Oral Tablet	Not available
680714034	Montelukast 10Mg/1 Oral Tablet	Not available
68071403409	Montelukast 10 Mg Oral Tablet	Not available
680714047	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68071404703	Montelukast 10 Mg Oral Tablet	Not available
680714054	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
68071405409	Montelukast 4 Mg Chewable Tablet	Not available
680715141	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
68071514109	Montelukast 5 Mg Chewable Tablet	Not available
680715278	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68071527803	Montelukast 10 Mg Oral Tablet	Not available
680840619	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
68084061901	Montelukast 5 Mg Chewable Tablet	Not available
68084061911	Montelukast 5 Mg Chewable Tablet	Not available
680840620	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68084062001	Montelukast 10 Mg Oral Tablet	Not available
68084062011	Montelukast 10 Mg Oral Tablet	Not available
680840638	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
68084063811	Montelukast 4 Mg Chewable Tablet	Not available
68084063821	Montelukast 4 Mg Chewable Tablet	Not available
680840864	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
68084086401	Montelukast 5 Mg Chewable Tablet	Not available
68084086411	Montelukast 5 Mg Chewable Tablet	Not available
680840875	Montelukast Sodium 10Mg/1 Oral Tablet, Coated	Not available
68084087501	Montelukast 10 Mg Oral Tablet	Not available
68084087511	Montelukast 10 Mg Oral Tablet	Not available
68115092330	Montelukast 10 Mg Oral Tablet	Singulair
68115092390	Montelukast 10 Mg Oral Tablet	Singulair
681513494	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68151349402	Montelukast 10 Mg Oral Tablet	Not available
681513498	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68151349802	Montelukast 10 Mg Oral Tablet	Not available
681514186	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
68151418607	Montelukast 5 Mg Chewable Tablet	Not available
681514338	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
68151433805	Montelukast 4 Mg Chewable Tablet	Not available
682583032	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
68258303203	Montelukast 5 Mg Chewable Tablet	Singulair
682583033	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68258303303	Montelukast 10 Mg Oral Tablet	Singulair

Code	Description	Brand[b]
68258891509	Montelukast 4 Mg Chewable Tablet	Not available
68258891609	Montelukast 5 Mg Chewable Tablet	Not available
68258891709	Montelukast 10 Mg Oral Tablet	Not available
68258893703	Montelukast 4 Mg Chewable Tablet	Singulair
684620392	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68462039205	Montelukast 10 Mg Oral Tablet	Not available
68462039230	Montelukast 10 Mg Oral Tablet	Not available
68462039290	Montelukast 10 Mg Oral Tablet	Not available
686450466	Montelukast Sodium 10Mg/1 Oral Tablet, Coated	Not available
686450484	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68645048470	Montelukast 10 Mg Oral Tablet	Not available
68645046654	Montelukast 10 Mg Oral Tablet	Not available
686450528	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68645052801	Montelukast 10 Mg Oral Tablet	Not available
686450560	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
68645056054	Montelukast 10 Mg Oral Tablet	Not available
687886410	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
68788641001	Montelukast 5 Mg Chewable Tablet	Not available
68788641002	Montelukast 5 Mg Chewable Tablet	Not available
68788641003	Montelukast 5 Mg Chewable Tablet	Not available
68788641004	Montelukast 5 Mg Chewable Tablet	Not available
68788641006	Montelukast 5 Mg Chewable Tablet	Not available
68788641009	Montelukast 5 Mg Chewable Tablet	Not available
687886946	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
68788694601	Montelukast 4 Mg Chewable Tablet	Not available
68788694602	Montelukast 4 Mg Chewable Tablet	Not available
68788694603	Montelukast 4 Mg Chewable Tablet	Not available
68788694604	Montelukast 4 Mg Chewable Tablet	Not available
68788694606	Montelukast 4 Mg Chewable Tablet	Not available
68788694609	Montelukast 4 Mg Chewable Tablet	Not available
687887064	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
68788706401	Montelukast 5 Mg Chewable Tablet	Not available
68788706402	Montelukast 5 Mg Chewable Tablet	Not available
68788706403	Montelukast 5 Mg Chewable Tablet	Not available
68788706404	Montelukast 5 Mg Chewable Tablet	Not available
68788706406	Montelukast 5 Mg Chewable Tablet	Not available
68788706409	Montelukast 5 Mg Chewable Tablet	Not available
687887387	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
68788738701	Montelukast 5 Mg Chewable Tablet	Not available
68788738702	Montelukast 5 Mg Chewable Tablet	Not available
68788738703	Montelukast 5 Mg Chewable Tablet	Not available
68788738704	Montelukast 5 Mg Chewable Tablet	Not available
68788738706	Montelukast 5 Mg Chewable Tablet	Not available
68788738709	Montelukast 5 Mg Chewable Tablet	Not available
687887668	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
68788766801	Montelukast 4 Mg Chewable Tablet	Not available

Code	Description	Brand[b]
68788766802	Montelukast 4 Mg Chewable Tablet	Not available
68788766803	Montelukast 4 Mg Chewable Tablet	Not available
68788766804	Montelukast 4 Mg Chewable Tablet	Not available
68788766806	Montelukast 4 Mg Chewable Tablet	Not available
68788766809	Montelukast 4 Mg Chewable Tablet	Not available
687887669	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
68788766901	Montelukast 5 Mg Chewable Tablet	Not available
68788766902	Montelukast 5 Mg Chewable Tablet	Not available
68788766903	Montelukast 5 Mg Chewable Tablet	Not available
68788766904	Montelukast 5 Mg Chewable Tablet	Not available
68788766906	Montelukast 5 Mg Chewable Tablet	Not available
68788766909	Montelukast 5 Mg Chewable Tablet	Not available
687887771	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
68788777101	Montelukast 4 Mg Chewable Tablet	Not available
68788777102	Montelukast 4 Mg Chewable Tablet	Not available
68788777103	Montelukast 4 Mg Chewable Tablet	Not available
68788777104	Montelukast 4 Mg Chewable Tablet	Not available
68788777106	Montelukast 4 Mg Chewable Tablet	Not available
68788777109	Montelukast 4 Mg Chewable Tablet	Not available
687888099	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
68788809903	Montelukast 10 Mg Oral Tablet	Not available
68788809906	Montelukast 10 Mg Oral Tablet	Not available
68788809909	Montelukast 10 Mg Oral Tablet	Not available
687888988	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
68788898801	Montelukast 5 Mg Chewable Tablet	Not available
68788898802	Montelukast 5 Mg Chewable Tablet	Not available
68788898803	Montelukast 5 Mg Chewable Tablet	Not available
68788898804	Montelukast 5 Mg Chewable Tablet	Not available
68788898806	Montelukast 5 Mg Chewable Tablet	Not available
68788898809	Montelukast 5 Mg Chewable Tablet	Not available
687889438	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
68788943801	Montelukast 10 Mg Oral Tablet	Not available
68788943802	Montelukast 10 Mg Oral Tablet	Not available
68788943803	Montelukast 10 Mg Oral Tablet	Not available
68788943804	Montelukast 10 Mg Oral Tablet	Not available
68788943806	Montelukast 10 Mg Oral Tablet	Not available
68788943809	Montelukast 10 Mg Oral Tablet	Not available
687889439	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
68788943901	Montelukast 4 Mg Chewable Tablet	Not available
68788943902	Montelukast 4 Mg Chewable Tablet	Not available
68788943903	Montelukast 4 Mg Chewable Tablet	Not available
68788943904	Montelukast 4 Mg Chewable Tablet	Not available
68788943906	Montelukast 4 Mg Chewable Tablet	Not available
68788943909	Montelukast 4 Mg Chewable Tablet	Not available
691890263	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
69189026301	Montelukast 10 Mg Oral Tablet	Not available

Code	Description	Brand[b]
693670287	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
69367028705	Montelukast 10 Mg Oral Tablet	Not available
69367028709	Montelukast 10 Mg Oral Tablet	Not available
694520105	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
69452010513	Montelukast 10 Mg Oral Tablet	Not available
69452010519	Montelukast 10 Mg Oral Tablet	Not available
69452010532	Montelukast 10 Mg Oral Tablet	Not available
694520106	Montelukast 4Mg/1 Oral Tablet, Chewable	Not available
69452010613	Montelukast 4 Mg Chewable Tablet	Not available
69452010619	Montelukast 4 Mg Chewable Tablet	Not available
69452010632	Montelukast 4 Mg Chewable Tablet	Not available
694520107	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
69452010713	Montelukast 5 Mg Chewable Tablet	Not available
69452010719	Montelukast 5 Mg Chewable Tablet	Not available
69452010732	Montelukast 5 Mg Chewable Tablet	Not available
698440039	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
69844003901	Montelukast 4 Mg Chewable Tablet	Not available
69844003902	Montelukast 4 Mg Chewable Tablet	Not available
698440040	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
69844004001	Montelukast 5 Mg Chewable Tablet	Not available
69844004002	Montelukast 5 Mg Chewable Tablet	Not available
698440041	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
69844004101	Montelukast 10 Mg Oral Tablet	Not available
69844004102	Montelukast 10 Mg Oral Tablet	Not available
70357000205	Montelukast 10 Mg Oral Tablet	Not available
70357000230	Montelukast 10 Mg Oral Tablet	Not available
70357000290	Montelukast 10 Mg Oral Tablet	Not available
70357000305	Montelukast 4 Mg Chewable Tablet	Not available
70357000330	Montelukast 4 Mg Chewable Tablet	Not available
70357000390	Montelukast 4 Mg Chewable Tablet	Not available
70357000405	Montelukast 5 Mg Chewable Tablet	Not available
70357000430	Montelukast 5 Mg Chewable Tablet	Not available
70357000490	Montelukast 5 Mg Chewable Tablet	Not available
704360090	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
70436009006	Montelukast 4 Mg Chewable Tablet	Not available
704360091	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
70436009106	Montelukast 5 Mg Chewable Tablet	Not available
705180172	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
70518017200	Montelukast 10 Mg Oral Tablet	Not available
70518017201	Montelukast 10 Mg Oral Tablet	Not available
70518017202	Montelukast 10 Mg Oral Tablet	Not available
705180294	Montelukast Sodium 10Mg/1 Oral Tablet, Coated	Not available
70518029400	Montelukast 10 Mg Oral Tablet	Not available
705180331	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
70518033100	Montelukast 10 Mg Oral Tablet	Not available
705180684	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available

Code	Description	Brand[b]
70518068400	Montelukast 10 Mg Oral Tablet	Not available
705180805	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
70518080500	Montelukast 10 Mg Oral Tablet	Not available
705181031	Montelukast 10Mg/1 Oral Tablet	Not available
70518103100	Montelukast 10 Mg Oral Tablet	Not available
705181075	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
70518107500	Montelukast 10 Mg Oral Tablet	Not available
705181085	Montelukast Sodium 10Mg/1 Oral Tablet, Coated	Not available
70518108500	Montelukast 10 Mg Oral Tablet	Not available
705181784	Montelukast Sodium 10Mg/1 Oral Tablet, Coated	Not available
70518178400	Montelukast 10 Mg Oral Tablet	Not available
705182603	Montelukast 10Mg/1 Oral Tablet	Not available
70518260300	Montelukast 10 Mg Oral Tablet	Not available
70518260301	Montelukast 10 Mg Oral Tablet	Not available
70518260302	Montelukast 10 Mg Oral Tablet	Not available
705182881	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
705183133	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
70518313300	Montelukast 10 Mg Oral Tablet	Not available
70518313301	Montelukast 10 Mg Oral Tablet	Not available
709340202	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
70934020230	Montelukast 10 Mg Oral Tablet	Not available
70934020290	Montelukast 10 Mg Oral Tablet	Not available
709340485	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
70934048530	Montelukast 5 Mg Chewable Tablet	Not available
712050128	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
71205012830	Montelukast 5 Mg Chewable Tablet	Not available
71205012860	Montelukast 5 Mg Chewable Tablet	Not available
71205012890	Montelukast 5 Mg Chewable Tablet	Not available
712050181	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
71205018130	Montelukast 10 Mg Oral Tablet	Not available
71205018160	Montelukast 10 Mg Oral Tablet	Not available
71205018190	Montelukast 10 Mg Oral Tablet	Not available
712050189	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
71205018930	Montelukast 4 Mg Chewable Tablet	Not available
71205018960	Montelukast 4 Mg Chewable Tablet	Not available
71205018990	Montelukast 4 Mg Chewable Tablet	Not available
713350033	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
71335003301	Montelukast 4 Mg Chewable Tablet	Not available
71335003302	Montelukast 4 Mg Chewable Tablet	Not available
71335003303	Montelukast 4 Mg Chewable Tablet	Not available
713350301	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
71335030101	Montelukast 5 Mg Chewable Tablet	Not available
71335030102	Montelukast 5 Mg Chewable Tablet	Not available
71335030103	Montelukast 5 Mg Chewable Tablet	Not available
71335030104	Montelukast 5 Mg Chewable Tablet	Not available
713350374	Montelukast Sodium 10Mg/1 Oral Tablet	Not available

Code	Description	Brand[b]
71335037401	Montelukast 10 Mg Oral Tablet	Not available
71335037402	Montelukast 10 Mg Oral Tablet	Not available
71335037403	Montelukast 10 Mg Oral Tablet	Not available
71335037404	Montelukast 10 Mg Oral Tablet	Not available
71335037405	Montelukast 10 Mg Oral Tablet	Not available
71335037406	Montelukast 10 Mg Oral Tablet	Not available
71335037407	Montelukast 10 Mg Oral Tablet	Not available
713350514	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
71335051401	Montelukast 10 Mg Oral Tablet	Not available
71335051402	Montelukast 10 Mg Oral Tablet	Not available
71335051403	Montelukast 10 Mg Oral Tablet	Not available
71335051404	Montelukast 10 Mg Oral Tablet	Not available
71335051405	Montelukast 10 Mg Oral Tablet	Not available
71335051406	Montelukast 10 Mg Oral Tablet	Not available
71335051407	Montelukast 10 Mg Oral Tablet	Not available
713350611	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
71335061101	Montelukast 5 Mg Chewable Tablet	Not available
71335061102	Montelukast 5 Mg Chewable Tablet	Not available
71335061103	Montelukast 5 Mg Chewable Tablet	Not available
71335061104	Montelukast 5 Mg Chewable Tablet	Not available
713350620	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
71335062001	Montelukast 4 Mg Chewable Tablet	Not available
71335062002	Montelukast 4 Mg Chewable Tablet	Not available
71335062003	Montelukast 4 Mg Chewable Tablet	Not available
713350629	Montelukast 5Mg/1 Oral Tablet, Chewable	Not available
71335062901	Montelukast 5 Mg Chewable Tablet	Not available
71335062902	Montelukast 5 Mg Chewable Tablet	Not available
71335062903	Montelukast 5 Mg Chewable Tablet	Not available
71335062904	Montelukast 5 Mg Chewable Tablet	Not available
713351326	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
71335132601	Montelukast 5 Mg Chewable Tablet	Not available
713351599	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
71335159901	Montelukast 10 Mg Oral Tablet	Not available
71335159902	Montelukast 10 Mg Oral Tablet	Not available
71335159903	Montelukast 10 Mg Oral Tablet	Not available
71335159904	Montelukast 10 Mg Oral Tablet	Not available
71335159905	Montelukast 10 Mg Oral Tablet	Not available
71335159906	Montelukast 10 Mg Oral Tablet	Not available
71335159907	Montelukast 10 Mg Oral Tablet	Not available
713351602	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
71335160201	Montelukast 4 Mg Chewable Tablet	Not available
71335160202	Montelukast 4 Mg Chewable Tablet	Not available
71335160203	Montelukast 4 Mg Chewable Tablet	Not available
71335159908	Montelukast 10 Mg Oral Tablet	Not available
713351979	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
71335197901	Montelukast 10 Mg Oral Tablet	Not available

Code	Description	Brand[b]
71335197902	Montelukast 10 Mg Oral Tablet	Not available
71335197903	Montelukast 10 Mg Oral Tablet	Not available
71335197904	Montelukast 10 Mg Oral Tablet	Not available
71335197905	Montelukast 10 Mg Oral Tablet	Not available
71335197906	Montelukast 10 Mg Oral Tablet	Not available
71335197907	Montelukast 10 Mg Oral Tablet	Not available
71335197908	Montelukast 10 Mg Oral Tablet	Not available
713351995	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
716100026	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
71610002630	Montelukast 10 Mg Oral Tablet	Not available
71610002660	Montelukast 10 Mg Oral Tablet	Not available
716100051	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
71610005130	Montelukast 10 Mg Oral Tablet	Not available
716100129	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
71610012909	Montelukast 10 Mg Oral Tablet	Not available
71610012930	Montelukast 10 Mg Oral Tablet	Not available
716100563	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
71610056330	Montelukast 10 Mg Oral Tablet	Not available
721890223	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
72189022330	Montelukast 5 Mg Chewable Tablet	Not available
728650175	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
72865017510	Montelukast 10 Mg Oral Tablet	Not available
72865017530	Montelukast 10 Mg Oral Tablet	Not available
72865017590	Montelukast 10 Mg Oral Tablet	Not available
782060170	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
78206017001	Montelukast 4 Mg Chewable Tablet	Singulair
782060171	Montelukast Sodium 4Mg/1 Oral Granule	Not available
78206017101	Montelukast 4 Mg Oral Granules	Singulair
782060172	Montelukast Sodium 10Mg/1 Oral Tablet, Film Coated	Not available
78206017201	Montelukast 10 Mg Oral Tablet	Singulair
78206017202	Montelukast 10 Mg Oral Tablet	Singulair
782060173	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
78206017301	Montelukast 5 Mg Chewable Tablet	Singulair
58864069430	Montelukast 5 Mg Chewable Tablet	Singulair
63629488607	Montelukast 10 Mg Oral Tablet	Not available
63629488608	Montelukast 10 Mg Oral Tablet	Not available
63629497801	Montelukast 5 Mg Chewable Tablet	Not available
63629497802	Montelukast 5 Mg Chewable Tablet	Not available
63629497803	Montelukast 5 Mg Chewable Tablet	Not available
63629497804	Montelukast 5 Mg Chewable Tablet	Not available
70518288100	Montelukast 4 Mg Chewable Tablet	Not available
71335051408	Montelukast 10 Mg Oral Tablet	Not available
71335199501	Montelukast 10 Mg Oral Tablet	Not available
71335199502	Montelukast 10 Mg Oral Tablet	Not available
71335199503	Montelukast 10 Mg Oral Tablet	Not available
71335199504	Montelukast 10 Mg Oral Tablet	Not available

Code	Description	Brand[b]
71335199505	Montelukast 10 Mg Oral Tablet	Not available
71335199506	Montelukast 10 Mg Oral Tablet	Not available
71335199507	Montelukast 10 Mg Oral Tablet	Not available
71335199508	Montelukast 10 Mg Oral Tablet	Not available
50268055611	Montelukast 10 Mg Oral Tablet	Not available
530024730	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
586570717	Montelukast Sodium 10Mg/1 Oral Tablet	Not available
586570716	Montelukast Sodium 5Mg/1 Oral Tablet, Chewable	Not available
586570715	Montelukast Sodium 4Mg/1 Oral Tablet, Chewable	Not available
43063038015	Montelukast 10 Mg Oral Tablet	Not available
43063038030	Montelukast 10 Mg Oral Tablet	Not available
58864065830	Montelukast 10 Mg Oral Tablet	Singulair
53002473001	Montelukast 5 Mg Chewable Tablet	Not available
58657071690	Montelukast 5 Mg Chewable Tablet	Not available
58657071630	Montelukast 5 Mg Chewable Tablet	Not available
58657071590	Montelukast 4 Mg Chewable Tablet	Not available
58657071530	Montelukast 4 Mg Chewable Tablet	Not available
58657071790	Montelukast 10 Mg Oral Tablet	Not available
58657071730	Montelukast 10 Mg Oral Tablet	Not available
82009000910	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
820090009	Montelukast 10Mg/1 Oral Tablet, Film Coated	Not available
Inhaled Corticosteroids		
000377590	Flunisolide 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	TBD
00037759006	60 Actuat Flunisolide 0.08 Mg/Actuat Metered Dose Inhaler	Aerospan
00037759012	120 Actuat Flunisolide 0.08 Mg/Actuat Metered Dose Inhaler	Aerospan
00037759063	60 Actuat Flunisolide 0.08 Mg/Actuat Metered Dose Inhaler	Aerospan
00074301460	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
00075006037	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
00075006039	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
00085073604	200 Actuat Beclomethasone Dipropionate 0.084 Mg/Actuat Metered Dose Inhaler	Vanceril
00085111201	120 Actuat Beclomethasone Dipropionate 0.084 Mg/Actuat Metered Dose Inhaler	Not available
00085111203	200 Actuat Beclomethasone Dipropionate 0.084 Mg/Actuat Metered Dose Inhaler	Vanceril
000851341	Mometasone Furoate 220Ug/1 Respiratory (Inhalation) Inhalant	TBD
00085134101	120 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
00085134102	60 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
00085134103	30 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
00085134104	14 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
00085134106	14 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
00085134107	30 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
000851461	Mometasone Furoate 110Ug/1 Respiratory (Inhalation) Inhalant	Not available
00085146102	30 Actuat Mometasone Furoate 0.11 Mg/Actuat Dry Powder Inhaler	Asmanex
00085146107	7 Actuat Mometasone Furoate 0.11 Mg/Actuat Dry Powder Inhaler	Asmanex
000852222	Mometasone Furoate 50Ug/1 Respiratory (Inhalation) Aerosol	Not available

Code	Description	Brand[b]
00085222201	120 Actuat Mometasone Furoate 0.05 Mg/Actuat Metered Dose Inhaler	Asmanex
000854333	Mometasone Furoate 100Ug/1 Respiratory (Inhalation) Aerosol	Not available
00085433301	120 Actuat Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Asmanex
000854334	Mometasone Furoate 200Ug/1 Respiratory (Inhalation) Aerosol	Not available
00085433401	120 Actuat Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Asmanex
00088300560	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Not available
00088300712	120 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
00088300760	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Not available
00089017540	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
00089017780	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
00089074006	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
00089074021	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
00089074022	200 Actuat Beclomethasone 0.04 Mg/Actuat Metered Dose Inhaler	Not available
00089074106	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
00089074120	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Not available
00089074121	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
00089078976	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
00089078977	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
00089079274	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
00089079275	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
00089079276	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
00089079600	50 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00089079621	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00089079700	50 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00089079721	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00089079798	50 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00089079799	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00173031278	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
00173031288	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
00173031298	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
00173033601	200 Actuat Beclomethasone 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
00173036098	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Not available
00173046900	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
00173049100	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
00173049200	60 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
00173049400	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
00173049500	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
00173049600	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	TBD
00173049700	60 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent

Code	Description	Brand[b]
00173049800	60 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
00173049900	60 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
00173050400	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat Dry Powder Inhaler	Flovent
00173050900	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
00173051000	60 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
00173051100	60 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
00173060000	28 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
00173060001	28 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
00173060002	60 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
00173060100	28 Actuat Fluticasone Propionate 0.25 Mg/Actuat Dry Powder Inhaler	Flovent
00173060101	28 Actuat Fluticasone Propionate 0.25 Mg/Actuat Dry Powder Inhaler	Flovent
00173060102	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat Dry Powder Inhaler	Flovent
00173060200	28 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
00173060201	28 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
00173060202	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
00173071800	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
00173071820	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
00173071860	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
00173071900	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
00173071920	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
00173071961	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
00173072000	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
00173072020	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
00173087410	30 Actuat Fluticasone Furoate 0.1 Mg/Actuat Dry Powder Inhaler	Arnuity
00173087414	14 Actuat Fluticasone Furoate 0.1 Mg/Actuat Dry Powder Inhaler	Arnuity
00173087461	14 Actuat Fluticasone Furoate 0.1 Mg/Actuat Dry Powder Inhaler	Arnuity
00173087610	30 Actuat Fluticasone Furoate 0.2 Mg/Actuat Dry Powder Inhaler	Arnuity
00173087614	14 Actuat Fluticasone Furoate 0.2 Mg/Actuat Dry Powder Inhaler	Arnuity
00173087661	30 Actuat Fluticasone Furoate 0.2 Mg/Actuat Dry Powder Inhaler	Arnuity
00173088810	30 Actuat Fluticasone Furoate 0.05 Mg/Actuat Dry Powder Inhaler	Arnuity
00173088862	30 Actuat Fluticasone Furoate 0.05 Mg/Actuat Dry Powder Inhaler	Arnuity
00173701000	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
00173701100	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
00173701101	60 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
00173701202	60 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
00186091542	200 Actuat Budesonide 0.16 Mg/Actuat Dry Powder Inhaler	Pulmicort
00186091566	200 Actuat Budesonide 0.16 Mg/Actuat Dry Powder Inhaler	Pulmicort
00186091612	120 Actuat Budesonide 0.18 Mg/Actuat Dry Powder Inhaler	Pulmicort
00186091665	120 Actuat Budesonide 0.18 Mg/Actuat Dry Powder Inhaler	Pulmicort
00186091706	60 Actuat Budesonide 0.09 Mg/Actuat Dry Powder Inhaler	Pulmicort
00186091765	60 Actuat Budesonide 0.09 Mg/Actuat Dry Powder Inhaler	Pulmicort
00247063417	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Vanceril
00247065907	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00247070307	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00247109417	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent

Code	Description	Brand[b]
00247109488	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
00456067098	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00456067099	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00456067298	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00456067299	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00456555006	60 Actuat Flunisolide 0.08 Mg/Actuat Metered Dose Inhaler	Aerospan
00456555012	120 Actuat Flunisolide 0.08 Mg/Actuat Metered Dose Inhaler	Aerospan
00456555063	60 Actuat Flunisolide 0.08 Mg/Actuat Metered Dose Inhaler	Aerospan
00801006037	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
00801006039	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
016590030	Beclomethasone Dipropionate Monohydrate 42 Ug/1 Spray, Suspension	BECONASE
016590860	Beclomethasone Dipropionate 40 Ug/1 Aerosol, Metered	QVAR
024208344	Flunisolide .25 Mg/Ml Solution	Flunisolide
045802118	Mometasone Furoate 1 Mg/Ml Solution	Mometasone Furoate
052125459	Mometasone Furoate Monohydrate 50 Ug/1 Spray, Metered	NASONEX
059310175	Beclomethasone Dipropionate 40 Ug/1 Aerosol, Metered	QVAR
059310177	Beclomethasone Dipropionate 80 Ug/1 Aerosol, Metered	QVAR
059310202	Beclomethasone Dipropionate 40 Ug/1 Aerosol, Metered	QVAR
059310204	Beclomethasone Dipropionate 80 Ug/1 Aerosol, Metered	QVAR
059310210	Beclomethasone Dipropionate 80 Ug/1 Aerosol, Metered	QNASL
064980506	Flunisolide .25 Mg/Ml Spray, Metered	Flunisolide
064980510	Flunisolide .25 Mg/Ml Spray, Metered	Flunisolide
067405275	Mometasone Furoate 1 Mg/Ml Solution	Mometasone Furoate
075989550	Flunisolide 80 Ug/1 Aerosol, Metered	Aerospan
10599000001	Mometasone Furoate 0.37 Mg Drug Implant	Propel
10599000101	Mometasone Furoate 0.37 Mg Drug Implant	Propel
10599000201	Mometasone Furoate 0.37 Mg Drug Implant	Propel
105990003	Mometasone Furoate 1350Ug/1 Intrasinal Implant	Not available
10599000301	Mometasone Furoate 1.35 Mg Drug Implant	Sinuva
10599000401	Mometasone Furoate 0.37 Mg Drug Implant	Propel
11517017504	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
11517017708	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
11517071101	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
11517071102	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
11517071103	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
11517071201	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
11517071202	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
11517071203	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
11517074001	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
11517074006	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
11517074101	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar

Code	Description	Brand[b]
11517074106	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
11517078906	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
11517078907	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
16590002520	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
165900860	Beclomethasone Dipropionate 40Ug/1 Respiratory (Inhalation) Aerosol, Metered	qvar
16590086071	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
16590086072	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
16590086073	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
17228091600	120 Actuat Budesonide 0.16 Mg/Actuat Dry Powder Inhaler	Pulmicort
17228091700	60 Actuat Budesonide 0.08 Mg/Actuat Dry Powder Inhaler	Pulmicort
17270057437	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
17270057439	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
21695029101	60 Actuat Budesonide 0.09 Mg/Actuat Dry Powder Inhaler	Pulmicort
23490940500	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
35356009914	14 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
35356015701	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
35356049401	60 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
38779036401	Beclomethasone Dipro Powder	Not available
38779036403	Beclomethasone Dipro Powder	Not available
38779036406	Beclomethasone Dipro Powder	Not available
38779040600	Flunisolide Powder	Not available
38779040606	Flunisolide Powder	Not available
38779241300	Mometasone Furoate Powder	Not available
38779241302	Mometasone Furoate Powder	Not available
38779241306	Mometasone Furoate Powder	Not available
38779241308	Mometasone Furoate Powder	Not available
38779241309	Mometasone Furoate Powder	Not available
49349074601	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
49349074621	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
49452080201	Beclomethasone Dipro Powder	Not available
49452080202	Beclomethasone Dipro Powder	Not available
49999061401	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
49999061412	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
50090091000	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
50090091600	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
50090093400	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
50090124500	60 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
500901342	Beclomethasone Dipropionate 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
50090134200	120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
50090223900	120 Actuat Budesonide 0.18 Mg/Actuat Dry Powder Inhaler	Pulmicort

Code	Description	Brand[b]
500903033	Beclomethasone Dipropionate 40Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
50090303300	120 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
500903459	Beclomethasone Dipropionate Hfa 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
50090345900	Breath-Actuated 120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
500905031	Beclomethasone Dipropionate Hfa 40Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
50090503100	Breath-Actuated 120 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
500905032	Beclomethasone Dipropionate Hfa 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
50090503200	Breath-Actuated 120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
50580017540	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
50580017780	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
51552088301	Beclomethasone Dipro Powder	Not available
51552088302	Beclomethasone Dipro Powder	Not available
51552088309	Beclomethasone Dipro Powder	Not available
51927164100	Beclomethasone Dipro Powder	Not available
51927179400	Flunisolide Powder	Not available
51927450600	Mometasone Furoate Powder	Not available
51947060001	60 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
51947060002	60 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
51947060100	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat Dry Powder Inhaler	Flovent
51947060101	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat Dry Powder Inhaler	Flovent
51947060102	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat Dry Powder Inhaler	Flovent
51947060200	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
51947060201	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
51947060202	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
52959013100	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
52959028603	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
52959059601	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Vanceril
52959059801	200 Actuat Beclomethasone Dipropionate 0.084 Mg/Actuat Metered Dose Inhaler	Vanceril
53002087758	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
53002088099	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
53002129401	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
53002131001	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
530021436	Beclomethasone Dipropionate 40Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
53002143602	120 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
530021477	Beclomethasone Dipropionate 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
53002147702	120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
530022436	Beclomethasone Dipropionate Hfa 40Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available

Code	Description	Brand[b]
53002243603	Breath-Actuated 120 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
530023477	Beclomethasone Dipropionate Hfa 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
53002347703	Breath-Actuated 120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
54569005300	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
54569006700	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Vanceril
54569100400	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
54569101300	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54569397600	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54569454000	200 Actuat Beclomethasone Dipropionate 0.084 Mg/Actuat Metered Dose Inhaler	Vanceril
54569474100	200 Actuat Budesonide 0.16 Mg/Actuat Dry Powder Inhaler	Pulmicort
54569482200	200 Actuat Beclomethasone Dipropionate 0.084 Mg/Actuat Metered Dose Inhaler	Vanceril
54569489600	60 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
54569566300	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
54569567100	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
54569570200	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
54569592800	120 Actuat Budesonide 0.16 Mg/Actuat Dry Powder Inhaler	Pulmicort
54569626500	60 Actuat Fluticasone Propionate 0.05 Mg/Actuat Dry Powder Inhaler	Flovent
54569626600	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
54569639000	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
54868126801	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
54868126901	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
54868184101	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Vanceril
54868188301	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54868188310	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54868418200	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
54868426400	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
54868429500	200 Actuat Budesonide 0.16 Mg/Actuat Dry Powder Inhaler	Pulmicort
54868439200	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
54868529400	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54868536200	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
54868536201	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
548685547	Mometasone Furoate 220Ug/1 Respiratory (Inhalation) Inhalant	Not available
54868554700	60 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
54868554701	30 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
54868554702	14 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
54868563700	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
54868584400	120 Actuat Budesonide 0.18 Mg/Actuat Dry Powder Inhaler	Pulmicort
548685857	Beclomethasone Dipropionate 40Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
54868585700	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
54868585701	120 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar

Code	Description	Brand[b]
548685858	Beclomethasone Dipropionate 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
54868585800	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
54868585801	120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
54868598900	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
54868599000	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
54868599500	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
55045186803	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
55045211907	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
55045252007	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
55045291901	60 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
55045305401	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
55045306300	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
55045335100	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
55045335400	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
55045341600	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
55045369508	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
55175443501	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Vanceril
55175446501	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
55175446601	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
58016620700	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
58016620701	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Beclovent
58087031720	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
59310011406	Sensor 60 Actuat Fluticasone Propionate 0.055 Mg/Actuat Dry Powder Inhaler	Armonair
593100175	Beclomethasone Dipropionate 40Ug/1 Respiratory (Inhalation) Aerosol, Metered	qvar
59310017540	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
59310017541	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
59310017780	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
59310017781	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
59310020006	Sensor 60 Actuat Fluticasone Propionate 0.113 Mg/Actuat Dry Powder Inhaler	Armonair
593100202	Beclomethasone Dipropionate 40Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
59310020212	120 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
59310020214	120 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
59310020240	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
593100204	Beclomethasone Dipropionate 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
59310020412	120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar

Code	Description	Brand[b]
59310020414	120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
59310020450	50 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
59310020480	120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
59310020485	50 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
593100302	Beclomethasone Dipropionate Hfa 40Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
59310030240	Breath-Actuated 120 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
59310030241	Breath-Actuated 120 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
593100304	Beclomethasone Dipropionate Hfa 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
59310030480	Breath-Actuated 120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
59310030481	Breath-Actuated 120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
59310031106	Sensor 60 Actuat Fluticasone Propionate 0.232 Mg/Actuat Dry Powder Inhaler	Armonair
59310050508	Sensor 60 Actuat Fluticasone Propionate 0.055 Mg/Actuat Dry Powder Inhaler	Armonair
59310051508	Sensor 60 Actuat Fluticasone Propionate 0.113 Mg/Actuat Dry Powder Inhaler	Armonair
59310052508	Sensor 60 Actuat Fluticasone Propionate 0.232 Mg/Actuat Dry Powder Inhaler	Armonair
59310070506	60 Actuat Fluticasone Propionate 0.055 Mg/Actuat Dry Powder Inhaler	Armonair
59310070508	60 Actuat Fluticasone Propionate 0.055 Mg/Actuat Dry Powder Inhaler	Armonair
59310071108	60 Actuat Fluticasone Propionate 0.113 Mg/Actuat Dry Powder Inhaler	Armonair
59310072206	60 Actuat Fluticasone Propionate 0.232 Mg/Actuat Dry Powder Inhaler	Armonair
59310072208	60 Actuat Fluticasone Propionate 0.232 Mg/Actuat Dry Powder Inhaler	Armonair
60346022676	200 Actuat Beclomethasone Dipropionate 0.042 Mg/Actuat Metered Dose Inhaler	Vanceril
60346028274	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
605050824	Flunisolide 29 Ug/1 Spray, Metered	Flunisolide
60598006160	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
60937071900	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Flovent
60937072000	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
62991102001	Beclomethasone Dipro Powder	Not available
62991102002	Beclomethasone Dipro Powder	Not available
62991102004	Beclomethasone Dipro Powder	Not available
62991102005	Beclomethasone Dipro Powder	Not available
63187095760	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
63402071101	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
63402071102	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
63402071103	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
63402071201	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
63402071202	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
63402071203	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
63874071420	240 Actuat Triamcinolone Acetonide 0.075 Mg/Actuat Metered Dose Inhaler	Azmacort
66267130000	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar

Code	Description	Brand[b]
680711691	Beclomethasone Dipropionate 40Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
68071169108	120 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
68115065201	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
68115065301	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
68115077507	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
68258891306	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
68258893308	100 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
68258896408	100 Actuat Beclomethasone Dipropionate 0.04 Mg/Actuat Metered Dose Inhaler	Qvar
68788692601	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Flovent
687887025	Beclomethasone Dipropionate 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	Not available
68788702501	120 Actuat Beclomethasone Dipropionate 0.08 Mg/Actuat Metered Dose Inhaler	Qvar
70515071101	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
70515071102	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
70515071103	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
70515071104	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
70515071105	60 Actuat Ciclesonide 0.08 Mg/Actuat Metered Dose Inhaler	Alvesco
70515071201	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
70515071202	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
70515071203	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
70515071204	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
70515071205	60 Actuat Ciclesonide 0.16 Mg/Actuat Metered Dose Inhaler	Alvesco
70518031000	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Flovent
728350301	Mometasone Furoate And Ammonium Lactate Kit	Not available
72835030102	Mometasone Furoate And Ammonium Lactate Kit	Not available
728350601	Mometasone Furoate And Dimethicone Kit	Not available
72835060102	Mometasone Furoate And Dimethicone Kit	Not available
759890550	Flunisolide 80Ug/1 Respiratory (Inhalation) Aerosol, Metered	aerospan
75989055006	60 Actuat Flunisolide 0.08 Mg/Actuat Metered Dose Inhaler	Aerospan
75989055012	120 Actuat Flunisolide 0.08 Mg/Actuat Metered Dose Inhaler	Aerospan
75989055063	60 Actuat Flunisolide 0.078 Mg/Actuat Metered Dose Inhaler	Aerospan
76519117700	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat Dry Powder Inhaler	Flovent
782060111	Mometasone Furoate 50Ug/1 Respiratory (Inhalation) Aerosol	Not available
78206011101	120 Actuat Mometasone Furoate 0.05 Mg/Actuat Metered Dose Inhaler	Asmanex
78206011159	120 Actuat Mometasone Furoate 0.05 Mg/Actuat Metered Dose Inhaler	Asmanex
782060112	Mometasone Furoate 100Ug/1 Respiratory (Inhalation) Aerosol	Not available
78206011201	120 Actuat Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Asmanex
78206011259	120 Actuat Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Asmanex
782060113	Mometasone Furoate 200Ug/1 Respiratory (Inhalation) Aerosol	Not available
78206011301	120 Actuat Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Asmanex
78206011359	120 Actuat Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Asmanex
782060114	Mometasone Furoate 220Ug/1 Respiratory (Inhalation) Inhalant	Not available
78206011401	120 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
78206011402	60 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex

Code	Description	Brand[b]
78206011403	14 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
78206011404	30 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
78206011459	14 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
782060115	Mometasone Furoate 110Ug/1 Respiratory (Inhalation) Inhalant	Not available
78206011501	30 Actuat Mometasone Furoate 0.11 Mg/Actuat Dry Powder Inhaler	Asmanex
78206011559	30 Actuat Mometasone Furoate 0.11 Mg/Actuat Dry Powder Inhaler	Asmanex
00085134105	14 Actuat Mometasone Furoate 0.22 Mg/Actuat Dry Powder Inhaler	Asmanex
00085146106	7 Actuat Mometasone Furoate 0.11 Mg/Actuat Dry Powder Inhaler	Asmanex
00085222202	120 Actuat Mometasone Furoate 0.05 Mg/Actuat Metered Dose Inhaler	Asmanex
00085433302	120 Actuat Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Asmanex
00085433402	120 Actuat Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Asmanex
59310071106	60 Actuat Fluticasone Propionate 0.113 Mg/Actuat Dry Powder Inhaler	Armonair
66993007996	120 Actuat Fluticasone Propionate 0.11 Mg/Actuat Metered Dose Inhaler	Not available
66993008096	120 Actuat Fluticasone Propionate 0.22 Mg/Actuat Metered Dose Inhaler	Not available
66993007896	120 Actuat Fluticasone Propionate 0.044 Mg/Actuat Metered Dose Inhaler	Not available

[a] Additional treatments may be included upon inspection of the dataset.
[b] Note codes with 'Not available' brands did not have a brand associated with the description

D. List of generic and brand drug names used to define washout and censoring criteria (6 months prior to MON initiation)[a]

Code	Description	Brand[b]
ICS		
24105010	Guaifenesin 200 Mg Oral Tablet	Breonesin
00085222301	120 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.05 Mg/Actuat Metered Dose Inhaler	Dulera
00085222302	120 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.05 Mg/Actuat Metered Dose Inhaler	Dulera
00085461001	120 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Dulera
00085461002	120 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Dulera
00085461005	60 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Dulera
00085461006	60 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Dulera
00085720601	120 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Dulera
00085720602	120 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Dulera
00085720607	60 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Dulera
00085720608	60 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Dulera
00089079600	50 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00089079621	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00089079700	50 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00089079721	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00089079798	50 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00089079799	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00173069500	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
00173069501	28 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 100/50
00173069502	28 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 100/50
00173069504	14 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
00173069561	14 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
00173069600	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
00173069601	28 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 250/50
00173069602	28 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 250/50
00173069604	14 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
00173069661	14 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
00173069700	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
00173069701	28 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 500/50
00173069702	28 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 500/50
00173069704	14 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
00173069761	14 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair

Code	Description	Brand[b]
00173071500	120 Actuat Fluticasone Propionate 0.045 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair 45/21
00173071503	120 Actuat Fluticasone 0.045 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair HFA
00173071520	120 Actuat Fluticasone Propionate 0.045 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair
00173071522	60 Actuat Fluticasone Propionate 0.045 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair
00173071561	60 Actuat Fluticasone Propionate 0.045 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair
00173071562	120 Actuat Fluticasone Propionate 0.045 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair 45/21
00173071600	120 Actuat Fluticasone Propionate 0.115 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair 115/21
00173071603	120 Actuat Fluticasone 0.115 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair HFA
00173071620	120 Actuat Fluticasone Propionate 0.115 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair
00173071622	60 Actuat Fluticasone Propionate 0.115 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair
00173071661	60 Actuat Fluticasone Propionate 0.115 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair
00173071662	120 Actuat Fluticasone Propionate 0.115 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair 115/21
00173071700	120 Actuat Fluticasone Propionate 0.23 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair 230/21
00173071703	120 Actuat Fluticasone 0.23 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair HFA
00173071720	120 Actuat Fluticasone Propionate 0.23 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair
00173071722	60 Actuat Fluticasone Propionate 0.23 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair
00173071761	60 Actuat Fluticasone Propionate 0.23 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair
00173085910	30 Actuat Fluticasone Furoate 0.1 Mg/Actuat / Vilanterol 0.025 Mg/Actuat Dry Powder Inhaler	Breo
00173085914	14 Actuat Fluticasone Furoate 0.1 Mg/Actuat / Vilanterol 0.025 Mg/Actuat Dry Powder Inhaler	Breo
00173085961	14 Actuat Fluticasone Furoate 0.1 Mg/Actuat / Vilanterol 0.025 Mg/Actuat Dry Powder Inhaler	Breo
00173088210	30 Actuat Fluticasone Furoate 0.2 Mg/Actuat / Vilanterol 0.025 Mg/Actuat Dry Powder Inhaler	Breo
00173088214	14 Actuat Fluticasone Furoate 0.2 Mg/Actuat / Vilanterol 0.025 Mg/Actuat Dry Powder Inhaler	Breo
00173088261	14 Actuat Fluticasone Furoate 0.2 Mg/Actuat / Vilanterol 0.025 Mg/Actuat Dry Powder Inhaler	Breo
00186037020	120 Actuat Budesonide 0.16 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
00186037028	60 Actuat Budesonide 0.16 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
00186037060	60 Actuat Budesonide 0.16 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
00186037220	120 Actuat Budesonide 0.08 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
00186037228	60 Actuat Budesonide 0.08 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
00186037260	60 Actuat Budesonide 0.08 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
00247065907	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00247070307	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00247197360	Fluticasone 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Inhalant Powder	Advair Diskus
00247198360	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair

Code	Description	Brand[b]
00247221560	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
00456067098	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00456067099	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00456067298	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
00456067299	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
21695019601	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
21695019701	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
21695036160	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
23490754001	120 Actuat Fluticasone Propionate 0.115 Mg/Actuat / Salmeterol 0.021 Mg/Actuat Metered Dose Inhaler	Advair 115/21
23490754101	Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 100/50
23490754201	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
33261087301	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
33261087401	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
49349073801	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
49349073860	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
49999081960	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
49999098460	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
49999098560	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
50090073000	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
50090073100	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
50090073200	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
50090140300	120 Actuat Budesonide 0.16 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
50090191600	60 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Dulera
50090240400	14 Actuat Fluticasone Furoate 0.2 Mg/Actuat / Vilanterol 0.025 Mg/Actuat Dry Powder Inhaler	Breo
51947069600	28 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 250/50
51947069601	28 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 250/50
51947069602	28 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 250/50
51947069606	60 Actuat Fluticasone 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair Diskus 250/50
51947069700	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 500/50
51947069701	28 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 500/50
51947069702	28 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 500/50
51947861301	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 100/50
51947861401	28 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 100/50

Code	Description	Brand[b]
51947861501	28 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 100/50
51947861601	60 Actuat Fluticasone 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair Diskus 250/50
51947861701	28 Actuat Fluticasone 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair Diskus 250/50
51947861801	28 Actuat Fluticasone 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair Diskus 250/50
51947861901	60 Actuat Fluticasone 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair Diskus 500/50
51947862001	28 Actuat Fluticasone 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair Diskus 500/50
51947862101	28 Actuat Fluticasone 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair Diskus 500/50
52125085601	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
52125085660	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
52959013100	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
53002088099	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54569101300	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54569397600	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54569524100	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
54569524200	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
54569524300	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
54569666500	14 Actuat Fluticasone Furoate 0.2 Mg/Actuat / Vilanterol 0.025 Mg/Actuat Dry Powder Inhaler	Breo
54868188301	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54868188310	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54868451600	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
54868451700	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
54868451800	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
54868529400	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
54868593600	120 Actuat Budesonide 0.16 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
54868593700	120 Actuat Budesonide 0.08 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
55045186803	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
55045252007	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
55045338801	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 100/50
55045368601	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
55887067860	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
58016460101	28 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 250/50
58016460401	28 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 250/50
58016481201	Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 100/50
58016481301	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 500/50
60346028274	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid

Code	Description	Brand[b]
61786064402	30 Actuat Fluticasone Furoate 0.1 Mg/Actuat / Vilanterol 0.025 Mg/Actuat Dry Powder Inhaler	Breo
61786064621	120 Actuat Budesonide 0.16 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
61786079660	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
67961037002	120 Actuat Budesonide 0.16 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort 160/4.5
67961037006	60 Actuat Budesonide 0.16 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort 160/4.5
67961037202	120 Actuat Budesonide 0.08 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort 80/4.5
67961037206	60 Actuat Budesonide 0.08 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort 80/4.5
68115065201	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
68115065301	100 Actuat Flunisolide 0.25 Mg/Actuat Metered Dose Inhaler	AeroBid
68115065701	60 Actuat Fluticasone 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair Diskus 100/50
68115076001	Fluticasone 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Inhalant Powder	Advair Diskus
68115092460	Fluticasone 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Inhalant Powder	Advair Diskus
68258303101	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
68258893806	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair 500/50
68258896601	120 Actuat Budesonide 0.16 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort 160/4.5
70518050800	60 Actuat Fluticasone Propionate 0.5 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
70518051400	60 Actuat Fluticasone Propionate 0.1 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
70518053800	60 Actuat Fluticasone Propionate 0.25 Mg/Actuat / Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Advair
70518202800	30 Actuat Fluticasone Furoate 0.1 Mg/Actuat / Vilanterol 0.025 Mg/Actuat Dry Powder Inhaler	Breo
70518269600	120 Actuat Budesonide 0.16 Mg/Actuat / Formoterol Fumarate 0.0045 Mg/Actuat Metered Dose Inhaler	Symbicort
78206012501	120 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.05 Mg/Actuat Metered Dose Inhaler	Dulera
78206012559	120 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.05 Mg/Actuat Metered Dose Inhaler	Dulera
78206012601	120 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Dulera
78206012602	60 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Dulera
78206012659	60 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.2 Mg/Actuat Metered Dose Inhaler	Dulera
78206012701	120 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Dulera
78206012702	60 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Dulera
78206012759	60 Actuat Formoterol Fumarate 0.005 Mg/Actuat / Mometasone Furoate 0.1 Mg/Actuat Metered Dose Inhaler	Dulera
LABA		
00078061906	Indacaterol 0.075 Mg Inhalant Powder	Arcapta
00078061915	Indacaterol 0.075 Mg Inhalation Powder	Arcapta
00078061961	Indacaterol 0.075 Mg Inhalation Powder	Arcapta
00078066406	Glycopyrrolate 0.0156 Mg / Indacaterol 0.0275 Mg Inhalation Powder	Utibron
00078066419	Glycopyrrolate 0.0156 Mg / Indacaterol 0.0275 Mg Inhalation Powder	Utibron
00078066461	Glycopyrrolate 0.0156 Mg / Indacaterol 0.0275 Mg Inhalation Powder	Utibron
00083016702	Formoterol Fumarate 0.012 Mg/Actuat Inhalant Powder	Foradil

Code	Description	Brand[b]
00083016711	Formoterol 0.012 Mg/Actuat Inhalant Powder	Foradil
00083016774	Formoterol 0.012 Mg/Actuat Inhalant Powder	Foradil
00083016776	Formoterol Fumarate 0.012 Mg/Actuat Inhalant Powder	Foradil
00085140101	Formoterol Fumarate 0.012 Mg Inhalation Powder	Foradil
00085140102	Formoterol 0.012 Mg/Actuat Inhalant Powder	Foradil
00085140201	Formoterol Fumarate 0.012 Mg Inhalation Powder	Foradil
00085140202	Formoterol Fumarate 0.012 Mg Inhalation Powder	Foradil
00173046400	Salmeterol 0.021 Mg/Actuat Inhalant Solution	Serevent
00173046500	Salmeterol 0.021 Mg/Actuat Inhalant Solution	Serevent
00173046600	Salmeterol 0.021 Mg/Actuat Inhalant Solution	Serevent
00173046700	Salmeterol 0.021 Mg/Actuat Inhalant Solution	Serevent
00173052000	28 Actuat Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Serevent
00173052100	60 Actuat Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Serevent
00173052200	Salmeterol 0.05 Mg/Actuat Inhalant Powder	Serevent Diskus
00173703000	Salmeterol 0.021 Mg/Actuat Inhalant Solution	Serevent
00247070213	Salmeterol 0.021 Mg/Actuat Inhalant Solution	Serevent
00247207260	60 Actuat Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Serevent
00597015528	28 Actuat Olodaterol 0.0025 Mg/Actuat / Tiotropium 0.0025 Mg/Actuat Inhalation Spray	Stiolto
00597015531	28 Actuat Olodaterol 0.0025 Mg/Actuat / Tiotropium 0.0025 Mg/Actuat Inhalation Spray	Stiolto
00597015561	60 Actuat Olodaterol 0.0025 Mg/Actuat / Tiotropium 0.0025 Mg/Actuat Inhalation Spray	Stiolto
00597015570	10 Actuat Olodaterol 0.0025 Mg/Actuat / Tiotropium 0.0025 Mg/Actuat Inhalation Spray	Stiolto
00597019228	28 Actuat Olodaterol 0.0025 Mg/Actuat Inhalation Spray	Striverdi
00597019231	28 Actuat Olodaterol 0.0025 Mg/Actuat Metered Dose Inhaler	Striverdi
00597019261	60 Actuat Olodaterol 0.0025 Mg/Actuat Inhalation Spray	Striverdi
11014070400	Arformoterol 0.0075 Mg/Ml Inhalant Solution	Brovana
11014070430	Arformoterol 0.0075 Mg/Ml Inhalant Solution	Brovana
11014070431	Arformoterol 0.0075 Mg/Ml Inhalant Solution	Brovana
11014070460	Arformoterol 0.0075 Mg/Ml Inhalant Solution	Brovana
12280017360	Salmeterol 0.05 Mg/Actuat Inhalant Powder	Serevent Diskus
17088003001	Formoterol Fumarate 0.012 Mg/Actuat Inhalant Powder	Foradil
49502060505	Formoterol Fumarate 0.01 Mg/Ml Inhalation Solution	Perforomist
49502060516	Formoterol Fumarate 0.01 Mg/Ml Inhalant Solution	Perforomist
49502060530	Formoterol Fumarate 0.01 Mg/Ml Inhalation Solution	Perforomist
49502060561	Formoterol Fumarate 0.01 Mg/Ml Inhalation Solution	Perforomist
49502060595	Formoterol Fumarate 0.01 Mg/Ml Inhalation Solution	Perforomist
49999030028	28 Actuat Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Serevent
51947841000	Salmeterol 0.05 Mg/Actuat Inhalant Powder	Serevent Diskus
51947841100	Salmeterol 0.05 Mg/Actuat Inhalant Powder	Serevent Diskus
51947841101	Salmeterol 0.05 Mg/Actuat Inhalant Powder	Serevent Diskus
51947841102	Salmeterol 0.05 Mg/Actuat Inhalant Powder	Serevent Diskus
51947841103	Salmeterol 0.05 Mg/Actuat Inhalant Powder	Serevent Diskus
54569385500	Salmeterol 0.021 Mg/Actuat Inhalant Solution	Serevent
54569486700	28 Actuat Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Serevent
54868370200	Salmeterol 0.021 Mg/Actuat Inhalant Solution	Serevent

Code	Description	Brand[b]
54868448100	60 Actuat Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Serevent
54868497200	Formoterol Fumarate 0.012 Mg Inhalation Powder	Foradil
54868497201	Formoterol Fumarate 0.012 Mg Inhalation Powder	Foradil
55045262502	Salmeterol 0.021 Mg/Actuat Inhalant Solution	Serevent
55154917501	Arformoterol 0.0075 Mg/Ml Inhalant Solution	Brovana
55154917502	Arformoterol 0.0075 Mg/Ml Inhalant Solution	Brovana
55154917503	Arformoterol 0.0075 Mg/Ml Inhalant Solution	Brovana
55154917504	Arformoterol 0.0075 Mg/Ml Inhalant Solution	Brovana
55154917506	Arformoterol 0.0075 Mg/Ml Inhalant Solution	Brovana
63402067501	Indacaterol 0.075 Mg Inhalation Powder	Arcapta
63402067502	Indacaterol 0.075 Mg Inhalation Powder	Arcapta
63402067506	Indacaterol 0.075 Mg Inhalation Powder	Arcapta
63402067530	Indacaterol 0.075 Mg Inhalation Powder	Arcapta
63402068101	Glycopyrrolate 0.0156 Mg / Indacaterol 0.0275 Mg Inhalation Powder	Utibron
63402068102	Glycopyrrolate 0.0156 Mg / Indacaterol 0.0275 Mg Inhalation Powder	Utibron
63402068106	Glycopyrrolate 0.0156 Mg / Indacaterol 0.0275 Mg Inhalation Powder	Utibron
63402068112	Glycopyrrolate 0.0156 Mg / Indacaterol 0.0275 Mg Inhalation Powder	Utibron
63402068160	Glycopyrrolate 0.0156 Mg / Indacaterol 0.0275 Mg Inhalation Powder	Utibron
63402091101	Arformoterol 0.0075 Mg/Ml Inhalation Solution	Brovana
63402091102	Arformoterol 0.0075 Mg/Ml Inhalation Solution	Brovana
63402091103	Arformoterol 0.0075 Mg/Ml Inhalation Solution	Brovana
63402091104	Arformoterol 0.0075 Mg/Ml Inhalation Solution	Brovana
63402091108	Arformoterol 0.0075 Mg/Ml Inhalation Solution	Brovana
63402091130	Arformoterol 0.0075 Mg/Ml Inhalation Solution	Brovana
63402091131	Arformoterol 0.0075 Mg/Ml Inhalation Solution	Brovana
63402091160	Arformoterol 0.0075 Mg/Ml Inhalant Solution	Brovana
63402091164	Arformoterol 0.0075 Mg/Ml Inhalation Solution	Brovana
68115065160	Formoterol 0.012 Mg/Actuat Inhalant Powder	Foradil
68258896106	60 Actuat Salmeterol 0.05 Mg/Actuat Dry Powder Inhaler	Serevent
LTRA		
00074803622	Zileuton 600 Mg Oral Tablet	Zyflo
00247189700	Zafirlukast 10 Mg Oral Tablet	Accolate
00247189730	Zafirlukast 10 Mg Oral Tablet	Accolate
00247189760	Zafirlukast 10 Mg Oral Tablet	Accolate
00247189777	Zafirlukast 10 Mg Oral Tablet	Accolate
00247189790	Zafirlukast 10 Mg Oral Tablet	Accolate
00247189800	Zafirlukast 20 Mg Oral Tablet	Accolate
00247189814	Zafirlukast 20 Mg Oral Tablet	Accolate
00247189830	Zafirlukast 20 Mg Oral Tablet	Accolate
00247189860	Zafirlukast 20 Mg Oral Tablet	Accolate
00247189877	Zafirlukast 20 Mg Oral Tablet	Accolate
00247189890	Zafirlukast 20 Mg Oral Tablet	Accolate
00310040139	Zafirlukast 10 Mg Oral Tablet	Accolate
00310040160	Zafirlukast 10 Mg Oral Tablet	Accolate
00310040239	Zafirlukast 20 Mg Oral Tablet	Accolate
00310040260	Zafirlukast 20 Mg Oral Tablet	Accolate

Code	Description	Brand[b]
00310041160	Zafirlukast 10 Mg Oral Tablet	Not available
00310041260	Zafirlukast 20 Mg Oral Tablet	Not available
00904664604	Zafirlukast 20 Mg Oral Tablet	Not available
10122090110	Zileuton 600 Mg Oral Tablet	Zyflo
10122090112	Zileuton 600 Mg Oral Tablet	Zyflo
10122090212	12 Hr Zileuton 600 Mg Extended Release Oral Tablet	Zyflo
10122090220	12 Hr Zileuton 600 Mg Extended Release Oral Tablet	Zyflo
24486090212	12 Hr Zileuton 600 Mg Extended Release Oral Tablet	Not available
26053036601	Zafirlukast 20 Mg Oral Tablet	Accolate
31722000701	Zafirlukast 10 Mg Oral Tablet	Not available
31722000705	Zafirlukast 10 Mg Oral Tablet	Not available
31722000760	Zafirlukast 10 Mg Oral Tablet	Not available
31722000801	Zafirlukast 20 Mg Oral Tablet	Not available
31722000805	Zafirlukast 20 Mg Oral Tablet	Not available
31722000860	Zafirlukast 20 Mg Oral Tablet	Not available
49884001002	Zafirlukast 10 Mg Oral Tablet	Accolate
49884001102	Zafirlukast 20 Mg Oral Tablet	Accolate
49884030302	Zafirlukast 10 Mg Oral Tablet	Not available
49884030402	Zafirlukast 20 Mg Oral Tablet	Not available
49884054902	Zafirlukast 10 Mg Oral Tablet	Not available
49884055402	Zafirlukast 20 Mg Oral Tablet	Not available
49884058902	Zafirlukast 10 Mg Oral Tablet	Accolate
49884059002	Zafirlukast 20 Mg Oral Tablet	Accolate
49884072308	12 Hr Zileuton 600 Mg Extended Release Oral Tablet	Not available
50268080511	Zafirlukast 20 Mg Oral Tablet	Not available
50268080512	Zafirlukast 20 Mg Oral Tablet	Not available
51129138001	Zileuton 600 Mg Oral Tablet	Zyflo
51129153701	Zafirlukast 20 Mg Oral Tablet	Accolate
53808020301	Zafirlukast 20 Mg Oral Tablet	Accolate
54569460401	Zafirlukast 20 Mg Oral Tablet	Accolate
54569632100	Zafirlukast 20 Mg Oral Tablet	Not available
54868417200	Zafirlukast 20 Mg Oral Tablet	Accolate
54868417201	Zafirlukast 20 Mg Oral Tablet	Accolate
54868417202	Zafirlukast 20 Mg Oral Tablet	Accolate
54921040102	Zafirlukast 10 Mg Oral Tablet	Accolate
54921040139	Zafirlukast 10 Mg Oral Tablet	Accolate
54921040160	Zafirlukast 10 Mg Oral Tablet	Accolate
54921040195	Zafirlukast 10 Mg Oral Tablet	Accolate
54921040202	Zafirlukast 20 Mg Oral Tablet	Accolate
54921040239	Zafirlukast 20 Mg Oral Tablet	Accolate
54921040260	Zafirlukast 20 Mg Oral Tablet	Accolate
54921040295	Zafirlukast 20 Mg Oral Tablet	Accolate
55111062501	Zafirlukast 10 Mg Oral Tablet	Not available
55111062505	Zafirlukast 10 Mg Oral Tablet	Not available
55111062530	Zafirlukast 10 Mg Oral Tablet	Not available
55111062560	Zafirlukast 10 Mg Oral Tablet	Not available

Code	Description	Brand[b]
55111062578	Zafirlukast 10 Mg Oral Tablet	Not available
55111062579	Zafirlukast 10 Mg Oral Tablet	Not available
55111062601	Zafirlukast 20 Mg Oral Tablet	Not available
55111062605	Zafirlukast 20 Mg Oral Tablet	Not available
55111062630	Zafirlukast 20 Mg Oral Tablet	Not available
55111062660	Zafirlukast 20 Mg Oral Tablet	Not available
55111062678	Zafirlukast 20 Mg Oral Tablet	Not available
55111062679	Zafirlukast 20 Mg Oral Tablet	Not available
55154690700	Zafirlukast 20 Mg Oral Tablet	Accolate
63629210201	Zafirlukast 10 Mg Oral Tablet	Not available
64380018801	Zafirlukast 20Mg/1 Oral Tablet, Coated	Not available
64980020612	12 Hr Zileuton 600 Mg Extended Release Oral Tablet	Not available
66105050106	Zafirlukast 10 Mg Oral Tablet	Accolate
66105050206	Zafirlukast 20 Mg Oral Tablet	Accolate
66267062210	Zileuton 600 Mg Oral Tablet	Zyflo
66267062220	Zileuton 600 Mg Oral Tablet	Zyflo
66267062230	Zileuton 600 Mg Oral Tablet	Zyflo
66267062240	Zileuton 600 Mg Oral Tablet	Zyflo
66267062260	Zileuton 600 Mg Oral Tablet	Zyflo
66336017630	Zafirlukast 10 Mg Oral Tablet	Not available
66993048532	12 Hr Zileuton 600 Mg Extended Release Oral Tablet	Not available
67651004402	12 Hr Zileuton 600 Mg Extended Release Tablet	Zyflo
67651004403	12 Hr Zileuton 600 Mg Extended Release Tablet	Zyflo
67651006202	12 Hr Zileuton 600 Mg Extended Release Tablet	Zyflo
67651006203	12 Hr Zileuton 600 Mg Extended Release Tablet	Zyflo
68084005911	Zafirlukast 20 Mg Oral Tablet	Not available
68084005921	Zafirlukast 20 Mg Oral Tablet	Not available
68115063860	Zafirlukast 20 Mg Oral Tablet	Accolate
68151197706	Zafirlukast 20 Mg Oral Tablet	Not available
68180016907	12 Hr Zileuton 600 Mg Extended Release Oral Tablet	Not available
68180016916	12 Hr Zileuton 600 Mg Extended Release Oral Tablet	Not available
68180016926	12 Hr Zileuton 600 Mg Extended Release Oral Tablet	Not available
68258895406	Zafirlukast 10 Mg Oral Tablet	Not available
68734070010	Zileuton 600 Mg Oral Tablet	Zyflo
68734070013	12 Hr Zileuton 600 Mg Extended Release Tablet	Zyflo
68734071010	12 Hr Zileuton 600 Mg Extended Release Tablet	Zyflo
68734071013	12 Hr Zileuton 600 Mg Extended Release Tablet	Zyflo
69189063801	Zafirlukast 20 Mg Oral Tablet	Not available
69339013012	12 Hr Zileuton 600 Mg Extended Release Oral Tablet	Not available
64380018701	Zafirlukast 10Mg/1 Oral Tablet, Coated	Not available

[a] Additional treatments may be included upon inspection of the dataset.
[b] Note codes with 'Not available' brands did not have a brand associated with the description

E. Medical codes used for defining covariates and outcomes – claims and EHR structured data[a]

Coding system and codes	Description
ICD-10-CM	***Diagnoses***
Comorbidities	
E11	Type 2 diabetes mellitus
E66	Overweight/obesity
I20-I25	Ischemic heart disease
K21	Reflux disease
L20-L30	Dermatitis/eczema
R05	Cough
R06.0	Dyspnea
R06.83	Snoring
Psychiatric disorders	
F10-F19	Mental and behavioral disorders due to psychoactive substance use
F20-F29	Psychotic disorders
F30-F39	Mood disorders (any)
F30, F31	Manic episode (F30) and bipolar disorder (F31)
F32	Major depression, single episode
F40-F48	Anxiety, dissociative, stress-related, somatoform and other nonpsychotic mental disorders (any)
F40	Phobic anxiety
F41	Generalized (F41.1) and other anxiety
F42, F60.5, R46.81	Obsessive-compulsive disorder and behavior
F60-F69	Disorders of adult personality and behavior
T14.91, X71-X83, Y21-Y33	Self-harm (including undetermined intent)
G47, F51	Sleep disorders (any)
G47.0, F51.0	Insomnia
G47.1, F51.1	Hypersomnia
G47.2	Circadian rhythm disorders
G47.3	Sleep apnea
G47.5, F51.3-F51.4	Parasomnias
G47.6, G25.81	Movement disorders, restless legs syndrome
Rhinitis	
J30	Vasomotor and allergic rhinitis
J30.0	Vasomotor rhinitis
J30.1	Allergic rhinitis due to pollen
J30.2	Other seasonal allergic rhinitis
J30.8	Other allergic rhinitis
J30.9	Allergic rhinitis, unspecified
J31	Chronic rhinitis
J32	Chronic sinusitis
Asthma severity	
J45	Asthma
J45.2	Mild intermittent asthma
J45.3	Mild persistent asthma
J45.4	Moderate persistent asthma
J45.5	Severe persistent asthma
J45.9	Other/unspecified asthma
RxNorm/RxCUI	***Regimens***
3498	Diphenhydramine
3638	Doxepin
4077	Estazolam
4501	Flurazepam
5553	Hydroxyzine
6711	Melatonin

6809	Metformin
8745	Promethazine
10355	Temazepam
10582	Levothyroxine
10737	Trazodone
10767	Triazolam
20610	Cetirizine
28889	Loratadine
39993	Zolpidem
40575	Zileuton
74667	Zaleplon
87636	Fexofenadine
88249	Montelukast
114970	Zafirlukast
461016	Eszopiclone
596205	Ramelteon
1424884	Vilanterol
1547099	Suvorexant
RxNorm/RxCUI	***Treatment classes (covariates and outcomes)***
AH000	Antihistamines
CN101	Opioid analgesics
CN300	Sedatives/hypnotics
CN600	Antidepressants
CN700	Antipsychotics
CV200	Calcium channel blockers
CV350	Antilipemic agents
CV800	Ace inhibitors
DE200	Anti-inflammatories, topical
GA900	Gastric medications, other (including medicines used to treat reflux disease)
HS051	Glucocorticoids
MS100	Antirheumatics
MS200	Muscle relaxants
NT100	Decongestants, nasal
NT200	Anti-inflammatories, nasal
NT400	Antihistamines, nasal
RE101	Anti-inflammatories, inhalation
RE102	Bronchodilators, inhalation
RE103	Bronchodilators, oral
RE104	Bronchodilators, xanthine-derivative
RE105	Bronchodilators, anticholinergic
RE200	Decongestants, systemic
RE300	Antitussives/expectorants

[a] Additional treatments, diagnosis, and procedures may be included upon inspection of the dataset.

F. Psychotherapy codes[a]

Code	Description
90810	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an office or outpatient facility, w20-30 min face-to-face with the patient
90811	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an office or outpatient
90812	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an office or outpatient facility, w45-50 min face-to-face with the patient
90813	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or
90814	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an office or outpatient facility, w75-80 min face-to-face with the patient
90815	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an office or outpatient facility, w75-80 min face-to-face
90823	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an inpatient hospital, partial hospital, or residential care setting, w20-30 min face-to-face with the patient
90824	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an inpatient hospital, partial hospital, or residential care setting, w20-30 min face-to-face with the patient; with medical evaluation and management services
90826	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an inpatient hospital, partial hospital, or residential care setting, w45-50 min face-to-face with the patient
90827	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an inpatient hospital, partial hospital, or residential care setting, w45-50 min face-to-face with the patient; with medical evaluation and management services
90828	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an inpatient hospital, partial hospital, or residential care setting, w75-80 min face-to-face with the patient
90829	Individual psychotherapy, interactive, using play equipment, physical devices, language interpreter, or other mechanisms of nonverbal communication, in an inpatient hospital, partial hospital, or residential care setting, w75-80 min face-to-face with the patient; with medical evaluation and management services
90832	Psychotherapy, 30 min with patient
90833	Psychotherapy, 30 min with patient when performed with an evaluation and management service (List separately in addition to the code for primary procedure)
90834	Psychotherapy, 45 min with patient
90836	Psychotherapy, 45 min with patient when performed with an evaluation and management service (List separately in addition to the code for primary procedure)
90837	Psychotherapy, 60 min with patient
90838	Psychotherapy, 60 min with patient when performed with an evaluation and management service (List separately in addition to the code for primary procedure)
90839	Psychotherapy for crisis; first 60 min
90840	Psychotherapy for crisis; each additional 30 min (List separately in addition to code for primary service)
90845	Psychoanalysis
90853	Group psychotherapy (other than of a multiple-family group)
90857	Interactive group psychotherapy
94.31	Psychoanalysis 94.32

94.37	Exploratory verbal psychotherapy 94.38
94.43	Psychodrama
94.44	Other group therapy

[a] Additional treatments, diagnosis, and procedures may be included upon inspection of the dataset.

G. List of medicines and generics by treatment class[a]

Generic Name	Brand Name
Asthma Drugs	
Short-Acting Beta Agonists (SABAs)	
albuterol	Proventil
albuterol	Albuterol
albuterol	Respirol
albuterol	Albuterol (refill)
albuterol	Proventil (Refill)
albuterol	Ventolin
albuterol	Ventolin Refill
albuterol sulfate	ProAir RespiClick
albuterol sulfate	Ventolin Rotacaps
albuterol sulfate	Ventolin Rotahaler/Rotacaps
albuterol sulfate	Ventolin HFA
albuterol sulfate	Albuterol sulfate
albuterol sulfate	ProAir HFA
albuterol sulfate	Proventil HFA
albuterol sulfate	Airet
albuterol sulfate	Ventolin
albuterol sulfate	Proventil
albuterol sulfate	AccuNeb
albuterol sulfate	Vospire ER
albuterol sulfate	Volmax
ipratropium bromide/albuterol sulfate	Combivent
ipratropium bromide/albuterol sulfate	Combivent Respimat
ipratropium bromide/albuterol sulfate	DuoNeb
ipratropium bromide/albuterol sulfate	Ipratropium-albuterol
levalbuterol HCl	Xopenex
levalbuterol HCl	Levalbuterol HCl
levalbuterol HCl	Xopenex Concentrate
levalbuterol tartrate	Xopenex HFA
levalbuterol tartrate	Levalbuterol tartrate
metaproterenol sulfate	Alupent
metaproterenol sulfate	Metaproterenol
pirbuterol acetate	Maxair
pirbuterol acetate	Maxair Autohaler

terbutaline sulfate	Brethaire
terbutaline sulfate	Brethine
terbutaline sulfate	Terbutaline
Anticholinergic agents	
tiotropium bromide	Spiriva with HandiHaler
tiotropium bromide	Spiriva Respimat
Phosphodiesterase Inhibitors	
aminophylline	Aminophylline
aminophylline/ephedrine/potassium iodide/phenobarbital	Dainite-KI
dyphylline	Dilor
dyphylline	Lufyllin
dyphylline	Dylix
guaifenesin/dyphylline	Lufyllin-GG
guaifenesin/dyphylline	Dyphylline-guaifenesin
guaifenesin/dyphylline	Dilor-G
guaifenesin/dyphylline	Panfil-G
guaifenesin/dyphylline	Dyline-GG
guaifenesin/dyphylline	D-G Liquid
guaifenesin/dyphylline	Dyphyl-G
guaifenesin/dyphylline	Dyphylline-GG
guaifenesin/dyphylline	DG 200
guaifenesin/dyphylline	COPD
guaifenesin/dyphylline	Difil-G 400
guaifenesin/dyphylline	Difil G Forte
guaifenesin/dyphylline	Dyflex-G
guaifenesin/dyphylline	Dyflex
guaifenesin/dyphylline	Bi-Filin G
guaifenesin/dyphylline	Difil-G
guaifenesin/dyphylline	Dyfilin-GG
guaifenesin/dyphylline	Dilex-G
guaifenesin/dyphylline	Dilex-G 200
guaifenesin/dyphylline	DILEX-G 400
guaifenesin/dyphylline	Dyphylline GG ES
guaifenesin/dyphylline	Jay-Phyl
guaifenesin/dyphylline	Bronkophylline GG
guaifenesin/dyphylline	Brondil
guaifenesin/dyphylline	Dy-G
guaifenesin/dyphylline	Dyphysin
guaifenesin/dyphylline/ephedrine/phenobarbital	Lufyllin-EPG
guaifenesin/theophylline	Slo-Phyllin GG
guaifenesin/theophylline	MYCI BRON-G
guaifenesin/theophylline	Elixophyllin GG

guaifenesin/theophylline	Theolate
guaifenesin/theophylline	Ed-Bron G
guaifenesin/theophylline	Theomar GG
guaifenesin/theophylline	Quibron
guaifenesin/theophylline	Quibron-300
guaifenesin/theophylline	Broncodur
guaifenesin/theophylline	Broncap
guaifenesin/theophylline anhydrous/pseudoephedrine	Broncomar-1
theophylline anhydrous	Uniphyl
theophylline anhydrous	T-Phyl
theophylline anhydrous	theophylline
theophylline anhydrous	Slo-Bid Gyrocaps
theophylline anhydrous	Slo-Phyllin
theophylline anhydrous	Slo-Phyllin 80
theophylline anhydrous	Theo-Dur
theophylline anhydrous	Uni-Dur
theophylline anhydrous	Theo-X
theophylline anhydrous	Theolair
theophylline anhydrous	Theolair-SR
theophylline anhydrous	Aerolate Jr
theophylline anhydrous	Aerolate Sr
theophylline anhydrous	Aerolate III TD
theophylline anhydrous	Elixophyllin
theophylline anhydrous	TheoCap
theophylline anhydrous	Theochron
theophylline anhydrous	Truxophyllin
theophylline anhydrous	Theo-24
theophylline anhydrous	Quibron-T
theophylline anhydrous	Quibron-T/SR
theophylline in dextrose 5 % in water	theophylline in dextrose 5 %
theophylline/caffeine/AA no.13/cinnamon/herbal 135	Pulmophylline-Pulmona
theophylline/dietary supplement,misc.comb.no.9	Senophylline
theophylline/ephedrine HCl/phenobarbital	theophylline-ephed-phenobarb
theophylline/ephedrine HCl/phenobarbital	Asthma
theophylline/ephedrine/potassium iodide/phenobarbital	Quadrinal
theophylline/potassium iodide	Elixophyllin-KI
Psychiatric and Psychotropic Drugs	
Attention-deficit/hyperactivity disorder	
methylphenidate HCl	Metadate CD
methylphenidate HCl	Metadate ER

methylphenidate HCl	Methylin
methylphenidate HCl	Methylin ER
methylphenidate HCl	Methylphenidate HCl
methylphenidate HCl	QuilliChew ER
methylphenidate HCl	Quillivant XR
methylphenidate HCl	Relexxii
methylphenidate HCl	Ritalin
methylphenidate HCl	Ritalin LA
methylphenidate HCl	Ritalin SR
pemoline	Cylert
pemoline	Pemoline
Antidepressants	
amitriptyline HCl	Elavil
amitriptyline HCl	Amitriptyline
amitriptyline HCl	Vanatrip
amitriptyline HCl	EnovaRx-Amitriptyline
amitriptyline HCl/chlordiazepoxide	Amitriptyline-chlordiazepoxide
amitriptyline HCl/chlordiazepoxide	Limbitrol
amitriptyline HCl/chlordiazepoxide	Limbitrol DS
amoxapine	Amoxapine
bupropion HBr	Aplenzin
bupropion HCl	Budeprion SR
bupropion HCl	Budeprion XL
bupropion HCl	Buproban
bupropion HCl	Bupropion HCl
bupropion HCl	Bupropion HCl (smoking deter)
bupropion HCl	Forfivo XL
bupropion HCl	Wellbutrin
bupropion HCl	Wellbutrin SR
bupropion HCl	Wellbutrin XL
bupropion HCl	Zyban
bupropion HCl/dietary supplement combination no.15	Appbutamone-D
bupropion HCl/dietary supplement combination no.16	Appbutamone
citalopram hydrobromide	Celexa
citalopram hydrobromide	Citalopram
clomipramine HCl	Anafranil
clomipramine HCl	Clomipramine
desipramine HCl	Desipramine
desipramine HCl	Norpramin
desvenlafaxine	Desvenlafaxine
desvenlafaxine	Khedezla

desvenlafaxine fumarate	Desvenlafaxine fumarate
desvenlafaxine succinate	Desvenlafaxine succinate
desvenlafaxine succinate	Pristiq
doxepin HCl	Doxepin
doxepin HCl	Silenor
doxepin HCl	Sinequan
doxepin HCl	Prudoxin
doxepin HCl	Zonalon
duloxetine HCl	Cymbalta
duloxetine HCl	Duloxetine
duloxetine HCl	Irenka
escitalopram oxalate	escitalopram oxalate
escitalopram oxalate	Lexapro
fluoxetine HCl	Fluoxetine
fluoxetine HCl	Prozac
fluoxetine HCl	Prozac Weekly
fluoxetine HCl	Rapiflux
fluoxetine HCl	Sarafem
fluoxetine HCl	Selfemra
fluoxetine HCl/dietary supplement no.17	Gaboxetine
fluoxetine HCl/dietary supplement no.8	Sentroxatine
fluvoxamine maleate	Fluvoxamine
fluvoxamine maleate	Luvox
fluvoxamine maleate	Luvox CR
imipramine HCl	Imipramine HCl
imipramine HCl	Tofranil
imipramine pamoate	Imipramine pamoate
imipramine pamoate	Tofranil-PM
isocarboxazid	Marplan
levomilnacipran HCl	Fetzima
maprotiline HCl	Ludiomil
maprotiline HCl	Maprotiline
mirtazapine	Mirtazapine
mirtazapine	Remeron
mirtazapine	Remeron SolTab
naltrexone HCl/bupropion HCl	Contrave
nefazodone HCl	Nefazodone
nefazodone HCl	Serzone
nortriptyline HCl	Aventyl
nortriptyline HCl	Nortriptyline
nortriptyline HCl	Pamelor
olanzapine/fluoxetine HCl	Olanzapine-fluoxetine

olanzapine/fluoxetine HCl	Symbyax
paroxetine HCl	Paroxetine HCl
paroxetine HCl	Paxil
paroxetine HCl	Paxil CR
paroxetine mesylate	Brisdelle
paroxetine mesylate	Paroxetine mesylate(menop.sym)
paroxetine mesylate	Pexeva
perphenazine/amitriptyline HCl	Duo-Vil 2-10
perphenazine/amitriptyline HCl	Duo-Vil 2-25
perphenazine/amitriptyline HCl	Etrafon 2-10
perphenazine/amitriptyline HCl	Etrafon 2-25
perphenazine/amitriptyline HCl	Etrafon Forte 4-25
perphenazine/amitriptyline HCl	Perphenazine-amitriptyline
perphenazine/amitriptyline HCl	Triavil 2-10
perphenazine/amitriptyline HCl	Triavil 2-25
perphenazine/amitriptyline HCl	Triavil 4-25
phenelzine sulfate	Nardil
phenelzine sulfate	Phenelzine
selegiline	Emsam
selegiline HCl	Carbex
selegiline HCl	Eldepryl
selegiline HCl	Selegiline HCl
selegiline HCl	Zelapar
chlorpromazine HCl	Chlorpromazine
chlorpromazine HCl	Thorazine
clonazepam	Ceberclon
clonazepam	Clonazepam
clonazepam	Klonopin
clozapine	Clozapine
clozapine	Clozaril
clozapine	FazaClo
clozapine	Versacloz
divalproex sodium	Depakote
divalproex sodium	Depakote ER
divalproex sodium	Depakote Sprinkles
divalproex sodium	Divalproex
fluphenazine decanoate	Fluphenazine decanoate
fluphenazine decanoate	Prolixin Decanoate
fluphenazine enanthate	Prolixin
fluphenazine HCl	Fluphenazine HCl
fluphenazine HCl	Prolixin
fluphenazine HCl	Permitil

haloperidol	Haloperidol
haloperidol decanoate	Haldol Decanoate
haloperidol decanoate	Haloperidol decanoate
haloperidol lactate	Haldol
haloperidol lactate	Haloperidol lactate
iloperidone	Fanapt
lamotrigine	Lamictal
lamotrigine	Lamictal ODT
lamotrigine	Lamictal ODT Starter (Blue)
lamotrigine	Lamictal ODT Starter (Green)
lamotrigine	Lamictal ODT Starter (Orange)
lamotrigine	Lamictal Starter (Blue) Kit
lamotrigine	Lamictal Starter (Green) Kit
lamotrigine	Lamictal Starter (Orange) Kit
lamotrigine	Lamictal XR
lamotrigine	Lamictal XR Starter (Blue)
lamotrigine	Lamictal XR Starter (Green)
lamotrigine	Lamictal XR Starter (Orange)
lamotrigine	Lamotrigine
lamotrigine	Subvenite
lamotrigine	Subvenite Starter (Blue) Kit
lamotrigine	Subvenite Starter (Green) Kit
lamotrigine	Subvenite Starter (Orange) Kit
lithium carbonate	Eskalith
lithium carbonate	Eskalith CR
lithium carbonate	Lithium carbonate
lithium carbonate	Lithobid
lithium citrate	Lithium citrate
loxapine	Adasuve
loxapine HCl	Loxitane
loxapine HCl	Loxitane-C
loxapine succinate	Loxapine succinate
loxapine succinate	Loxitane
lurasidone HCl	Latuda
mesoridazine besylate	Serentil
molindone HCl	Moban
molindone HCl	Molindone
olanzapine	Olanzapine
olanzapine	Zyprexa
olanzapine	Zyprexa Zydis
olanzapine pamoate	Zyprexa Relprevv
oxcarbazepine	Oxcarbazepine

oxcarbazepine	Oxtellar XR
oxcarbazepine	Trileptal
paliperidone	Invega
paliperidone	Paliperidone
paliperidone palmitate	Invega Sustenna
paliperidone palmitate	Invega Trinza
perphenazine	Trilafon
perphenazine	Perphenazine
pimozide	Orap
pimozide	Pimozide
quetiapine fumarate	Quetiapine
quetiapine fumarate	Seroquel
quetiapine fumarate	Seroquel XR
risperidone	Perseris
risperidone	Risperdal
risperidone	Risperdal M-TAB
risperidone	Risperidone
risperidone microspheres	Risperdal Consta
thioridazine HCl	Mellaril
thioridazine HCl	Mellaril-S
thioridazine HCl	Thioridazine
thiothixene	Navane
thiothixene	Thiothixene
thiothixene HCl	Navane
thiothixene HCl	Thiothixene HCl
trifluoperazine HCl	Stelazine
trifluoperazine HCl	Trifluoperazine
valproic acid	Depakene
valproic acid	Stavzor
valproic acid	Valproic acid
valproic acid (as sodium salt) (valproate sodium)	Depacon
valproic acid (as sodium salt) (valproate sodium)	Valproate sodium
valproic acid (as sodium salt) (valproate sodium)	Depakene
valproic acid (as sodium salt) (valproate sodium)	Valproic acid (as sodium salt)
ziprasidone HCl	Geodon
ziprasidone HCl	Ziprasidone HCl
ziprasidone mesylate	Geodon
ziprasidone HCl	Ziprasidone HCl
ziprasidone mesylate	Geodon
Anxiety agents	
alprazolam	Alprazolam
alprazolam	Alprazolam Intensol

alprazolam	Niravam
alprazolam	Xanax
alprazolam	Xanax XR
alprazolam/dietary supplement,misc combo no.17	Gabazolamine
aspirin/meprobamate	Equagesic
aspirin/meprobamate	Meprobamate-aspirin
aspirin/meprobamate	Micrainin
buspirone HCl	BuSpar
buspirone HCl	Buspirone
buspirone HCl	Vanspar
chlordiazepoxide HCl	Librium
chlordiazepoxide HCl	Chlordiazepoxide HCl
chlordiazepoxide HCl	Poxi
chlordiazepoxide HCl/methscopolamine nitrate	Librax (with methscopolamine)
chlordiazepoxide/clidinium bromide	Chlordiazepoxide-clidinium
chlordiazepoxide/clidinium bromide	Librax (with clidinium)
clorazepate dipotassium	Clorazepate dipotassium
clorazepate dipotassium	Gen-XENE
clorazepate dipotassium	Tranxene-SD
clorazepate dipotassium	Tranxene T-Tab
diazepam	Diazepam
diazepam	Valium
diazepam	Diazepam Intensol
diazepam	Diastat
diazepam	Diastat AcuDial
diazepam	Diastat Pediatric
diazepam	Diastat Universal
diazepam (in soybean oil)	Dizac
droperidol	Droperidol
droperidol	Inapsine
halazepam	Paxipam
lorazepam	Ativan
lorazepam	Lorazepam
lorazepam	Lorazepam Intensol
lorazepam in 0.9 % sodium chloride	Lorazepam in 0.9% sod chloride
lorazepam in 5 % dextrose and water	Lorazepam in dextrose 5 %
meprobamate	Equanil
meprobamate	MB-Tab
meprobamate	Meprobamate
meprobamate	Miltown
oxazepam	Oxazepam
oxazepam	Serax
Sedative hypnotics	
amobarbital sodium/secobarbital sodium	Tuinal
butabarbital sodium	Butisol
chloral hydrate	Chloral hydrate

chloral hydrate	Somnote
chloral hydrate	Aquachloral
estazolam	Estazolam
estazolam	Prosom
eszopiclone	Eszopiclone
eszopiclone	Lunesta
ethchlorvynol	Placidyl
flurazepam HCl	Dalmane
flurazepam HCl	Flurazepam
mephobarbital	Mebaral
mephobarbital	Mephobarbital
pentobarbital sodium	Nembutal Sodium
pentobarbital sodium	Pentobarbital sodium
pentobarbital sodium	Nembutal
quazepam	Doral
quazepam	Quazepam
ramelteon	Rozerem
secobarbital sodium	Seconal
secobarbital sodium	Seconal Sodium
suvorexant	Belsomra
temazepam	Restoril
temazepam	Temazepam
temazepam/dietary supplement no.8	Strazepam
triazolam	Halcion
amobarbital sodium/secobarbital sodium	Tuinal
butabarbital sodium	Butisol
chloral hydrate	Chloral hydrate
chloral hydrate	Somnote
chloral hydrate	Aquachloral
estazolam	Estazolam
estazolam	Prosom
eszopiclone	Eszopiclone
eszopiclone	Lunesta
ethchlorvynol	Placidyl
flurazepam HCl	Dalmane
flurazepam HCl	Flurazepam
mephobarbital	Mebaral
mephobarbital	Mephobarbital
pentobarbital sodium	Nembutal Sodium
pentobarbital sodium	Pentobarbital sodium
pentobarbital sodium	Nembutal
quazepam	Doral
quazepam	Quazepam
ramelteon	Rozerem
secobarbital sodium	Seconal
secobarbital sodium	Seconal Sodium

suvorexant	Belsomra
temazepam	Restoril
temazepam	Temazepam
temazepam/dietary supplement no.8	Strazepam
triazolam	Halcion
triazolam	Triazolam
zaleplon	Sonata
zaleplon	Zaleplon
zolpidem tartrate	Ambien
zolpidem tartrate	Ambien CR
zolpidem tartrate	AMBIEN PAK
zolpidem tartrate	Zolpidem
zolpidem tartrate	Zolpimist
zolpidem tartrate	Edluar
zolpidem tartrate	Intermezzo

[a] Additional treatments may be included upon inspection of the dataset.