Supplementary Materials

Supplementary Appendix (see separate file): Details on the characterization of different criteria included in this study

Supplementary Methods. Additional details on cohort construction, definitions of specific criteria, and statistical analysis plan.

Supplementary Table S1: Classification of potentially problematic medication use for overaggressive treatment of hypertension (i.e., average systolic blood pressure <110 during enhanced face to face interview and on certain antihypertensives without clear alternative reason)

Supplementary Table S2: Classification of strongly anticholinergic medication use based on the 2019 Beers criteria Table 7

Supplementary Table S3: Classification of sedative-hypnotic medications based on previous studies and the Sedative Load Model

Supplementary Table S4: Criteria that were excluded in a sensitivity analysis to compare persons with and without dementia based on only those criteria that were the same in each groups

Supplementary Table S5: Number of individuals classified as having dementia by year

Supplementary Table S6: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and across the different domains in the primary cohort matched on age, sex, comorbidity count, and year of assessment

Supplementary Table S7: Number and survey weighted percentage of persons with diabetes and hypertension who met criteria for over-aggressive treatment of these conditions in the primary cohort matched on age, sex, comorbidity count, and year of assessment

Supplementary Table S8: Baseline characteristics of community-dwelling older adults with and without dementia enrolled in the Health and Retirement Study from 2008-2018 in the cohort matched only on year of assessment

Supplementary Table S9: Baseline characteristics of community-dwelling older adults with and without dementia enrolled in the Health and Retirement Study from 2008-2018 in the fully matched cohort

Supplementary Table S10: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and across the different domains in the cohort matched only on year of assessment

Supplementary Table S11: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and across the different domains in the fully matched cohort

Supplementary Table S12: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and across the different domains using propensity score matching and inverse probability of treatment weighting

Supplementary Table S13: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and across the different domains in the primary matched cohort including and excluding criteria that are specific to individuals with dementia

Supplementary Table S14: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and in the medication overuse domain in the primary matched cohort and a separate matched cohort in which the non-dementia controls were not preferentially selected based on presence of enhanced face to face interview

Supplementary Table S15: Results from the index of local sensitivity to nonignorability (ISNI) method for the linear regression model for systolic blood pressure and hemoglobin A1c

Supplementary Table S16: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and in the overaggressive treatment of chronic conditions sub-domain for the primary cohort comparing methods using multiple imputation (MI) (primary analysis) and the index of local sensitivity to nonignorability (ISNI) (sensitivity analysis)

Supplementary Figure S1: Example outline of cohort entry and timing of medication assessment for an individual enrolled in the Health and Retirement study

Supplementary Figure S2: Flow chart of individuals aged 66 years and older with and without dementia in the Health and Retirement Study from 2008-2018 included in this study

Supplementary Figure S3: Distribution of the number of potentially problematic medications identified across all criteria among persons with and without dementia in the primary matched cohort

Supplementary Figure S4: Histograms representing the distribution of systolic blood pressure and hemoglobin A1c values under the different methods, including index of local sensitivity to nonignorability (ISNI), multiple imputation, and non-missing observed data

Supplementary Methods

Cohort construction:

Supplementary Figure S1 shows the flow chart used to identify individuals included in the study. We identified persons with dementia (PWD) based on a previously validated algorithm developed by Hurd et al.¹ This algorithm was developed using data from the Aging,

Demographics, and Memory Study (ADAMS), a sub-study from the 2000 and 2002 waves of the Health and Retirement Study (HRS) in which a random sample of participants aged 70 years and older underwent full neuropsychological evaluations.² An ordered probit model was developed using predictors such as age, sex, education, cognitive test results, and physical functioning to classify individuals in subsequent HRS waves as having dementia. We used a predicted dementia probability >0.5 with this algorithm to classify individuals as having probable dementia. This algorithm has been shown to have good accuracy in validation studies.³

Once an individual was classified as having dementia at a specific HRS interview wave, that individual was then classified as having dementia for all subsequent interview waves. For individuals classified as having dementia with only one interview wave available, we used this interview wave as the index date to obtain medication information in the previous year. For individuals with multiple HRS interview waves having a classification of dementia, we randomly selected one of their interview waves to use as the index interview wave for which all medication information was obtained in the year prior. We prioritized the waves in which the individual was selected for the enhanced face to face interview as this would allow us to collect information on their hemoglobin A1c, cystatin C, and systolic blood pressure if the patient had these measured.

An individual could have been in the control pool during earlier HRS interview waves (probability of dementia using the Hurd algorithm <0.5 indicating no classification of dementia)

before later having a classification of dementia during a later wave (dementia probability >0.5 indicating classification of dementia). Once the individual had a classification of dementia at an HRS interview wave, they were no longer eligible for the control pool in subsequent years. For example, an individual who was interviewed in 2008 and 2010 and not classified as having dementia would be included in the control pool for those time points but would be included in the dementia pool if they were classified as having dementia at the 2012 HRS interview wave.

After applying our inclusion and exclusion criteria, a total of 9,844 distinct individuals were ultimately eligible. From this cohort, 1,475 distinct individuals were classified as having dementia at least once during the study period based on the dementia classification algorithm. There were 9,199 individuals who were ultimately included in the control pool (individuals without classification of dementia). The sum of these numbers (1,475 + 9,199 = 10,674) is greater than 9,844 as some individuals were included first in the control cohort and later in the dementia cohort.

Classification of medication overuse

We identified individuals for the over-aggressive treatment of hypertension criterion based on an average systolic blood pressure <110 with a prescription for certain antihypertensives. We applied a series of exclusion criteria to ensure they did not have an alternative indication for an antihypertensive even with an average systolic blood pressure <110. This may occur for individuals with heart failure with reduced ejection fraction on a beta-blocker, angiotensin converting enzyme inhibitor, or spironolactone. This may also occur for individuals with atrial fibrillation on a beta blocker which is used for rate control rather than blood pressure. Therefore, we checked if individuals had certain combinations of comorbidities prior to them being flagged as receiving a potentially problematic medication in the setting of

average systolic blood pressure <110. We first excluded alpha-1 blockers such as doxazosin, prazosin, and terazosin and loop diuretics since these medications are often not used explicitly for hypertension (i.e., commonly used for benign prostatic hyperplasia, posttraumatic stress disorder, and edema in the setting of chronic kidney disease or heart failure). We then split individuals into 8 mutually exclusive groups based on the presence of 1) cardiac conditions, 2) arrhythmias, and 3) chronic kidney disease or diabetes. We used the Clinical Classifications Software (CCS) to map International Classification of Diseases (ICD)-9 and -10 codes onto categories of conditions. Cardiac conditions were defined as a diagnosis code for essentially any heart condition other than essential hypertension. This was to be as conservative as possible when flagging a medication as potentially problematic based on this criteria. This included ICD9 CCS 7.1.2 (HTN with complications), 7.2 (disease of the heart) except for 7.2.9 (cardiac dysrhythmias), CCS procedure codes 7.2, 7.3 and ICD10 CCS CIR001-CIR006, CIR008-CIR016, CIR018-CIR019 (excludes CIR007 = essential hypertension and CIR017 = cardiac dysrhythmias). Arrhythmias were generally defined as atrial fibrillation, atrial flutter, or supraventricular tachycardia using diagnosis codes ICD 9 427.0, 427.3 or ICD10 I47.1, I48*. Chronic kidney disease and diabetes were defined using diagnosis codes ICD 9 CCS 3.2 & 3.3 (diabetes), 10.1.3, 10.1.2.2 (chronic renal failure) and ICD10 CCS END 002-END006 (diabetes), GEN003 (chronic kidney disease).

Finally, we characterized potentially problematic medication use based on the presence or absence of these diagnosis codes. The 8 mutually exclusive groups are shown in Supplementary Table S1 where 1 = condition present based on diagnosis codes and 0 = absent based on diagnosis codes. The bullet points list the medications that were considered potentially inappropriate for each group.

If an individual who met the criteria for over-aggressive treatment of hypertension or diabetes was on multiple antihypertensive or antidiabetic agents, we ultimately decided to randomly flag one of the medications. For example, an individual with an average systolic blood pressure of 105 who was on metoprolol, amlodipine, and hydrochlorothiazide without any other identifiable diagnosis codes that would indicate these medications may be potentially appropriate, we would randomly select one of these medications as indicative of over-aggressive treatment of hypertension. We did this because we felt it would be unfair to identify all 3 medications as potentially problematic. Similarly, for an individual with diabetes who had a hemoglobin A1c of 7.0% and was on insulin and glipizide, we randomly flagged one of these medications as potentially problematic.

We recognize that this classification system is not perfect, and some medications identified as potentially problematic may be reasonable choices based on individual circumstances. We also did not factor in dose modifications for medications like insulin in the setting of hemoglobin A1c <7.5%. However, our aim was to identify medications often considered overused and frequently represent high-value candidates to consider for discontinuation.

Classification of medications that negatively affect cognition

Medications classified as those that negatively affect cognition included strongly anticholinergics and sedative-hypnotics. Strongly anticholinergic medications included those in Table 7 of the 2019 Beers criteria as shown in Supplementary Table S2.⁴ Multiple tools have been developed for classifying medications based on anticholinergic burden, such as the Anticholinergic Cognitive Burden (ACB) scale and Anticholinergic Risk Scale (ARS).⁵ We ultimately settled on the medications listed in Table 7 of the 2019 Beers criteria as this represents

common medications with strong anticholinergic properties. These included various antidepressants, antiemetics, antihistamines, antimuscarinics, antiparkinsonian agents, antipsychotics, antispasmodics, and skeletal muscle relaxants. While these medications overlap with the 2019 Beers criteria sub-domain, we ensured that each medication was only flagged once when computing the overall results for frequency and mean.

Medications classified as sedative-hypnotics are shown in Supplementary Table S3.

There are comparatively fewer sedative burden scales with the most prominent being the Sedative Load Model (SLM).^{6,7} This model classifies drugs into no, low, moderate, or high sedative potency based on clinical expertise. Based on the SLM and in line with a previous study of polypharmacy among older adults with and without dementia, we included medications such as benzodiazepines, nonbenzodiazepine hypnotics, selected antiepileptic drugs, selected antipsychotics, selected antihistamines, and doxepin.⁸

Classification of medications to avoid based on specific criteria

Operationalizing the 2019 American Geriatrics Society Beers criteria and Screening Tool of Older Persons' Prescriptions (STOPP) Version 2 criteria using only claims data can often be challenging. Previous attempts have been made to apply the STOPP Version 2 criteria using only electronic health record data. ^{9,10} While we generally followed the guidance from this multidisciplinary consensus procedure, we chose a more conservative approach. For example, we excluded criteria such as avoiding "Amiodarone as first-line antiarrhythmic therapy in supraventricular tachyarrhythmias" or "Beta-blockers in diabetes mellitus with frequent hypoglycemic episodes." These criteria could be operationalized based on the absence of prescriptions of first-line antiarrhythmics in the year prior (e.g., beta-blockers) or the presence of

diagnosis code for hypoglycemia. However, we felt that this would not be a fair representation of inappropriate medication use in the absence of additional clinical information.

Overlapping medication criteria

A few criteria involved flagging medications as potentially problematic if they were used in combination (e.g., overlapping use of benzodiazepines and opioids). For these criteria, for each medication prescription we looked at the prescription fill day and days supply to specify a date range for when the medication may be in use. We recognize that this is not perfect as individuals may fill a medication but not take it for several weeks after that. However, this is a limitation inherent in pharmacoepidemiology research using prescription fill information. For the medications in question (e.g., benzodiazepine and opioid), we flagged them as using in combination if the date ranges for the individual medications overlapped for at least 7 days. We chose a 7 day overlap period as some of these medications may only be prescribed for short courses or for as needed use (e.g., 1 time prescription for 1 pill of lorazepam prior to a flight or MRI scan).

Chronic medication criteria

We operationalized a few criteria based on chronic use which was variably defined (e.g., proton pump inhibitor use for >8 weeks, non-steroidal anti-inflammatory drug (NSAID) use for >3 months or NSAID use for >1 month with a diagnosis code of heart failure). The definitions of chronic medication use varied slightly. For example, to ascertain that an individual was on a medication for >8 weeks, we required 2 consecutive fills in the past year that were filled within 30 days of each other with at least 28 days per fill. We also included a single fill with a day supply greater than 8 weeks (i.e., >56 days).

Chronic kidney disease criteria

Several criteria involved identifying potentially problematic medications based on an individual's creatinine clearance (CrCl). For example, both the 2019 Beers and STOPP Version 2 criteria have sections on medications that should be avoided in chronic kidney disease (CKD). The 2019 Beers criteria recommends avoiding duloxetine if CrCl <30 and reducing the dose of gabapentin if CrCl <60. We included most criteria that recommending avoiding medications based on a CrCl cut-off and excluded those that recommended reducing the dose as these were challenging to operationalize.

To ascertain an individual's kidney function for these criteria, we looked at both diagnosis codes for CKD and an individual's cystatin C if available from the enhanced face to face interview. The CKD diagnosis codes are all based on estimated glomerular filtration rate (eGFR) cut-offs. Similarly, cystatin C allows for the calculation of eGFR. While CrCl and eGFR are not equivalent, for our purpose, we considered them roughly similar. We used the CKD-Epi cystatin C formula to convert the cystatin C values available to an eGFR as follows: eGFR = 133 x min(Scys/0.8, 1)-0.499 x max (Scys/0.8, 1)-1.328 x 0.996Age x 0.932 [if female] where eGFR = mL/min/1.73 m2, Scys (standardized serum cystatin C) = mg/l, min = indicates the minimum of Scys/0.8 or 1, max = indicates the maximum of Scys/0.8 or 1, and age = years.

Methods to handle missing data

For the sub-domain of over-aggressive treatment of diabetes and hypertension, many individuals did not have an available hemoglobin A1c (HbA1c) or systolic blood pressure (SBP) measured. These values were collected during the enhanced face to face interview in the Health and Retirement Study. Among the 1,441 individuals without dementia in the primary matched cohort, 1,441 (100%) had a SBP measured and 1,074 (75%) had a HbA1c measured. Among the 1,441 individuals with dementia in the primary matched cohort, 538 (37%) had a SBP measured

and 381 (26%) had a HbA1c measured. Given that the control pool of persons without dementia was larger and we prioritized individuals who had an enhanced face to face interview, we were able to identify a higher percentage of persons without dementia who had an available SBP or HbA1c measured.

Due to the amount of missingness in SBP and HbA1c, ignoring the missing measures would lead to cohort selection bias and sample size reduction, reducing the study power and skewing the results for the sub-domain of over-aggressive treatment of diabetes and hypertension. To handle the missing data, we applied the multiple imputation (MI) method to fill in the missing SBP and A1c. We also conducted a sensitivity analysis using the index of local sensitivity to nonignorability (ISNI) (see sensitivity analysis section below).

Multiple Imputation

For the primary analysis, we used multiple imputation to create 10 complete datasets. The missing SBP and HbA1c were drawn from the two conditional distributions, where

$$\mathrm{SBP}\:|X_1,\:X_2,\:\:\dots\dots,\:X_{22}\:\:\sim\:\mathbb{N}\:(\mu_1,\:\sigma_1^2),$$

$$\mathsf{HbA1c} \mid X_1, \, X_2, \, \, \dots \dots, \, X_{22} \, \sim \mathbb{N} \, (\mu_2, \, \sigma_2^2).$$

 X_1, X_2, \dots, X_{22} are the covariates listed in Supplementary Table S15. After the imputing step, we linked the 10 imputed datasets to an individual's medications and identified the overuse medication cases across all 10 datasets. Then we produced the mean, frequency of overuse, odds ratio, and incidence rate ratio for dementia vs non-dementia groups through a pooling step where we combined the parameter estimate and standard error from each imputed dataset for the final inference. MI is highly precise and efficient. The random draw for the missing data from the conditional distribution produces unbiased estimates. The pooling step captures the missing data

uncertainty and sampling variation, rendering high coverage probability for the parameter estimation. ¹¹ We used the SAS PROC MI procedure to conduct the multiple imputation. Sensitivity analyses

We performed several sensitivity analyses to examine the robustness of our findings. First, we created 2 additional matched cohorts: first matched only on year of assessment and another matched on several additional factors. For the first cohort, we 1:1 matched individuals with a classification of dementia to those without a classification of dementia based only on their year of assessment. In the second cohort, we 1:1 matched individuals with and without dementia by year of assessment, age, sex, comorbidity count, race/ethnicity, education, marital status, lives alone, Medicaid eligibility, body mass index, smoking status, region of country, hospitalization or emergency department visit in the past year, outpatient visits in the past year, activities of daily living (ADL) difficulty score, and instrumental ADL (IADL) difficulty score.

Second, we used inverse probability of treatment weighting (IPTW) instead of propensity score matching to calculate the results in the primary cohort. IPTW involves comparing individuals with and without dementia in the sample weighted by the inverse probability of treatment (where in this case "treatment" indicates the presence of dementia). IPTW uses the entire cohort, and each individual is assigned a weight based on the likelihood that they have dementia.

Third, we considered alternative ways of including certain criteria that were either 1) different between individuals with and without dementia or 2) only apply to individuals with dementia since this would lead to a higher number of flagged medications in those with dementia (Supplementary Table S4). For example, STOPP Version 2 D1 which advises to stop tricyclic antidepressants with dementia, narrow angle glaucoma, cardiac conduction abnormalities,

prostatism, or prior history of urinary retention would apply to everyone in the dementia cohort and only those with the certain medical conditions in the non-dementia cohort. Similarly, STOPP Version 2 D9 which recommends stopping antipsychotics in patients with behavioral and psychological symptoms of dementia would only apply to individuals with dementia. Including these criteria could create an unfair comparison between those with and without dementia. In our primary analysis for the overall mean number of flagged medications and percentage of individuals with at least 1 flagged medication, we excluded these criteria to avoid this unfair comparison. As a sensitivity analysis, we included these criteria when calculating the overall measure to see how our results changed. In our primary analysis for the individual domains (e.g., medications to avoid based on specific criteria such as 2019 Beers/STOPP Version 2), we included these criteria that were specific to individuals with dementia. As a sensitivity analysis, we excluded these criteria when calculating the individual domain measures.

Fourth, we repeated an analysis in which the non-dementia cohort was not preferentially selected based on the presence of an enhanced face-to-face (EFTF) interview. In 2006, HRS initiated EFTF interviews which included additional measures such as physical performance tests and blood samples. At each HRS interview wave, half of the sample is assigned an EFTF interview. This alternates every wave such that the EFTF interview is available every 4 years at the individual level. When constructing the control pool involving individuals without dementia, we decided to preferentially select individuals who had an EFTF interview. We did this so that we could maximize the number of people with an available hemoglobin A1c, systolic blood pressure, and cystatin C to ascertain information on potentially problematic medication use in the medication overuse domain. While assignment to an EFTF interview is random and alternates every other HRS interview wave, individuals who complete the EFTF interview (with blood

draw and SBP measured) may differ than those who do not (e.g., if they declined the EFTF interview when given the opportunity). Therefore, we repeated the analysis in which the control pool (individuals without dementia) was not preferentially selected based on the presence of an EFTF interview.

Fifth, we conducted an index of local sensitivity to nonignorability (ISNI) sensitivity analysis as explained below to assess the robustness of the multiple imputation procedure.

ISNI Sensitivity Analysis

a. Rationale

While MI is one of the most common and widely used missing data methods, its validity is built upon one key assumption: ignorability. That is, the missing data mechanism (MDM) follows the missing at random (MAR) assumption; the parameters for the observed data (θ) and missing data (φ) are distinct.¹² The missing data follows the MAR assumption if the probability of missingness only depends upon the observed variables.¹³ When ignorability holds, we can directly draw inferences from the observed data without modeling the MDM. In our study, we assumed the missing SBP and HbA1c were MAR and implemented the MI method for the analyses. The MAR assumption is usually unverifiable. When the MDM pivots from MAR to missing not at random (MNAR), the probability of missingness is related to both observed and unobserved data, and the MI method is no longer robust as it produces biased parameter estimation.¹¹ Therefore, incorrectly assuming MAR can negatively impact the research results, and it is important to conduct a sensitivity analysis that compares the estimates and inference results once the missing mechanism departs from MAR to MNAR.

b. Theoretical outline

The ISNI method is a principled sensitivity index method that evaluates the reliability of the analysis under the MAR assumption. When the missingness is MNAR, the missing mechanism can no longer be ignored. That is, one must model the observed and missing data jointly to draw valid and robust parameter estimates and inferences. Nevertheless, fitting a nonignorable missing data model is both conceptually and computationally challenging. Moreover, it was not in our primary interest to model the missingness. On the other hand, the ISNI method provides a fast-implemented easy-to-use method that requires fitting no nonignorable models. Starting with the MAR model, ISNI measures the deviation of the parameter estimates when the MDM changes from MAR to MNAR. A general ISNI sensitivity method outline works like this:

- 1. Let G_i be the missing indicator for the outcome Y_i . G_i =1(0) if Y_i is missing (or observed). We model the missing indicator (MDM) via a selection model, where G is conditional on both observed and unobserved outcomes (Y^{obs} , Y^{mis}). The probability density function (PDF) for G |Y is denoted as $f_{\gamma}^{G|Y}(g|y)$.
- 2. We introduce the parameter, γ , for modeling the MDM. γ is broken down as γ_0 and γ_1 , where γ_0 , γ_1 reflect the effects on the probability of missingness from the fully observed Y^{obs} and potentially unobserved Y^{mis} . Therefore, the PDF is denoted as $f_{\gamma_0,\gamma_1}^{G|\gamma}(g|y^{obs},y^{mis})$. Since we often model the observed outcomes with a set of covariates ($Y^{obs}=X\beta$) for the MAR model, γ_0 can also refer to the set of coefficients for the fully observed covariates for missingness.
- 3. For example, we model $G|Y^{obs}$, Y^{mis} via a logistic regression model, which is specified as follows:

$$\ln \left(\frac{P(G_i=1)}{1-P(G_i=1)} \right) = \gamma_0 X + \gamma_1 Y_i^{mis}.$$

Here γ_1 is referred to as a nonignorable parameter. When γ_1 =0, the missing probability does not depend on the missing outcome hence the model reduces to ignorable missingness (MAR model); when $\gamma_1 \neq 0$, the missing probability depends upon the missing outcome hence the missingness is nonignorable (MNAR model).

4. When the missingness is nonignorable, one must model the joint likelihood for both observed data and the missing data. As aforementioned, θ denotes the parameter governing the complete observed data. Therefore, the joint log-likelihood function is specified as

$$L(\theta,\,\gamma_0,\,\gamma_1;\,y^{obs},g\,) = \ln\int_{\Omega_{\gamma mis}} f_{\theta}^{\,Y}\big(y^{obs},\,y^{mis}\big) f_{\gamma_0,\,\gamma_1}^{\,G\,|\,Y}\big(g\,\big|\,y^{obs},\,y^{mis}\big) dy^{mis}$$

5. ISNI measures the rate of change from $\hat{\theta}(\gamma_1)$ to the MAR estimator $\hat{\theta}(\gamma_1=0)$. To identify the optimal value of θ , we take the derivative of the jointly log likelihood function with respect to θ , resulting in a function of θ and γ_1 . ISNI in calculation is defined as the derivative $\frac{\partial \hat{\theta}(\gamma_1)}{\partial \gamma_1}$ evaluated at $\gamma_1=0$, which measures the rate of deviation in $\hat{\theta}(\gamma_1)$ from the standard MAR estimate $\hat{\theta}(0)$. The mathematical expression for ISNI is

$$ISNI = \frac{\partial \widehat{\theta}(\gamma_1)}{\partial \gamma_1} = -\nabla^2 L_{\theta,\theta}^{-1} \nabla^2 L_{\theta,\gamma_1},$$

Where $\nabla^2 L_{\theta,\theta} = \frac{\partial^2 L(\theta, \gamma_0, \gamma_1)}{\partial \theta \partial \theta^T} = \frac{\partial^2 f_{\theta}(y^{obs})}{\partial \theta \partial \theta^T}|_{\widehat{\theta}(0),\widehat{\gamma_0}(0),\gamma_1=0}$ represents the Fisher's

information, the inverse variance-covariance matrix of the MAR estimate $\hat{\theta}(0)$;

 $\nabla^2 L_{\theta,\gamma_1} = \frac{\partial^2 L(\theta,\gamma_0,\gamma_1)}{\partial \theta \partial \gamma_1} \big|_{\widehat{\theta}(0),\widehat{\gamma_0}(0),\gamma_1=0} \text{ represents the level of nonorthogonality of } \theta \text{ and } \gamma_1$ and can be evaluated by the readily available MAR estimates } \widehat{\theta}(0) \text{ and } \widehat{\gamma_0}(0).

When applying the ISNI method for the sensitivity analysis, we impose a plausible range of values for γ_1 which allows the ignorable model (MAR) to pivot to nonignorable model (MNAR), and examine the extent of the change in $\hat{\theta}(\gamma_1)$. For example, when $\gamma_1 = 1$, $ISNI \approx \hat{\theta}(1) - \hat{\theta}(0)$, where $\hat{\theta}(0)$ is the maximum likelihood estimator (MLE) from the MAR estimate. In general, we impose $\gamma_1 = \pm 1$ to allow the model to pivot locally in the nonignorable direction.

6. When γ₁ ≠ 0, we can approximate the parameter estimate as θ̂(γ₁) ≈ θ̂(0) + ISNI · γ₁. Although ISNI measures the rate of change in parameter estimate when the model pivots from MAR to MNAR, it does not infer the level of significance for the parameter change. To gauge whether a change in the MLE estimate is significant, we define the index 'minimum degree of nonignorability', MinNI (also previously known as c index in Troxel 2004),¹⁴ specified as

$$MinNI = \left| \frac{\sigma_Y SE}{ISNI} \right|$$

where σ_Y is the standard deviation of the observed outcome, and SE is the standard error of $\hat{\theta}(0)$. We consider a one-SE change in the MAR estimate to be significant ($\hat{\theta}(\gamma_1) = \hat{\theta}(0) + SE_{\theta}$). Given the parameter approximation under nonignorable model, $\frac{ISNI}{SE_{\theta}} = 1$. The ratio > 1 would indicate that the estimate is highly subject to nonignorable missingness.

Recall the selection model in step 3, $\gamma_1 = 1$ indicates that one unit increase in y is associated with a 2.7-fold (e^1) increase in odds of being missing. This interpretation is valid when the outcome is categorical or count; however, when y is a continuous variable and has different scale, such as SBP reading or HbA1c, one unit increase in SBP or HbA1c has the same increase

in the odds of being missing but, SBP and HbA1c had different range values, and a slight change in y relative to its entire range can be associated with a substantial change in the probability of missingness. Therefore, instead of one-unit change in y, we consider one standard deviation (σ_Y) increase in y is associated with 2.7-fold odds increase. That is, we vary γ_1 from $-\frac{1}{\sigma_Y}$ to $\frac{1}{\sigma_Y}$, and examine the parameter estimate $\hat{\theta}(0) \pm ISNI \cdot \frac{1}{\sigma_Y}$. Furthermore, we proposed the MinNI that quantify the level of σ_Y . That is, a change of 1/MinNI standard deviation of y is associated in the increase odds of 2.7 for being missing. Therefore,

$$ISNI \cdot \frac{MinNI}{\sigma_Y} / SE_{\theta} = 1 \rightarrow MinNI = \left| \frac{\sigma_Y SE_{\theta}}{ISNI} \right|$$

MinNI is scale independent. A small MinNI means modest nonignorable missingness could lead to sensitivity; a large MinNI means only extreme level of nonignorability could it induce the sensitivity. Troxel (2004) suggested that using MinNI<1 as threshold for nonignorable sensitivity.¹⁴

c. Application

Assuming MAR, we fit two linear regression models for SBP and HbA1c. With the moderate amount of missing data, we conducted sensitivity analysis that two logistic regression models were adopted the missing model, specified as

$$\ln \frac{P(G_i = 1)}{1 - P(G_i = 1)} = (X_1 + X_2 + \dots, X_{22})_i^T \gamma_0 + \gamma_1 \cdot SBP;$$

$$\ln \frac{P(G_i = 1)}{1 - P(G_i = 1)} = (X_1 + X_2 + \dots, X_{22})_i^T \gamma_0 + \gamma_1 \cdot HbA1c.$$

We used the R package "isni" to conduct the sensitivity analysis. Columns "MAR Est." and "Std. Error" in Supplementary Table S15 represent the regression coefficient estimates and standard errors, respectively. The results suggest that age, male, smoking status, education level,

hospitalization, South region, arthritis, cancer, heart disease, hypertension, lung disease were significant predictors for SBP; male, race, living status, college and above education, >1 hospitalization, >1 ER visits, heart disease, and diabetes were significant predictors for HbA1c. Baseline SBP (intercept), activities of daily living (ADL) dependencies, instrumental activities of daily living (IADL) dependencies, and college and above level of education were all sensitive to nonignorable missingness, as the MinNI values were less than 1. Under the MAR model, controlling for all other variables, the baseline SBP (intercept) was 95.27. However, when the missingness pivots to MNAR, the baseline SBP should be adjusted upwards by 95.27 + 222.74/19.72=106.57 (19.72 is the standard deviation of SBP). Therefore, the MAR model underestimated the true intercept (based on the observable values) compared to the estimate from the nonignorable selection model. One unit increase in ADL/IADL dependency would decrease SBP by 0.26 and 0.18 using the MAR model. Under the nonignorable model, both estimates were adjusted upwards by 5.56/1.17 and 8.19/0.95. Hence, one unit increase in ADL/IADL dependency would increase SBP by 4.51 (-0.26 +5.56/1.17) and 8.43 (-0.18+8.19/0.95). Moreover, patients with college and above level of education in comparison to less than high school education should have on average a SBP that is 2.86 lower, and the nonignorable model further adjusts it downwards by 11.62. On the other hand, no MinNI value was less than one in the HbA1c selection model.

Comparing the results of MI and ISNI

We used the ISNI adjusted coefficient estimates to predict the missing SBP and HbA1c. Then we compared the ISNI predicted results to multiple imputed results. Supplementary Figure S3 demonstrates the histograms of the SBP and HbA1c under ISNI predicted, multiple imputed (10 datasets), and non-missing observed data.

The SBP and HbA1c values under the three methods overlapped. The ISNI predicted SBP tended to overestimate the true value of SBP (mean SBP was shifted to the right). However, it was still within the range of multiple imputed values. Therefore, despite the nonignorable parameters, the SBP outcomes showed similar distribution under the two methods.

As shown in Supplementary Table S16, results for the percentage of individuals with at least 1 problematic medication and mean number of problematic medications per person in the "over-aggressive treatment of chronic condition domain" were comparable between the MI and ISNI analyses. No significant differences in IRR and OR were found between the matched cohorts of persons with dementia and persons without dementia. The overall medication results were also similar between the MI and ISNI analyses. This provided evidence that the MI results were robust for the analysis.

Supplementary Table S1: Classification of potentially problematic medication use for over-aggressive treatment of hypertension (i.e., average systolic blood pressure <110 during enhanced face to face interview and on certain antihypertensives without clear alternative reason)

Mutually exclusive groups ^a	Potentially problematic medication
1. Heart condition = $1 + SVT = 0 + CKD = 0^b$	Aliskiren Antiadrenergic antihypertensives (excluding doxazosin, prazosin, terazosin) Vasodilators (excluding isosorbide-hydralazine combination) Thiazide and thiazide-like diuretics
2. Heart condition = $0 + SVT = 1 + CKD = 0$	CCBs other than verapamil/diltiazem ACEi ARB Aliskiren Antiadrenergic antihypertensives (excluding doxazosin, prazosin, terazosin) Eplerenone Potassium sparing diuretics Vasodilators Thiazide and thiazide-like diuretics Nitrates
3. Heart condition = $0 + SVT = 0 + CKD = 1$	Beta-blockers CCBs Aliskiren Antiadrenergic antihypertensives (excluding doxazosin, prazosin, terazosin) Eplerenone Potassium sparing diuretics Vasodilators Thiazide and thiazide-like diuretics Nitrates
4. Heart condition = 1 + SVT = 1 + CKD = 0	Aliskiren Antiadrenergic antihypertensives (excluding doxazosin, prazosin, terazosin) Vasodilators (excluding isosorbide-hydralazine combination) Thiazide and thiazide-like diuretics
5. Heart condition = $1 + SVT = 0 + CKD = 1$	Aliskiren Antiadrenergic antihypertensives (excluding doxazosin, prazosin, terazosin) Vasodilators (excluding isosorbide-hydralazine combination) Thiazide and thiazide-like diuretics
6. Heart condition = 0 + SVT = 1 + CKD = 1	CCBs other than verapamil/diltiazem Aliskiren Antiadrenergic antihypertensives (excluding doxazosin, prazosin, terazosin) Eplerenone Potassium sparing diuretics

	Vasodilators
	Thiazide and thiazide-like diuretics
	Nitrates
7. Heart condition = $1 + SVT = 1 + CKD = 1$	Aliskiren
	Antiadrenergic antihypertensives (excluding
	doxazosin, prazosin, terazosin)
	Vasodilators (excluding isosorbide-hydralazine
	combination)
	Thiazide and thiazide-like diuretics
8. Heart condition = $0 + SVT = 0 + CKD = 0$	Beta-blockers
	CCBs
	ACEi
	ARB
	Aliskiren
	Antiadrenergic antihypertensives (excluding
	doxazosin, prazosin, terazosin)
	Eplerenone
	Vasodilators
	Potassium sparing diuretics
	Thiazide and thiazide-like diuretics
	Nitrates

Abbreviations: ACEi, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; CCB, calcium channel blocker; CKD, chronic kidney disease; SVT, supraventricular tachycardia

a Mutually exclusive groups were created as the medications that were considered eligible to be flagged as potentially problematic varied based on diagnosis codes. The number "1" indicates that the condition was present based on diagnosis codes, and the number "0" indicates that the condition was absent based on diagnosis codes.

b See the supplementary methods for definitions of these conditions. For example, "heart conditions" were defined as a diagnosis code for essentially any heart condition other than essential hypertension. This was to be as conservative as possible when flagging a medication as potentially problematic based on this criteria. This included ICD9 CCS 7.1.2 (HTN with complications), 7.2 (disease of the heart) except for 7.2.9 (cardiac dysrhythmias), CCS procedure codes 7.2, 7.3 and ICD10 CCS CIR001-CIR006, CIR008-CIR016, CIR018-CIR019 (excludes CIR007 = essential hypertension and CIR017 = cardiac dysrhythmias).

Supplementary Table S2: Classification of strongly anticholinergic medication use based on the 2019 Beers criteria Table 7

Medication class	Individual medications
Antiarrhythmics	disopyramide
Antidepressants	amitriptyline, amoxapine, clomipramine, desipramine, doxepin, imipramine, nortriptyline, paroxetine, protriptyline, and trimipramine
Antiemetics	prochlorperazine, promethazine
Antihistamines (first generation)	brompheniramine, carbinoxamine, chlorpheniramine, clemastine, cyproheptadine, dexbrompheniramine, dexchlorpheniramine, dimenhydrinate, diphenhydramine (oral), doxylamine, hydroxyzine, meclizine, clidinium-chlordiazepoxide, dicyclomine, homatropine (excludes ophthalmic), methscopolamine, propantheline, promethazine, pyrilamine, triprolidine
Antimuscarinics (urinary	darifenacin, fesoterodine, flavoxate, oxybutynin, solifenacin, tolterodine, and
incontinence)	trospium
Antiparkinsonian agents	benztropine, trihexyphenidyl
Antipsychotics	chlorpromazine, clozapine, loxapine, olanzapine, perphenazine, thioridazine, trifluoperazine
Antispasmodics	atropine, belladonna alkaloids, scopolamine (excluded ophthalmic)
Skeletal muscle relaxants	cyclobenzaprine, orphenadrine

Supplementary Table S3: Classification of sedative-hypnotic medications based on previous studies and the Sedative Load Model

Medication class	Individual medications
Benzodiazepines	Alprazolam, chlordiazepoxide, clorazepate, diazepam,
	halazepam, lorazepam, oxazepam, prazepam, clobazam,
	clonazepam, midazolam, estazolam, flurazepam,
	quazepam, remimazolam, remazepam, triazolam
Nonbenzodiazepine sedative hypnotics	Zolpidem, zaleplon, eszopiclone
Selected antiepileptic drugs	Phenobarbital, gabapentin, pregabalin
Selected antipsychotics	All first generation antipsychotics, quetiapine,
	olanzapine, and clozapine
Selected antihistamines	Promethazine and diphenhydramine
Additional antidepressant	doxepin

Supplementary Table S4: List of criteria that were either different between individuals with and without dementia or only applied to individuals with dementia

Criteria that are o	different between individuals with and without dementia
STOPP-V2 D1	Stop tricyclic antidepressants (TCAs) with dementia, narrow angle glaucoma, cardiac conduction abnormalities, prostatism, or prior history of urinary retention (risk of worsening these conditions).
STOPP-V2 I1	Stop antimuscarinic drugs with dementia, or chronic cognitive impairment (risk of increased confusion, agitation) or narrow-angle glaucoma (risk of acute exacerbation of glaucoma), or chronic prostatism (risk of urinary retention).
Criteria that only	apply to individuals with dementia
STOPP-V2 D8	Stop anticholinergics/antimuscarinics in patients with delirium or dementia (risk of exacerbation of cognitive impairment).
STOPP-V2 D9	Stop neuroleptic antipsychotic in patients with behavioral and psychological symptoms of dementia (BPSD) unless symptoms are severe and other non-pharmacological treatments have failed (increased risk of stroke).
STOPP-V2 D11	Stop acetylcholinesterase inhibitors with a known history of persistent bradycardia (< 60 beats/min.), heart block or recurrent unexplained syncope or concurrent treatment with drugs that reduce heart rate such as beta-blockers, digoxin, diltiazem, verapamil (risk of cardiac conduction failure, syncope and injury)
STOPPFrail memantine	Memantine: Discontinue and monitor in patients with moderate to severe dementia, unless memantine has clearly improved BPSD.
2019 Beers cholinesterase inhibitors in syncope	Acetylcholinesterase inhibitors cause bradycardia and should be avoided in older adults whose syncope may be due to bradycardia

Abbreviations: STOPP-V2, Screening Tool of Older Persons' Prescriptions Version 2; STOPPFrail, Screening Tool of Older Persons' Prescriptions in Frail adults with a limited life expectancy

Supplementary Table S5: Number of individuals with a dementia classification in the Health and Retirement Study by interview wave year and overall

Year of interview	Total number of individuals interviewed at specific wave	Number with classification of dementia in the specific wave	Percentage of individuals with classification of dementia in specific wave
2008	5,078	364	7.2%
2010	5,145	358	7.0%
2012	5,250	382	7.3%
2014	5,752	418	7.3%
2016	5,784	445	7.7%
2018	4,912	354	7.2%
Overall	9,844	1,475	15.0%

Supplementary Table S6: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and across the different domains in the primary cohort matched on age, sex, comorbidity count, and year of assessment

Medication domain	Outcome measures	Persons with dementia $(N = 1,441)$	Persons without dementia (N = 1,441)	OR or IRR (95% CI)
Overall	% with ≥1 flagged med	73%	67%	OR=1.34 (1.12, 1.62) (p=0.002)
Overall	Mean number of flagged medications	2.09	1.62	IRR=1.29 (1.17, 1.42) (p<0.001)
Medication overuse	2			
Over- aggressive treatment of	% with ≥1 flagged med	17%	14%	OR=1.25 (0.98, 1.60) (p=0.07)
chronic conditions	Mean number of flagged medications	0.18	0.15	IRR=1.21 (0.98, 1.50) (p=0.08)
Medications inappropriate	% with ≥1 flagged med	4%	2%	OR = 1.78 (1.10, 2.86) (p = 0.02)
near end of life (STOPPFrail)	Mean number of flagged medications	0.06	0.04	IRR = 1.59 (0.96, 2.63) (p = 0.07)
Medication misuse				
Medications that negatively	% with ≥1 flagged med	41%	30%	OR = 1.59 $(1.33, 1.89)$ $(p < 0.001)$
affect cognition	Mean number of flagged medications	0.61	0.42	IRR = 1.45 (1.26, 1.67) (p < 0.001)
2019 Beers	% with ≥1 flagged med	60%	51%	OR = 1.45 (1.23, 1.72) (p < 0.001)
criteria	Mean number of flagged medications	1.53	1.06	IRR = 1.44 (1.28, 1.63) (p < 0.001)
STOPP	% with ≥1 flagged med	66%	53%	OR = 1.69 (1.42, 2.00) (p < 0.001)
Version 2 criteria	Mean number of flagged medications	1.32	0.96	IRR = 1.37 (1.24, 1.51) (p < 0.001)

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; OR, odds ratio; STOPP, Screening Tool of Older Persons' Prescriptions; STOPPFrail, Screening Tool of Older Persons' Prescriptions in Frail adults with a limited life expectancy

Supplementary Table S7: Number and survey weighted percentage of persons with diabetes and hypertension who met criteria for over-aggressive treatment of these conditions in the primary cohort matched on age, sex, comorbidity count, and year of assessment

	Persons with dementia (n=1,441)	Persons without dementia (n=1,441)
	Number (survey we	eighted percentage)
Individuals with diabetes ^a	504 (32.6%)	444 (30.2%)
Individuals with diabetes with hemoglobin A1c <7.5% and on insulin/sulfonylurea ^b	203 (39.9%)	179 (39.0%)
Individuals with hypertension ^c	1,178 (79.1%)	1,194 (81.6%)
Individuals with hypertension with an average systolic blood pressure <110 and on qualifying potentially problematic antihypertensive ^d	72 (5.8%)	47 (3.8%)

a We identified individuals with diabetes through either International Classification of Diseases (ICD)-9 or ICD-10 diagnoses codes for Type 2 diabetes (250.00, 250.02, 250.10, 250.12, 250.20, 250.22, 250.30, 250.32, 250.40, 250.42, 250.50, 250.52, 250.60, 250.62, 250.70, 250.72, 250.80, 250.82, 250.90, 250.92, E11*) or prescription for any antidiabetic drug in the year prior to the interview date.

b Among individuals with diabetes, we identified individuals with a hemoglobin A1c<7.5% who were also receiving insulin/sulfonylurea. The numbers presented were averaged over the 10 imputed datasets. The number and percentage reported here answers the question "among individuals with diabetes, how many were receiving over-aggressive treatment for their diabetes?" The denominator for this calculation is the number of individuals with diabetes which is different than what is presented in Table 3 and Figure 1 where the denominator is the whole cohort (n=1,441).

c We identified individuals with hypertension through either self-report during the enhanced face to face interview or prescription for antihypertensives in the year prior to the interview date. While certain antihypertensives can be used for multiple indications (e.g., metoprolol for atrial fibrillation rather than hypertension), our numbers align with other national survey data in an older population where the prevalence of hypertension is in the range of 80%.

d Among individuals with hypertension, we identified individuals with an average systolic blood pressure <110 who were also receiving potentially problematic antihypertensives. This was operationalized in the same way as done in Table 3 and Figure 1 (see supplementary methods; for example, an individual who was on metoprolol with SBP <110 and diagnosis code for atrial fibrillation would not be included here). The numbers presented were averaged over the 10 imputed datasets. The number and percentage reported here answers the question "among individuals with hypertension, how many were receiving overaggressive treatment for their hypertension?" The denominator for this calculation is different than what is presented in Table 3 and Figure 1 where the denominator is the whole cohort (n=1,441).

Supplementary Table S8: Baseline characteristics of community-dwelling older adults with and without dementia enrolled in the Health and Retirement Study from 2008-2018 in the cohort matched only on year of assessment

	Individuals with dementia $(n = 1, 475)$	Individuals without dementia (n = 12,492) ^a	
Characteristic	Number (weighted %)	Number (weighted %)	SMD
Age in years, median (IQR)	83.9 (78.3-89.3)	73.6 (69.3-79.4)	0.02
Female sex	976 (66.9%)	7815 (60.5%)	-0.13
Race/Ethnicity			0.32
Non-Hispanic White	892 (69.0%)	9322 (82.1%)	
Non-Hispanic Black	303 (14.7%)	1624 (7.6%)	
Hispanic	250 (14.1%)	1300 (8.0%)	
Other	30 (2.2%)	246 (2.3%)	
Marital status (%)			-0.42
Married or partnered	7081 (57.4%)	556 (36.7%)	
Single or widowed	5411 (42.6%)	919 (63.3%)	
Lives alone (%)	3824 (32.3%)	464 (34.9%)	0.05
Comorbidities			
Cancer	350 (23.3%)	2583 (21.1%)	0.05
Diabetes	492 (30.7%)	3500 (27.6%)	0.07
Heart disease	659 (44.5%)	4257 (34.1%)	0.21
Hypertension	1130 (74.7%)	8910 (69.1%)	0.13
Lung disease	221 (16.6%)	1601 (12.8%)	0.11
Stroke	402 (26.6%)	1380 (10.6%)	0.42
Median (IQR) number of IADL dependencies (range 0-5)	1.8 (0-3.7)	0 (0-0)	0.02
Median (IQR) number of ADL dependencies (range 0-6)	0.8 (0-3.2)	0 (0-0)	0.02
Number of medications (median, IQR)	8.0 (4.6-12.3)	7.6 (4.4-12.0)	0.0007
Polypharmacy (≥5 medications)	1010 (77.8%)	1192 (80.1%)	0.06

Abbreviations: ADL, activities of daily living; IADL, instrumental activities of daily living; IQR, interquartile range; SMD, standardized mean difference

a A single individual without dementia could be counted multiple times if they participated in multiple interviews during their enrollment in the Health and Retirement Study.

Supplementary Table S9: Baseline characteristics of community-dwelling older adults with and without dementia enrolled in the Health and Retirement Study from 2008-2018 in the fully matched cohort^a

	Individuals with dementia	Individuals without dementia	
	(n = 971)	(n = 971)	
Characteristic	Number (weighted %)	Number (weighted %)	SMD
Age in years, median (IQR)	82.3 (75.9-87.8)	82.2 (76.3-87.3)	-0.0005
Female sex	639 (65.2%)	639 (65.7%)	0.01
Race/Ethnicity			0.09
Non-Hispanic White	604 (70.0%)	617 (72.5%)	
Non-Hispanic Black	186 (13.8%)	169 (11.3%)	
Hispanic	159 (13.9%)	165-170 (~14.0%) ^b	
Other	22 (2.4%)	<25 (<3%) ^b	
Marital status (%)			-0.008
Married or partnered	404 (41.0%)	427 (41.4%)	
Single or widowed	567 (59.0%)	544 (58.6%)	
Lives alone (%)	320 (35.3%)	324 (38.0%)	-0.05
Comorbidities			
Cancer	233 (23.3%)	203 (21.5%)	0.04
Diabetes	331 (31.2%)	281 (26.9%)	0.10
Heart disease	411 (42.1%)	425 (43.4%)	-0.03
Hypertension	736 (72.9%)	728 (73.0%)	-0.001
Lung disease	141 (16.3%)	154 (16.0%)	0.008
Stroke	236 (24.0%)	177 (18.0%)	0.15
Median (IQR) number of IADL dependencies (range 0-5)	0.6 (0-2.0)	0.6 (0-1.8)	0.0003
Median (IQR) number of ADL dependencies (range 0-6)	0 (0-1.8)	0.05 (0-1.8)	0.001
Number of medications (median, IQR)	6.4 (3.9-9.9)	6.8 (4.1-10.6)	-0.002
Polypharmacy (≥5 medications)	731 (74.0%)	755 (75.6%)	-0.04

Abbreviations: ADL, activities of daily living; IADL, instrumental activities of daily living; IQR, interquartile range; SMD, standardized mean difference

a In the fully matched cohort, we 1:1 matched individuals with and without dementia by year of assessment, age, sex, comorbidity count, race/ethnicity, education, marital status, lives alone, Medicaid eligibility, body mass index, smoking status, region of country, hospitalization or emergency department visit in the past year, outpatient visits in the past year, activities of daily living (ADL) difficulty score, and instrumental ADL (IADL) difficulty score.

b Results are presented in this manner due to the Centers for Medicare and Medicaid Services (CMS) cell suppression size policy which sets the minimum threshold for the display of CMS data. This was necessary as the "Other" category involved <25 individuals.

Supplementary Table S10: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and across the different domains in the cohort matched only on year of assessment

Medication domain	Outcome measures	Persons with dementia (N = 1,475)	Persons without dementia (N = 12,492) ^a	OR or IRR (95% CI)
Overall	% with ≥1 flagged med	73%	67%	OR=1.31 (1.14, 1.51) (p<0.001)
Overali	Mean	2.08	1.66	IRR=1.25 (1.18, 1.35) (p<0.001)
Medication overuse				
Over-aggressive treatment of	% with ≥1 flagged med	17%	14%	OR=1.28 (1.06, 1.55) (p=0.010)
chronic conditions	Mean	0.18	0.15	IRR=1.22 (1.04, 1.44) (p=0.017)
Medications	% with ≥1 flagged med	4%	2%	OR=2.89 (2.09, 4.00) (p<0.001)
inappropriate near end of life	Mean	0.07	0.02	IRR=2.68 (1.91, 3.76) (p<0.001)
Medication misuse				,
Medications that negatively	% with ≥1 flagged med	40%	31%	OR = 1.53 (1.35, 1.74) (p<0.001)
affect cognition	Mean	0.61	0.43	IRR = 1.41 (1.27, 1.56) (p<0.001)
2019 Beers criteria	% with ≥1 flagged med	60%	56%	OR = 1.18 (1.04, 1.34) (p = 0.01)
	Mean	1.54	1.26	IRR = 1.26 (1.15, 1.38) (p<0.001)
STOPP Version	% with ≥1 flagged med	66%	50%	OR = 1.89 (1.66, 2.16) (p < 0.001)
2 criteria	Mean	1.31	0.88	IRR = 1.49 (1.39, 1.60) (p < 0.001)

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; OR, odds ratio; STOPP, Screening Tool of Older Persons Prescriptions

a A single individual without dementia could be interviews during their enrollment in the Health	counted multiple times if they were included in multiple and Retirement Study.

Supplementary Table S11: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and across the different domains in the fully matched cohort^a

Medication domain	Outcome measures	Persons with dementia (N = 971)	Persons without dementia (N = 971)	OR or IRR (95% CI)					
Overall	% with ≥1 flagged med	73%	71%	OR=1.11 (0.88, 1.40) (p=0.37)					
	Mean	2.09	2.04	IRR=1.02 (0.91, 1.15) (p=0.72)					
Medication overuse									
Over- aggressive treatment of chronic conditions	% with ≥1 flagged med	18%	17%	OR=1.33 (0.98, 1.80) (p=0.07)					
	Mean	0.18	0.14	IRR=1.282 (0.994, 1.654) (p=0.06)					
Medications inappropriate near end of life	% with ≥1 flagged med	4%	3%	OR = 1.17 (0.69, 1.98) (p = 0.57)					
	Mean	0.06	0.05	IRR = 1.16 (0.69, 1.95) (p = 0.58)					
Medication misuse									
Medications that negatively affect cognition	% with ≥1 flagged med	39%	32%	OR = 1.36 (1.10, 1.68) (p =0.005)					
	Mean	0.59	0.46	IRR = 1.28 (1.07, 1.52) (p =0.006)					
2019 Beers criteria	% with ≥1 flagged med	59%	60%	OR = 1.01 $(0.81, 1.24)$ $(p = 0.96)$					
	Mean	1.51	1.47	IRR = 1.04 (0.90, 1.21) (p = 0.61)					
STOPP Version 2 criteria	% with ≥1 flagged med	65%	59%	OR = 1.31 (1.06, 1.62) (p =0.001)					
	Mean	1.33	1.18	IRR = 1.14 (1.01, 1.28) (p =0.004)					

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; OR, odds ratio; STOPP, Screening Tool of Older Persons Prescriptions

a In the fully matched cohort, we 1:1 matched individuals with and without dementia by year of assessment, age, sex, comorbidity count, race/ethnicity, education, marital status, lives alone, Medicaid eligibility, body mass index, smoking status, region of country, hospitalization or emergency department visit in the past year, outpatient visits in the past year, activities of daily living (ADL) difficulty score, and instrumental ADL (IADL) difficulty score.

Supplementary Table S12: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and across the different domains using propensity score matching and inverse probability of treatment weighting

		Primary cohort matched on year of assessment, age, sex, and comorbidity count			IPTW cohort			
Medication domain	Outcome measures	Persons with dementia (N = 1,441)	Persons without dementia (N = 1,441)	OR or IRR (95% CI)	Persons with dementia (N = 1,475)	Persons without dementia (N = 12,492) ^a	OR or IRR (95% CI)	
Overall	% with ≥1 flagged med	73%	67%	OR=1.34 (1.12, 1.62) (p=0.002)	73%	67%	OR=1.33 (1.14, 1.55) (p<0.001)	
	Mean	2.09	1.62	IRR=1.29 (1.17, 1.42) (p<0.001)	2.08	1.66	IRR=1.29 (1.20, 1.40) (p<0.001)	
Medication overus	Medication overuse							
Over- aggressive treatment of chronic conditions	% with ≥1 flagged med	17%	14%	OR=1.25 (0.98, 1.60) (p=0.07)	18%	17%	OR=1.28 (1.05, 1.56) (p=0.013)	
	Mean	0.18	0.15	IRR=1.21 (0.98, 1.50) (p=0.08)	0.18	0.15	IRR=1.23 (1.04, 1.46) (p=0.012)	
Medications inappropriate near end of life	% with ≥1 flagged med	4%	2%	OR = 1.78 (1.10, 2.86) (p = 0.02)	7%	4%	OR=1.88 (1.30, 2.73) (p=0.001)	
	Mean	0.06	0.04	IRR = 1.59 (0.96, 2.63) (p = 0.07)	0.04	0.02	IRR=1.88 (1.30, 2.73) (p<0.001)	
Medication misuse								
Medications that negatively	% with ≥1 flagged med	41%	30%	OR = 1.59 (1.33, 1.89) (p < 0.001)	40%	30%	OR=1.60 (1.39-1.83) (p<0.001)	

affect cognition	Mean	0.61	0.42	IRR = 1.45 (1.26, 1.67)	0.61	0.40	IRR=1.51 (1.36, 1.68)
cognition	Wican	0.01	0.42	(p < 0.001)	0.01	0.40	(p<0.001)
2019 Beers criteria	% with ≥1	600/	710/	OR = 1.45	600/	500/	OR=1.40
	flagged med	60%	51%	(1.23, 1.72) (p < 0.001)	60%	52%	(1.22, 1.61) (p<0.001)
	Maan	1.52	1.06	IRR = 1.44	1.51	1.06	IRR=1.43
	Mean	1.53	1.00	(1.28, 1.63) (p < 0.001)	1.51	1.06	(1.30, 1.58) (p<0.001)
STOPP Version 2 criteria	% with ≥1			OR = 1.69			OR=1.76
	flagged med	66%	53%	(1.42, 2.00) $(p < 0.001)$	66%	52%	(1.53, 2.03) (p<0.001)
				IRR = 1.37			IRR=1.88
	Mean	1.32	0.96	(1.24, 1.51)	1.31	0.92	(1.30, 2.73)
				(p < 0.001)			(p=0.001)

Abbreviations: CI, confidence interval; IPTW, inverse probability of treatment weighting; IRR, incidence rate ratio; OR, odds ratio; STOPP, Screening Tool of Older Persons' Prescriptions

a For the control pool (i.e., persons without dementia) in the inverse probability of treatment weighting analysis, the number of persons without dementia included was greater than the number of unique individuals without dementia because a person could contribute information from multiple waves in this analysis. For example, a person with an HRS interview in 2008, 2010, and 2012 who did not have a classification of dementia during any of these waves would be included 3 times in this analysis. We accounted for intra-individual correlation and repeated measures in calculating the odds ratio, incidence rate ratio, and p-value using a generalized estimating equation (GEE) model.

Supplementary Table S13: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and across the different domains in the primary matched cohort including and excluding criteria that are specific to individuals with dementia^a

			All criteria		Excluding criteria specific to persons with dementia			
Medication domain	Outcome measures	Persons with dementia (N = 1,441)	Persons without dementia (N = 1,441)	OR or IRR (95% CI)	Persons with dementia (N = 1,441)	Persons without dementia (N = 1,441)	OR or IRR (95% CI)	
Overalla	% with ≥1 flagged med	77%	67%	OR=1.58 (1.31, 1.90) (p<0.001)	73%	67%	OR=1.34 (1.12, 1.62) (p=0.002)	
	Mean	2.20	1.63	IRR=1.35 (1.22, 1.48) (p<0.001)	2.09	1.62	IRR=1.29 (1.17, 1.42) (p<0.001)	
Medication overuse								
Over-aggressive treatment of chronic conditions	% with ≥1 flagged med	17%	14%	OR=1.25 (0.98, 1.60) (p=0.07)	17%	14%	OR=1.25 (0.98, 1.60) (p=0.07)	
	Mean	0.18	0.15	IRR=1.21 (0.98, 1.50) (p=0.08)	0.18	0.15	IRR=1.21 (0.98, 1.50) (p=0.08)	
Medications inappropriate near end of life ^a	% with ≥1 flagged med	4%	2%	OR = 1.78 (1.10, 2.86) (p = 0.02)	4%	2%	OR = 1.73 (1.07, 2.78) (p = 0.025)	
	Mean	0.06	0.04	IRR = 1.59 (0.96, 2.63) (p = 0.07)	0.06	0.04	IRR =1.52 (0.92, 2.51) (p = 0.105)	
Medication misuse								
Medications that negatively affect cognition	% with ≥1 flagged med	41%	30%	OR = 1.59 (1.33, 1.89) (p < 0.001)	41%	30%	OR=1.59 (p<0.001)	
	Mean	0.61	0.42	IRR = 1.45 (1.26, 1.67)	0.61	0.42	IRR=1.45 (p<0.001)	

				(p < 0.001)			
2019 Beers	% with ≥1 flagged med	60%	51%	OR = 1.45 $(1.23, 1.72)$ $(p < 0.001)$	58%	51%	OR = 1.37 (1.16, 1.62) (p<0.001)
criteria ^b	Mean	1.53	1.06	IRR = 1.44 (1.28, 1.63) (p < 0.001)	1.48	1.06	IRR = 1.40 (1.23, 1.58) (p<0.001)
STOPP Version	% with ≥1 flagged med	66%	53%	OR = 1.69 (1.42, 2.00) (p < 0.001)	53%	52%	OR = 1.02 (0.86, 1.20) (p = 0.82)
2 criteria ^b	Mean	1.32	0.96	IRR = 1.37 (1.24, 1.51) (p < 0.001)	0.98	0.94	IRR = 1.04 (0.94, 1.15) (p = 0.49)

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; OR, odds ratio; STOPP, Screening Tool of Older Persons' Prescriptions

a There were some criteria in the subdomains of "Medications inappropriate near end of life," "2019 Beers criteria," and "STOPP Version 2 criteria" which were specific to individuals with dementia or differed between those with and without dementia (see supplementary methods and Supplementary Table S4 for additional details). The boxes shaded in yellow represent the sensitivity analysis which excluded criteria that were specific to individuals with dementia. The boxes shaded in green represent the primary analysis in Table 3 and Figure 1. For the overall results in the primary analysis (results displayed in Table 3 and Figure 1, green shaded boxes in this supplementary table), we excluded the criteria specific to individuals with dementia in order to make a fairer comparison between those with and without dementia when calculating the overall measure. In a sensitivity analysis, we included all criteria in calculating the overall results (yellow shaded boxes in this supplementary table). In the primary analysis for the individual sub-domains (results displayed in Table 3 and Figure 1, green shaded boxes in this supplementary table), we did not exclude these criteria. In a sensitivity analysis, we excluded these criteria in calculating the results for these sub-domains (yellow shaded boxes in this supplementary table). Since a single medication could be identified as potentially problematic in multiple different ways, the overall results of this sensitivity analysis are similar to the primary analysis.

Supplementary Table S14: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and in the medication overuse domain in the primary matched cohort and a separate matched cohort in which the non-dementia controls were not preferentially selected based on presence of enhanced face to face interview

			ed cohort (prim Fable 3 and Fig	nary analysis from ure 1)	Matched cohort where persons without dementia were not specifically selected based on the presence of EFTF interview (sensitivity analysis)				
Medication domain	Outcome measures	Persons with dementia (N = 1,441)	Persons without dementia (N = 1,441)	OR or IRR (95% CI)	Persons with dementia (N =1,470)	Persons without dementia (N =1,470)	OR or IRR (95% CI)		
011	% with ≥1 flagged med	73%	67%	OR=1.34 (1.12, 1.62) (p=0.002)	73%	69%	OR=1.21 (1.00, 1.46) (p=0.049)		
Overall	Mean	2.09	1.62	IRR=1.29 (1.17, 1.42) (p<0.001)	2.08	1.73	IRR=1.20 (1.09-1.33) (p<0.001)		
Medication overuse	;								
Over- aggressive	% with ≥1 flagged med	17%	14%	OR=1.25 (0.98, 1.60) (p=0.07)	17%	16%	OR=1.11 (0.85-1.45) (p=0.43)		
treatment of chronic conditions	Mean	0.18	0.15	IRR=1.21 (0.98, 1.50) (p=0.08)	0.18	0.16	IRR=1.09 (0.86-1.38) (p=0.48)		

Abbreviations: CI, confidence interval; EFTF, enhanced face to face; IRR, incidence rate ratio; OR, odds ratio

Supplementary Table S15: Results from the index of local sensitivity to nonignorability (ISNI) method for the linear regression models for systolic blood pressure and hemoglobin A1c

		Systolic blo	ood pressu	re model			Hemoglo	bin A1c mo	odel	
Variable	MAR est.	Std. error	P-value	ISNI	MinNI	MAR est.	Std. error	P-value	ISNI	MinNI
(Intercept)	95.27	8.87	< 2e-16	222.74	0.78	7.53	0.43	< 2e-16	0.38	1.03
Age	0.28	0.03	< 2e-16	0.23	2.33	0.00	0.00	0.51	0.00	1.68
Male sex	1.41	0.38	0.00	-0.93	8.06	0.04	0.02	0.01	0.00	4.50
Race										
Other										
Non-Hispanic White	13.32	8.62	0.12	-23.90	7.10	-1.84	0.42	0.00	-0.07	5.19
Non-Hispanic Black	15.24	8.63	0.08	-24.70	6.88	-1.56	0.42	0.00	-0.06	6.30
Hispanic	13.74	8.65	0.11	-29.72	5.73	-1.70	0.42	0.00	-0.06	5.96
ADL	-0.26	0.21	0.21	5.56	0.73	-0.01	0.01	0.27	0.00	2.63
IADL	-0.18	0.27	0.52	8.19	0.66	0.01	0.01	0.27	0.01	1.40
Lives alone	-0.03	0.53	0.95	1.83	5.75	0.05	0.02	0.04	0.00	5.24
Current smoker	1.65	0.65	0.01	-3.27	3.89	0.01	0.03	0.77	-0.01	3.13
Married or	0.84	0.53	0.11	3.03	3.43	-0.01	0.02	0.57	0.01	3.67
partnered										
Education										
< high school										
High School or GED	-1.26	0.47	0.01	-8.38	1.10	-0.04	0.02	0.07	0.00	3.60
College and above	-2.86	0.47	0.00	-11.62	0.80	-0.08	0.02	0.00	0.01	1.35
Hospitalization										
0										
1	-1.43	0.71	0.04	-1.02	13.73	-0.05	0.03	0.08	-0.01	3.99
>1	-2.32	1.18	0.05	15.97	1.45	-0.12	0.05	0.01	0.01	5.31
ER Visit										
0										
1	0.35	0.82	0.67	2.27	7.12	0.01	0.04	0.80	0.01	2.59

>1	0.03	1.41	0.98	-5.68	4.90	0.14	0.06	0.02	0.00	548.42
Outpatient visit										
0										
1	1.23	0.93	0.19	12.75	1.44	-0.04	0.04	0.28	0.00	30.46
>1	0.54	0.36	0.13	0.65	10.82	0.01	0.02	0.65	-0.01	1.24
Region										
Northeast or										
Other										
Midwest	-0.68	0.57	0.23	-3.50	3.23	0.01	0.03	0.57	-0.01	1.63
South	-1.08	0.53	0.04	-1.48	7.02	-0.05	0.02	0.04	-0.01	2.35
West	-0.03	0.60	0.96	-4.12	2.87	0.01	0.03	0.82	-0.02	1.34
Dementia status	-1.30	0.94	0.17	-7.21	2.58	-0.07	0.04	0.11	0.01	3.20
Comorbidities										
Arthritis	-1.29	0.40	0.00	-7.90	1.01	-0.02	0.02	0.33	0.00	4.27
Cancer	-0.88	0.42	0.04	0.05	179.71	-0.01	0.02	0.58	0.00	6.37
Diabetes	0.52	0.39	0.18	-0.48	16.10	1.10	0.02	< 2e-16	0.01	2.27
Heart	-2.12	0.37	0.00	-0.55	13.41	0.06	0.02	0.00	0.00	233.08
Hypertension	7.18	0.39	< 2e-16	2.88	2.65	0.02	0.02	0.26	0.00	3.36
Lung disease	-2.41	0.52	0.00	-3.56	2.90	0.00	0.02	0.90	0.00	7.79
Stroke	0.19	0.54	0.73	-1.42	7.58	-0.04	0.02	0.06	0.00	5.57

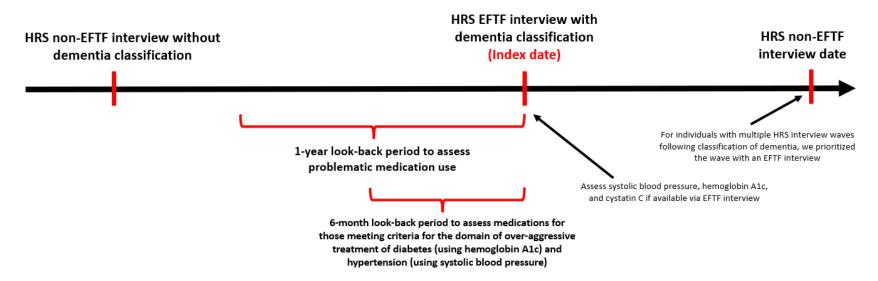
Abbreviations: ADL, activities of daily living; Est, estimate; GED, General Educational Development; IADL, instrumental activities of daily living; ISNI, index of local sensitivity to nonignorability; MAR, missing at random; MinNI, minimum degree of nonignorability; Std. error, standard error

Supplementary Table S16: Frequency and mean number of potentially problematic medications among community-dwelling older adults with and without dementia overall and in the over-aggressive treatment of chronic conditions sub-domain for the primary cohort comparing methods using multiple imputation (MI) (primary analysis) and the index of local sensitivity to nonignorability (ISNI) (sensitivity analysis)

		Multiple	Imputation (primar	ry results)	ISNI m	ethod (sensitivity ar	nalysis)
Medication domain	Outcome measures	Persons with dementia (n=1,441)	Persons without dementia (n=1,441)	OR or IRR (95% CI)	Persons with dementia (n=1,441)	Persons without dementia (n=1,441)	OR or IRR (95% CI)
0 11	% with ≥1 flagged med	73%	67%	OR=1.34 (1.12, 1.62) (p=0.002)	73%	67%	OR=1.29 (1.08, 1.55) (p<0.001)
Overall	Mean	2.09	1.62	IRR=1.29 (1.17, 1.42) (p<0.001)	2.08	1.62	IRR=1.28 (1.16, 1.41) (p<0.001)
Medication overus	se						
Over-aggressive treatment of	% with ≥1 flagged med	17%	14%	OR=1.25 (0.98, 1.60) (p=0.07)	16%	15%	OR=1.10 (0.88, 1.38) (p=0.42)
chronic conditions	Mean	0.18	0.15	IRR=1.21 (0.98, 1.50) (p=0.08)	0.16	0.15	IRR=1.06 (0.87, 1.29) (p=0.56)

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; ISNI, index of local sensitivity to nonignorability; OR, odds ratio

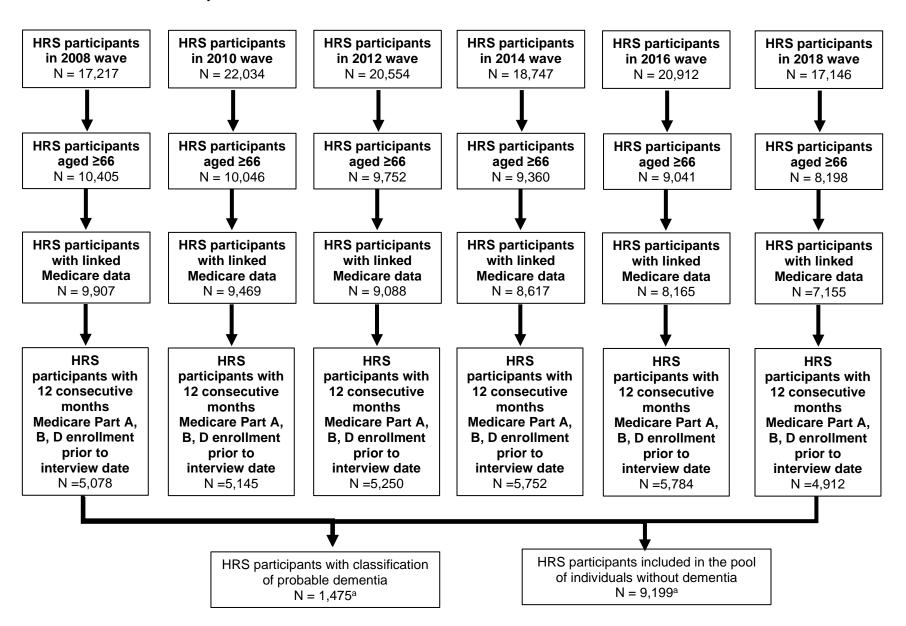
Supplementary Figure S1: Example outline of cohort entry and timing of medication assessment for an individual enrolled in the Health and Retirement study^a



Abbreviations: EFTF, enhanced face-to-face; HRS, Health and Retirement Study

a This figure represents an example participant in the Health and Retirement Study who was followed for multiple interview waves. During their first interview wave, the participant did not have a dementia classification. During their second interview wave 2 years later, the participant had a dementia classification and participated in the enhanced face-to-face interview. During their third interview wave 2 years later, the participant had an additional non-enhanced face to face interview. Since we prioritized waves in which the individual participated in the enhanced face to face interview, we would select the second interview wave as the index date (first date when the individual was classified as having dementia and had enhanced face to face interview performed). Medication use was then assessed in the 1-year period prior to this index date. For over-aggressive treatment of diabetes/hypertension, we used a 6-month look-back period.

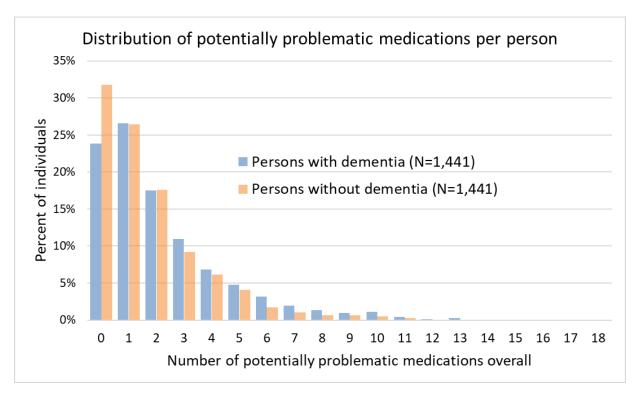
Supplementary Figure S2: Flow chart of individuals aged 66 years and older with and without dementia in the Health and Retirement Study from 2008-2018 included in this study



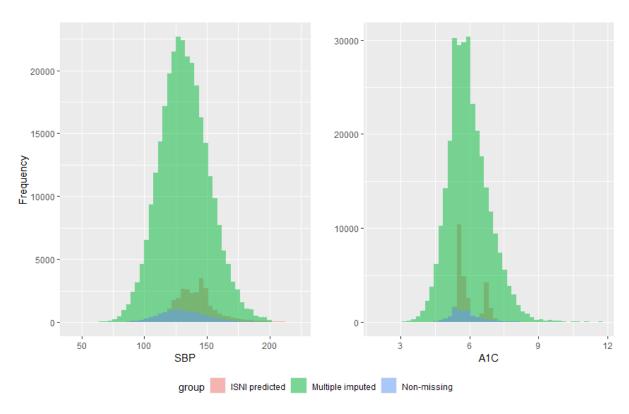
Abbreviations: HRS, Health and Retirement Study

a In the figure, many individuals participated in multiple HRS interview waves. Therefore, the sum total of people in at least one wave is much greater than the sum of participants in each individual wave. After applying our inclusion and exclusion criteria, a total of 9,844 distinct individuals were ultimately eligible. From this cohort, 1,475 distinct individuals were classified as having dementia during the study period based on the dementia classification algorithm. There were 9,199 individuals who were included in the control pool. The sum of these numbers (1,475 + 9,199 = 10,674) is greater than 9,844 as some individuals were included in the control pool during earlier waves (no classification of dementia) before eventually having a classification of dementia during a later wave. For example, an individual who was interviewed in 2008 and 2010 and not classified as having dementia would be included in the control pool for those time points but could later be included in the dementia pool if they were classified as having dementia at the 2012 HRS interview wave.

Supplementary Figure S3: Distribution of the number of potentially problematic medications identified across all criteria among persons with and without dementia in the primary matched cohort



Supplementary Figure S4: Histograms representing the distribution of systolic blood pressure and hemoglobin A1c values under the different methods, including index of local sensitivity to nonignorability (ISNI), multiple imputation, and non-missing observed data



Abbreviations: A1c, hemoglobin A1c; ISNI, index of local sensitivity to nonignorability; SBP, systolic blood pressure

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Domain Criteria

Medication overuse Over-aggressive treatment of diabetes

Medication overuse Over-aggressive treatment of hypertension

Strongly anticholinergic Selected antiarrhythmics (disopyramide)

Strongly anticholinergic Selected antidepressants
Strongly anticholinergic Selected antiemetics

Strongly anticholinergic First generation antihistamines

Strongly anticholinergic Urinary antimuscarinics

Strongly anticholinergic Antiparkinson anticholinergics (e.g., benztropine/trihexyphenidyl)

Strongly anticholinergic Selected antipsychotics

Strongly anticholinergic Antispasmodics

Strongly anticholinergic Selected skeletal muscle relaxants

Sedative-hypnotics Benzodiazepines

Sedative-hypnotics Z-drugs

Sedative-hypnotics
Sedative-hypnotics
Sedative-hypnotics
Sedative-hypnotics
Sedative-hypnotics
Sedative-hypnotics
Sedative-hypnotics
Sedative-hypnotics
Sedative-hypnotics
Additional antidepressant

STOPPFrail Lipid-lowering therapies (statins, ezetimibe, sequestrants, fibrates, niacin)

STOPPFrail Memantine in moderate to severe dementia

STOPPFrail Theophylline and aminophylline

STOPPFrail Anti-resorptive/bone anabolic drugs for osteoporosis

STOPPFrail NSAIDs for >2 months

STOPPFrail Drugs for overactive bladder (muscarinic antagonists and mirabegron)

Beers (2019 version) First generation antihistamines

Beers (2019 version) Antiparkinsonian agents

Beers (2019 version)

Beers (2019 version)

Beers (2019 version)

Antispasmodics

Dipyridamole

Nitrofurantoin

Beers (2019 version) Peripheral alpha-1 blockers for hypertension

Beers (2019 version) Central alpha-agonists for hypertension (excluding clonidine)

Beers (2019 version) Disopyramide

Beers (2019 version) Nifedipine, immediate release
Beers (2019 version) Selected antidepressants

Beers (2019 version) Antipsychotics except in schizophrenia/bipolar

Beers (2019 version)BarbituratesBeers (2019 version)BenzodiazepinesBeers (2019 version)Meprobamate

Beers (2019 version) Z-drugs

Beers (2019 version) Ergoloid mesylates

Beers (2019 version) Androgens without hypogonadism

Beers (2019 version) Desiccated thyroid

Beers (2019 version) Estrogens (oral/topical patch)

Beers (2019 version) Growth hormone
Beers (2019 version) Megestrol

Beers (2019 version) Long-acting sulfonylureas

Beers (2019 version) Metoclopramide except for gastroparesis
Beers (2019 version) PPI for >8 weeks unless high-risk patient

Beers (2019 version) Meperidine

Beers (2019 version) Non-COX-selective NSAIDs, chronic use (>90 days)

Beers (2019 version) Indomethacin, ketorolac Beers (2019 version) Skeletal muscle relaxants

Beers (2019 version)	Desmopressin
Beers (2019 version)	Cilostazol in heart failure
Beers (2019 version)	NSAIDs (all) in heart failure
Beers (2019 version)	Thiazolidinediones in heart failure
Beers (2019 version)	Cholinesterase inhibitors in syncope
Beers (2019 version)	Peripheral alpha-1 blockers in syncope
Beers (2019 version)	Tertiary TCAs in syncope
Beers (2019 version)	Selected antipsychotics in syncope
Beers (2019 version)	Selected antiemetics in Parkinson disease
Beers (2019 version)	Selected antipsychotics in Parkinson disease
Beers (2019 version)	Non-COX-selective NSAIDs with GI ulcers
Beers (2019 version)	NSAIDS (all) in CKD Stage 4 or higher
Beers (2019 version)	Estrogen in women with urinary incontinence
Beers (2019 version)	Peripheral alpha-1 blockers in women with urinary incontinence
Beers (2019 version)	Strongly anticholinergic drugs with LUTS/BPH
Beers (2019 version)	Opioid and benzodiazepine in combination
Beers (2019 version)	Opioid and gabapentin/pregabalin in combination
Beers (2019 version)	Strongly anticholinergic and strongly anticholinergic in combination
Beers (2019 version)	Three or more CNS-active drugs
Beers (2019 version)	TMP-SMX with reduced kidney function
Beers (2019 version)	Amiloride with reduced kidney function
Beers (2019 version)	Apixaban with reduced kidney function
Beers (2019 version)	Dabigatran with reduced kidney function
Beers (2019 version)	Dofetilide with reduced kidney function
Beers (2019 version)	Edoxaban with reduced kidney function
Beers (2019 version)	Fondaparinux with reduced kidney function
Beers (2019 version)	Rivaroxaban with reduced kidney function
Beers (2019 version)	Spironolactone with reduced kidney function
Beers (2019 version)	Triamterene with reduced kidney function
Beers (2019 version)	Duloxetine with reduced kidney function
Beers (2019 version)	Tramadol with reduced kidney function
Beers (2019 version)	Probenecid with reduced kidney function
STOPP Version 2	Verapamil/diltiazam with heart failure
STOPP Version 2	Beta-blocker and verapmil/diltiazem in combination
STOPP Version 2	Beta-blocker with bradycardia/heart block
STOPP Version 2	Centrally-acting antihypertensives
STOPP Version 2	PDE-5 inhibitors in heart failure
STOPP Version 2	Antiplatelet/anticoagulant with significant bleeding risk
STOPP Version 2	Ticlopidine
STOPP Version 2	NSAID and anticoagulant in combination
STOPP Version 2	TCAs in dementia, glaucoma, BPH/urinary retention, cardiac issues
STOPP Version 2	Anticholinergic antipsychotics with BPH/urinary retention
STOPP Version 2	Selected antipsychotics in Parkinson disease
STOPP Version 2	Strongly anticholinergics in dementia
STOPP Version 2	Antipsychotics in BPSD
STOPP Version 2	Cholinesterase inhibitors in bradycardia/syncope/heart block
STOPP Version 2	Levodopa or dopamine agonists for benign essential tremor
STOPP Version 2	First generation antihistamines
STOPP Version 2	Digoxin at doses > 125 ug/day with reduced kidney function
STOPP Version 2	Direct thrombin inhibitors with reduced kidney function
STOPP Version 2	Factor Xa inhibitors with reduced kidney function
STOPP Version 2	NSAIDs with reduced kidney function
STOPP Version 2	Colchicine with reduced kidney function
	,

STOPP Version 2	Metformin with reduced kidney function
STOPP Version 2	Selected antiemetics with Parkinson disease (metoclopramide/prochlorperazine)
STOPP Version 2	PPI for >8 weeks unless high-risk patient
STOPP Version 2	Theophylline as monotherapy in COPD
STOPP Version 2	Antimuscarinic bronchodilators with specific comorbidities (inhaled anticholinergics)
STOPP Version 2	COX-2 selective NSAIDs with CV disease
STOPP Version 2	Oral bisphosphonate with GI issues
STOPP Version 2	Bladder antimuscarinics with dementia, narrow angle glaucoma, BPH
STOPP Version 2	Long-acting sulfonylureas
STOPP Version 2	Thiazolidinediones in heart failure
STOPP Version 2	Estrogens with breast cancer/VTE
STOPP Version 2	Androgens without hypogonadism
STOPP Version 2	Benzodiazepines
STOPP Version 2	Z-drugs
STOPP Version 2	Strongly anticholinergic and strongly anticholinergic in combination (same as Beers)

				Medication Ov	veruse .					
METADATA ID	METADATA Description	METADATA	A Diagnosis code	B Diagnosis code	C Medication code Aspirin	RISK	NOTES	Limitations/Issues		
Aspirin	Aspirin for primary prevention of ASCVD in participant aged 70 years and older	ICD9 ICD10 Medication variable		Omitted as	very few people are getting	aspirin through prescription		Most of the people are receiving dipyridamole/aspirin combination which is unlikely to represent a primary prevention population		
METADATA ID	METADATA Description	METADATA	A Medication code Iron	B Diagnosis code Iron deficiency anemia	RISK	CODE	NOTES	Limitations/Issues		
		ICD9 / CCS for ICD9								
Iron supplementation	Prescription for iron in the absence of diagnosis code for iron deficiency anemia	ICD10 / CCS for ICD10			Omitted as very fe	w people are getting iron through	prescription			
		Medication variable								
METADATA ID	METADATA Description	METADATA	A Laboratory value A1c	B Medication code Insulin	C Medication code Sulfanylurea	D Diagnosis code Type 2 diabetes	RISK	CODE	NOTES	Limitations/Issues
Over-aggressive treatment of diabetes	Prescription for insulin or sulfonylureas with A1c < 7.5% in patient with diabetes	ICD9 / CCS for ICD9 ICD30 / CCS for ICD10 Medication variable		insulin	sulfonylurea	250.00, 250.02, 250.10, 250.12, 250.20, 250.22, 250.30, 250.32, 250.40, 504.2, 250.50, 250.52, 250.60, 250.62, 250.70, 250.72, 250.80, 250.82, 250.90, 250.92		A & (Prescription for 8 C within 180 days prior to A1c blood draw) & D	Only include diagnosis codes for Type 2 diabetes (do not want to include patients with Type 1 diabetes) 2. Only includes medications with highest hypoglycemia risk 3. Assess medication prescription 180 days before	Presumes doctor knows a A1c although they will no the HRS blood draw result differentiate decreasing dose in response to A1c
METADATA ID	METADATA Description	Laboratory value METADATA	A1c < 7.5% A Diagnosis codes	B Medication code	RISK	CODE	NOTES	Limitations/Issues		
Over-aggressive treatment of hypertension	Prescription for antihypertensive medication with average SBF < 110 mm Hg during enhanced face to face interview	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable		See supplementary n	methods section for details		Time window of prescription within 180 days of BP measurement 2. Applies only to those with average SBP < 110 based on 3 measurements during face-to-face interview	blood pressure readings on a single day, which may not be reflective of		

		Medications inap	propriate near the	e end of life (only applie	ed to those with li	imited life expecta	ncy)		l		
Rules	represent the STOPPFrail criteria applied to par https://pubmed.ncbi.nlm.nih.gov/21208778/j.							nds to a comorbidity score >9 ursing Home Residents"			
METADATA	METADATA Residence	METADATA	(https://link.spri			coos	NOTES	Limitations/Issues			
		ICD9 / CCS for ICD9	Antihyperlaidemics				Anthyperlipidemics variable				
Lipid-lowering therapies		Medication variable	anthyperlpidemics		*	*		Bille acid sequestrants are sometimes used aff label for chanic diarrhes			
METADATA ID	METADATA Description	METADATA	Medication code	n Medication code	DVCV	mes	MULLE	Limit wileye Assure			
Antihypertensis therapies	Antihypertensive therapies (carefully reduce or discontinue these drugs in patients with systolic blood pressure (SEP) penistently <120 mmilg.)			Omitted due to difficulty in a	lefining SBP pensistently < 13	IO and addressed in other cate	gory using SBP < 110				
METADATA ID	AMETADATA Description	METADATA	Medication code	n Medication code	DYCY	me	BATTES	Limit witness Assesses			
Anti-anginal therapy in absen	Anti-anginal therapy (specifically nitrates, nicorandil, ranolazine). Aim to carefully reduce and discontinue these drugs in patients who have had no reported anginal symptom in the previous 12 months AND who have no rememor objective wideror of common.			a	mitted due to difficulty in op	erationalizing definition					
METAGATA	have no provenior objective evidence of connary arreny disease	METADATA	Δ.		RISK	coor	NOTES	Limitations/Issues			
Antiplatelets for primary ASCVC	Reprieties Antiplatelets for primary cardiovascular presention		Adadiration roots	Medication rode Omittee	f as very few participants we		•				
METADATA ID	METADATA Description	METADATA	A Medication code	0 Medication code	RISK	0006	NOTES	Limitations/Issues			
Aspirin for atria fibrillation	Aspirin for stroke prevention in astial fibrillation METADATA Description	METADATA	A Medication code	0 Medication code	Sas very few participants we	ere receiving prescribed aspirit	MULTER	Limitations Assures			
Antourhetes	Neurolegic antipsychotics in patients with dementia:	ICD9 / CCS for ICD9	Antiquehotics								
patients with dementia	patients taking them for longer than 12 weeks if there are no current clinical features of behavioural and psychiatric symptoms of dementia (BPSC).	ICD10 / CCS for ICD10 Medication variable			Omitted due to diff	Sculty in operationalizing dose	reductions				
METADATA	AMETACATA Description	METADATA	A Medication code Measoning	n Medication code	DIGE	rnne	MULTEC	Limitations/Issues			
Memantine in moderate to seve dementia	Memartine: Discontinue and monitor in patients with ne moderate to severe dementia, unless memartine has clearly improved 8PSD.	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable				*		Not able to operationalize "unless memorine has clearly improved BPSD." Memarine may be appropriate to continue in PWD in last Year of life in ways that we are not able to capture.			
METADATA ID	METADATA Description	Medication variable	A Medication code	0 Diagnosis	c Medication code	D Medication code	E Medication code		CODE	NOTES	Limitations/luxues
					Anticogulant (e.g., warferin, fector Xe inhibitor, direct						
Proton pump	Proton pump Inhibiton: Reduce dose of proton pump inhibitons when upod at full they are not dose of	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	FFI high door	Borrett's esophogus, Gl ulcer, esophopitis. Gl hemorrhope	inhibitor, direct thrombin inhibitors)	Any NSAVO	Corticosteroids				
inhibitors for extended duration	unless persistent dyspeptic symptoms at lower maintenance dose METADATA	Medication variable	A		RISK	cons	Omitted due to diffici	uby in operationalizing Limitations/Issues			
an.	Reprinting	ICD9 / CCS for ICD9 ICD IO / CCS for ICD IO	Madiration rods	S Madiration rods							
H2 antagonists f extended durati	H2 antagonist: Reduce dose of H2 antagonist when or used at full therapeutic dose 38 weeks, unless on persistent dyspeptic symptoms at lower maintenance dose	Medication variable			Omitted d	ue to difficulty in operations la	ing				
METADATA	METADAZA Description	METADATA	A Medication code	0 Medication code	RISK	CODE	NOTES	Limitations/Issues			
Theophylline an aminophylline	Theophylline and a minophylline (narrow therapeutic index, doubtful therapeutic benefit and require monthorize of serum levels)	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	theophyline	a minophyline	Ala	Ala					
METADATA IN	METADATA Businistina	Medication variable METADATA	A Madiration rada Leukstriene onteconist	Il Nissannis rada COPO	C Diseases rode Athre	Disensels code Disensels code Alleraic chinits	RISK	CODE	NOTES	Limitations/Results	
		ICD9 / CCS for ICD9									
Leukotriene antagonists in setting of COPC	Leukotriene antagonists (montelukaut, zafiriukaut) in setting of COPO. Only indicated in asthmu.	ICD10 / CCS for ICD10				0	mitted due to difficulty in operations	ling			
METADATA	METADATA	Medication variable	Δ.		RISK	C006	NOTES	Limitations/suum			l
Calcium	METADATA Description Calcium supplements: Unlikely to be of any benefit in short-term unless proven, symptomatic hypocal cerals	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	A Medication code Colinion	Diamosis code	Omitted as very few peop	sie receive prescriptions for cal	cium supplements				
METADATA an	short-term unless proved, symptomatic hypocalicemia. METACATA Resprinting	Medication variable METADATA	A Madiration code	S Diseases code	RISK	CODE	NOTES	Limitations/Issues			
Vitamin D	Vitamin D (egocalciferol and colecalciferol): Lack of clear evidence to support the use of vitamin D to prevent falls and fractures, cardiova scular events or	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	VALUE D		Ornitted as very few	v people receive prescriptions:	for vitamin D				
METADATA	CANCERS. METADATA	Medication variable	A		c	RISK	cons	NOTES	Limitations/Issues	1	
ID.	Description	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Medication code Ostroporosis drugs	Ottercontails 12.4 / 733.0* MUS013 / M81*	Disensels code Secondary malignant necelouse of base 198.5 C79.51						
Anti- rescriptive/bon anabolic drugs fi osteoporosis	Acti-rescritive/bone anabolic drugs for esteoporosis (bisphosphonates, strontium, teliparaside, denosumabl	Medication variable	osteoporosis	, ,		A & B	ABBBIC	We attempt to exclude those participants who are receiving biphosphonates (e.g., zolednois acid) for bony metastesses using ICD diagnosis code of secondary malignant neoplasm of bone			
METADATA ID	METADATA Description	METADATA	A Medication code NSAID	0 Disamosis code	RISK	cons	NOTES	Limitations/Issues			
Long-term oral NSAID (>2 month	Long-term oral NSAID use: increased risk of side effects (e.g. paptic alcer disease, bleeding, worsening heart failure) when taken regularly for k2 months.	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	nuid		A & duration > 2 months	A & duration > 2 months	Includes all NSAIDs. 2. Using this definition will include people who are on NSAID+PPIs				
METADATA ID	METADATA Description	METADATA	A Medication code	0 Disenceis code	C Diamosis code	RESK	CODE	NOTES	Limitations/Issues		
			Carticasteraids	Certain rheumatologic condition in a. PMR. RA. GPAI	Adversel insufficiency						
Long-term continuaternish is	Long-term and conticasteroids: Increased risk of major dide effects when taken regularly for 22 months. Consider careful dose rectation and discontinuation.	ICD9 / CCS for ICD9		Omitted due to 48	Sculty in operationalizing are	d challenging to determine are	propriateness of steroids at each of the	e (e.g., stensids for end-stage COPD)			
months	Consider careful dose reduction and discontinuation.	ICD10 / CCS for ICD10									
METADATA ID	METADATA Description	Medication variable METADATA	A Medication code	ii Diamosis code	RISK	cone	NOTES	Limitations/Issues		l	
Onugs for BPH is catherized mail	Drugs for benign prostatic hyperplasia (5-alpha neductase inhibitors and alpha-blockers) in cathetenise male patients: No breeff with long-term blodder conhibition along-term blodder	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10			Omitted due to is	ack of information on catheriae	of patients				
METADATA ID	catheteriasion METADATA Description	Medication variable	A Medication code Overactive bladder	0 Diamonis code	RISK	cons	NOTES	Limitations/Issues			
	Oruge for overactive bia dder imuscarinic anthronoists	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	maderition				1. Exclude "clear history of				
Drugs for overactive bladd	Drugs for overactive bis dder (muscarinic antagonists and mirabegron): No benefit in patients with persistent er inneversible urinary incontinence unless clear history of painful detrusor hyperactivity	Medication variable					painful detrusor hyperactivity" 2. "Urinary_all" medication classification includes urinary antimuscarinics and minabegron				
METAGATA ID	MICTADATA Description	METADATA	A Medication code Diobetes medications	D Laboratory value	C Diaznosis code	RSK	cons		Limitations/Issues	1	
			Diabetes medications (insulin and sulfanylunea)	Alec 7.5%	Type 2 diobetes						
Anti-diabetic dr.	Anti-diabetic drugs (avoid ALc targets <7.5% associates with net harm in this population)	I ICD9 / CCS for ICD9				Omitted as covered under me	edication oversuse category				
	A Tarmin my population	ICD10 / CCS for ICD10 Medication variable									
METADATA IN	METADATA Representation	Medication variable METADATA	A Madiration code	0 Disease on the	RISK	cons	NOTES	Limitations/Issues		ı	
Multivitamins	Multivitamin combination supplements: Discontinue when prescribed for prophylasis rather than treatment of hypovitaminosis	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Multistanio		Omitted due to limite	d number of people getting the	ese prescribed				
METADATA ID	of hypovitaminosis METADATA Description	Medication variable	A Medication code	ii Diamosis code	RISK	cone	NOTES	Limitations/Issues			
Eglic acid	Folic acid: Discontinue when treatment course is completed. The usual treatment duration is 1–4 month unless malabsorption, mainstrition or concomitant	ICD9 / CCS for ICD9			Omitted as we	ry few people getting these pre	escribed				
METADAYA	unless mallabsorption, mainutrition or concomitant methodrexase use METAPATA Description	Medication variable		n Disenceis code	DIOV	mer	MULTEC	Limitations/Issues			
10	Description Nutritional supplements: Discortinue when prescribed for prophylasis rather than treatment of mainutrition.	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Medication code	James code		ed as these are not prescribed					

		Stron	gly anticholinerg	gic medications					
	High-risk antich	olinergic medicatio	ons from the 2019 Am	nerican Geriatrics So	ciety Beers	s criteri	a Table 7		
METADATA ID	METADATA Description	METADATA	A Medication code disopyramide	B Diagnosis code	RISK		CODE	NOTES	Limitations/Issues
		ICD9 / CCS for ICD9	,					_	
Antiarrhythmics	Disopyramide	ICD10 / CCS for ICD10				Α	Α		
D	Description	Medication variable	disopyramide Medication code Anticholinergic antidepressants	Diagnosis code					
	amitriptyline, amoxapine, clomipramine, desipramine, doxepin,	ICD9 / CCS for ICD9	,						
Antidepressants	imipramine, nortriptyline, paroxetine, protriptyline, and trimipramine	ICD10 / CCS for ICD10				Α	Α		
METADATA	METADATA	Medication variable METADATA	antidepressants_AC	D.	RISK		CODE	NOTES	Limitations/Issues
)	Description		Medication code Antiemetics	Diagnosis code	RISK		CODE	NOTES	Limitations/Issues
		ICD9 / CCS for ICD9							
Antiemetics	prochlorperazine, promethazine	ICD10 / CCS for ICD10				Α	А		
//ETADATA	METADATA	Medication variable METADATA	antiemetics A	В	RISK		CODE	NOTES	Limitations/Issues
D	Description		Medication code First generation antihistamine	Diagnosis code					y
	brompheniramine, carbinoxamine, chlorpheniramine,	ICD9 / CCS for ICD9							
Antihistamines (first	clemastine, cyproheptadine, dexbrompheniramine, dexchlorpheniramine, dimenhydrinate, diphenhydramine (oral), doxylamine, hydroxyzine, meclizine, clidinium-chlordiazepoxide,	ICD10 / CCS for ICD10				А	А		
generation)	dicyclomine, homatropine (excludes ophthalmic), methscopolamine, propantheline, promethazine, pyrilamine, triprolidine	Medication variable	first_gen_antihistamine						
METADATA D	METADATA Description	METADATA	A Medication code Antimuscarinics	B Diagnosis code	RISK		CODE	NOTES	Limitations/Issues
Antimuscarinics (urinary	darifenacin, fesoterodine, flavoxate, oxybutynin, solifenacin,	ICD9 / CCS for ICD9							
incontinence)	tolterodine, and trospium	ICD10 / CCS for ICD10				Α	А		
METADATA D	METADATA Description	Medication variable METADATA	Antimuscarinics A Medication code	B Diagnosis code	RISK		CODE	NOTES	Limitations/Issues
			Antiparkinsonian agents						
		ICD9 / CCS for ICD9						_	
Antiparkinsonian agents	benztropine, trihexyphenidyl	ICD10 / CCS for ICD10				Α	Α		
//ETADATA	METADATA	Medication variable METADATA	ac_park	D	RISK		CODE	NOTES	Lincianal and flamma
))	Description		Medication code Antipsychotics	Diagnosis code	RISK		CODE	NOTES	Limitations/Issues
Antipsychotics	chlorpromazine, clozapine, loxapine, olanzapine, perphenazine, thioridazine, trifluoperazine	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10				А	А	All these medications also included in highly sedating list	
//ETADATA	METADATA	Medication variable METADATA	antipsychotics_beers	В	RISK		CODE	NOTES	Limitations/Issues
D	Description		Medication code Antispasmodics	Diagnosis code	NISK		CODE	NOTES	Limitations/issues
	atropine, belladonna alkaloids, scopolamine (excluded	ICD9 / CCS for ICD9							
Antispasmodics	ophthalmic)	ICD10 / CCS for ICD10				Α	А		
ETADATA	METADATA Description	Medication variable METADATA	A Medication code	B Diagnosis code	RISK		CODE	NOTES	Limitations/Issues
			Skeletal muscle relaxants						
		ICD9 / CCS for ICD9						_	
Skeletal muscle relaxants	cyclobenzaprine, orphenadrine	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10				A	А	_	

			Sedative hypnot	ics:						
		Medication list m	odified from sedative load mo		2020)					
METADATA	METADATA	METADATA	A	В	RISK		CODE		NOTES	Limitations/Issues
ID	Description	METAPATA	Medication code Benzodiozepines	Diagnosis code	Hisk		CODE		NO.ES	Limations/issues
Benzodiazepines	Alprazolam, chlordiazepoxide, clorazepate, diazepam, halazepam, lorazepam, oxazepam, prazepam, clobazam, clonazepam, midazolam, estazolam, flurazepam, quazepam,	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10				A		А		
	remimazolam, remazepam, triazolam	Medication variable	benzo							
METADATA ID	METADATA Description	METADATA	A Medication code Non-benzo sedative hypnotics	B Diagnosis code	RISK		CODE		NOTES	Limitations/Issues
Nonbenzodiazepine sedative hypnotics	Zolpidem, zaleplon, eszopiclone	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10				А		А	_	
METADATA ID	METADATA Description	Medication variable METADATA	z_drug A Medication code	B Diagnosis code	RISK		CODE		NOTES	Limitations/Issues
Selected antiepileptic drugs	Phenobarbital, gabapentin, pregabalin	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	antiepileptic antiepileptic			A		A		
METADATA ID	METADATA Description	METADATA	A Medication code Sedating antipsychotics	B Diagnosis code	RISK		CODE		NOTES	Limitations/Issues
Selected antipsychotics	All first generation antipsychotics, quetiapine, olanzapine, and clozapine	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	antipsychotics sedating			A		A	_	
METADATA ID	METADATA Description	METADATA	A Medication code Promethazine & diphenhydramine	B Diagnosis code	RISK		CODE		NOTES	Limitations/Issues
		ICD9 / CCS for ICD9								
		ICD10 / CCS for ICD10								
Antihistamine	Promethazine and diphenhydramine					А		Α		
		Medication variable	antihistamine_sedative_load							
METADATA ID	METADATA Description	METADATA	A Medication code Doxepin	B Diagnosis code	RISK		CODE		NOTES	Limitations/Issues
Additional antidepressant	Doxepin	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	doxepin			А		A	Includes low-dose doxepin for insomnia	

	Definitions mo	dified from: Ribe et	al 2021 (https://hmion	STOPP Versio		et al. 2019 (https://pu	hmed nchi nlm nih sov/3	0914175 /)		
DATA	METADATA	METADATA	A	В	С	RISK	CODE	NOTES	Limitations/Issues	
	Description		Medication code Digoxin	Diagnosis code diastolic heart failure	Diagnosis code atrial fibrillation					
Digoxin for heart lure with normal istolic funcction	Stop digoxin for heart failure with normal systolic ventricular function (no clear evidence of benefit)	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable		O	nitted due to lack of informati	ion on systolic ventricular fun	ection			
	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
2. Verapamil or	Verapamil or diltiazem with NYHA Class	ICD9 / CCS for ICD9	Verapamil or diltiazem	Heart failure 428*, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93		A &B	_	"NYHA Class III or IV heart failure" excluded from definition. 2. No well- established criteria for assessing heart failure from		
or IV heart failure	iii or iv neart failure (may worsen neart failure).	Medication variable	verapamil_diltiazem		*	A QLD		diagnosis codes. The ICD codes included here reflect a consensus from several different sources.		
ADATA	METADATA Description	METADATA	A Medication code tw	B Medication code verapamil/diltiazem	RISK	CODE	NOTES	Limitations/Issues		
33. Beta-blocker + erapamil/diltiazem	Beta-blocker in combination with verapamil or diltiazem (risk of heart block).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	beta_blocker	verapamii_diltiazem	A & B	A & B (overlapping prescription)		Impossible to know from prescription drug data whether the patient was taking both simultaneously versus patient being told by physician to take one instead of the other.		
TADATA	METADATA Description	METADATA	A Medication code	B Diagnosis code	C Diagnosis code	D Measurement	RISK	CODE	NOTES	Limitations/Issues
	Description		beta-blocker	Bradycardia 427.8	Heart block 426.0, 426.10, 426.12, 426.13, 426.6, 426.9,	Heart rate				
Beta-blocker with radycardia or heart block	Beta blocker with bradycardia (< 50/min), type II heart block, or complete heart block (risk of complete heart block, asystole)	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Measurement Medication variable	beta_blocker	427.8 149.5, R00.1	426.13, 426.6, 426.9, 746.86 I44.1, I44.2, I44.3, I45.5, I45.9, Q24.6	HR < 50	А	A & (B C D within 6 months of beta-blocker prescription)	Diagnosis code for bradycardia/heart block or HR measurement < 50 within 6 months of beta- blocker prescription 2. Heart rate measurement comes from HRS face-to- face interview.	
TADATA	METADATA Description	METADATA	A Medication code	B Diagnosis code	C Medication code	RISK	CODE	NOTES	Limitations/Issues	
			Amiodarone	SVT	Beta blocker, digoxin, verapamil, diltiazem					
. Amiodarone as first- ne antiarrhythmic for	Amiodarone as first-line antiarrhythmic therapy in supraventricular tachyarrhythmias (higher risk of side-	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10			Omitted due to	difficulty in operationalizing	first-line therapy			
SVT	effects than beta-blockers, digoxin, verapamil or diltiazem)	Medication variable								
TADATA	METADATA Description	METADATA	A Medication code	B Diagnosis code	C Medication code	D Diagnosis code	E Diagnosis code	RISK	CODE	NOTES
			Loop divretics	Hypertension	Other antihypertensives (CCBs, thiazides, ACEi/ARB, potassium-sparing)	Chronic kidney disease	Heart failure			
Loop diuretic as first-	Loop diuretic as first-line treatment for		EDUP DISPETICE	турстстион	potaziani spaning)					
line treatment for hypertension	hypertension (safer, more effective alternatives available).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable				Omitted due to diffic	ulty in operationalizing first-line	therapy		
	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
. Loop diuretic for endent ankle edema	Loop diuretic for dependent ankle edema without dinical, biochemical evidence or radiological evidence of heart failure, liveraliure, neghrotic syndrome or renal failure (leg elevation and /or compression hosiery usually	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable			Omitted due to diffic	rulty in operationalizing				
	more appropriate). METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
	Stop thiazide diuretic with current									
8. Thiazide diuretics with electrolyte abnormalities	significant hypokalaemia (i.e. serum K+ < 3.0 mmol/l), hyponatraemia (i.e. serum Na+ < 130 mmol/l) hypercalcaemia (i.e. corrected serum calcium > 2.65 mmol/l) or with a history of gout (hypokalaemia, hyponatraemia, hypercalcaemia and gout can be precipitated by thiazide diuretic)	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable			Omitted due to lack of	information on lab values				
TADATA	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
89. Loop diuretic and urinary incontinence	Loop diuretic for treatment of hypertension with concurrent urinary incontinence (may exacerbate incontinence).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable			Omitted due to diffic	rulty in operationalizing				
	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
	Centrally-acting antihypertensives (e.g.	ICD9 / CCS for ICD9								
10. Centrally-acting antihypertensives	methyldopa, clonidine, moxonidine, rilmenidine, guanfacine), unless clear intolerance of, or lack of efficacy with, other classes of antihypertensives	ICD10 / CCS for ICD10			A	А	Not possible to code 'unless clear intolerance of, or lack of efficacy with, other			
	(centrally-active antihypertensives are generally less well tolerated by older people than younger people)	Medication variable	cns_alpha_agonists				classes of antihypertensives'.			
'ADATA	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
B11. ACEI/ARB in	Stop ACE inhibitors or Angiotensin Receptor Blockers in patients with	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10			Omitted due to lack of	information on lab values				
hyperkalemia ADATA	hyperkalemia. METADATA Description	Medication variable METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
B12. Aldosterone antagonists and ACEI/ARB without monitoring	Stop aldosterone antagonists (e.g., spirnonlactone, eplerenone) with concurrent potassium-conserving drugs (e.g. ACE's, ARB's, amloride, triumterene) without monitoring of serum potassium (risk of dangerous hyperfalaemis	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable			ack of information on Iab valu	es and frequency of monitori	ng for hyperkatemia			
	METADATA Description	METADATA	A Medication code PDE-S inhibitors	B Diagnosis code Heart failure	C Medication code Nitrates (excluding PRN nitrates)	RISK	CODE	NOTES	Limitations/Issues	
PDE-5 inhibitors in heart failure	Stop phosphodiesterase type-5 inhibitors (e.g. sildenafil, tadalafil, vardenafil) in severe heart failure characterized by hypotension i.e. extolir RP < 90 mmHe or concurrent	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10		Heart failure 428*, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93 150*, 111.0, 113.0, 113.2		A	A & [B C]	Excludes PRN nitrates like sublingual nitroglycerin	Not possible to encode severe heart failure	

nitrate therapy for angina (risk of cardiovascular collapse) Medication variable pde

	cardiovascular collapse)	Medication variable	pde		nitrates						
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues			
C1. Long-term aspirin >		ICD9 / CCS for ICD9									
160 mg/day	than 160mg per day	ICD10 / CCS for ICD10 Medication variable				e receiving prescribed aspirin					
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues			
C2. Aspirin and PUD	Stop aspirin with a past history of	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10			0						
	peptic ulcer disease without concomitant PPI	Medication variable			Omitted as very few people	e receiving prescribed aspirin					
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	C Diagnosis code	D Diagnosis code	RISK	CODE	NOTES	Limitations/Issues	
			Antiplatelet agents, vitamin K								
			antagonists, direct thrombin inhibitors, factor Xa inhibitors		Recent GI bleeding	Cerebral hemorrhage					
C3. Antiplatelets or	Aspirin, clopidogrel, dipyridamole, vitamin K antagonists, direct thrombin	ICD9 / CCS for ICD9		286.0, 286.1, 286.4, 287.31 D66, D67, D68.0, D69.3		430*, 431*, 432*			1. "Uncontrolled severe		
anticcoagulants with concurrent significant	inhibitors or factor Xa inhibitors with concurrent significant bleeding risk, i.e.	ICD10 / CCS for ICD10		D66, D67, D68.0, D69.3	K92.0, K92.1, K92.2	160*, 161*, 162*	А	A & [B C D within 1 year]			
bleeding risk	uncontrolled severe hypertension, bleeding diathesis, recent non-trivial	Medication variable	antiplatelets, anticoagulant						within 1 year of prescription.		
	spontaneous bleeding										
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues			
	Stop aspirin plus clopidogrel as	ICD9 / CCS for ICD9									
C4. Aspirin and	secondary stroke prevention, unless the patient has a coronary stent(s) inserted	ICD10 / CCS for ICD10									
clopidogrel as secondary stroke prevention	concurrent acute coronary syndrome or				Omitted as very few peopl	e receiving prescribed aspirin					
	has a high grade symptomatic carotid arterial stenosis	Medication variable									
METADATA	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues			
	DESCRIPTION	ICD9 / CCS for ICD9	medication code	Diagnosis code							
	Stop aspirin in combination with	ICD10 / CCS for ICD10									
C5. Aspirin & anticoagulant	vitamin K antagonist, direct thrombin inhibitor or factor Xa inhibitors in				Omitted as very few peopl	e receiving prescribed aspirin					
	patients with chronic atrial fibrillation (no added benefit from aspirin).	Medication variable									
METADATA	METADATA	METADATA	A	В	c	D	RISK	CODE	NOTES	Limitations/Issues	
ID	Description		Medication code	Medication code	Diagnosis code Coronary implant (CABG or	Diagnosis code					
	Stop antiplatelet agents with vitamin K		Antiplatelets	Anticoaquiant	PCI)	Acute coronary syndrome					
C6. Antiplatelets &	antagonist, direct thrombin inhibitor or factor Xa inhibitors in patients with	ICD9 / CCS for ICD9									
anticoagulant	stable coronary, cerebrovascular or peripheral arterial disease (no added	ICD10 / CCS for ICD10			On	itted due to difficulty in oper	ationalizing from claims data				
	benefit from dual therapy)	Medication variable									
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues			
		ICD9 / CCS for ICD9	Ticlopidine								
C7. Ticlopidine	Ticlopidine in any circumstances (clopidogrel and prasugrel have similar	ICD10 / CCS for ICD10			A	A					
	efficacy, stronger evidence and fewer side-effects).										
METADATA ID	METADATA Description	Medication variable METADATA	A Medication code	B Diagnosis code	B Diagnosis code	B Diagnosis code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues
	Stop vitamin K antagonist, direct thrombin inhibitor or factor Xa	ICD9 / CCS for ICD9	Anticoaqulants	Deep venaus thrombasis	Pulmonary embolus	Atrial fibrillation	Mechanical heart value				
C8 Anticoagulant for first	t thrombin inhibitor or factor Xa inhibitors for first deep venous										
DVT without continuing	innibitors for first deep venous	ICD10 / CCS for ICD10									
C8. Anticoagulant for first DVT without continuing provoking risk factors for > 6 months	provoking risk factors (e.g.	ICD10 / CCS for ICD10				Omitted due to diffic	ulty in operationalizing from clai	ms data			
provoking risk factors for		Medication variable METADATA	А	В	RISK		ulty in operationalizing from clai				
provoking risk factors for > 6 months	provoking risk factors (e.g. thrombophilia) for > 6 months, (no proven added benefit)	Medication variable METADATA	A Medication code	B Diagnosis code	RISK	Omitted due to diffic		ms data Limitations/Issues			
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provoking risk factors for 56 m onths. METADATA D C9. Arnicas gulant for first P without continuing, provoking risk factors for sketch of the continuing ri	providing risk Sectors (e.g. textonologiship Se or Secretis, (e.g. textonologiship Se or Secretis, (for proven added benefit) METADATA Description Solv stams it astrogonist, disect Solv stams of astrogonist, disect solvent continuing providing risk actors (e.g. textonologiship) for 32 z moints (for providing risk actors (e.g. textonologiship) for 32 z moints (for providing risk actors (e.g. textonologiship) for 32 z moints (for providing risk actors (e.g. textonologiship) for 32 z moints (for providing risk actors (e.g. textonologiship) METADATA Description Stop NASIU and vistamis K antagonist, and circet through solviblator or factor 5 x direct through solviblator or factor 5 x solviblators (e.g. textonologiship) Stop NASIU and vistamis K antagonist, and circet through solviblator or factor 5 x solviblators (e.g. textonologiship) Stop NASIU and vistamis K antagonist, and circet textonologiship or factor 5 x solviblators (e.g. textonologiship) Stop NASIU and vistamis K antagonist, and circet textonologiship or factors (e.g. textonologiship) Stop NASIU and vistamis K antagonist, and circet textonologiship or factors (e.g. textonologiship) Stop NASIU and vistamis K antagonist, and circet textonologiship or factors (e.g. textonologiship) Stop NASIU and vistamis K antagonist, and circet textonologiship or factors (e.g. textonologiship) Stop NASIU and vistamis K antagonist, and circet textonologiship or factors (e.g. textonologiship) Stop NASIU and vistamis K antagonist, and circet textonologiship or factors (e.g. textonologiship) Stop NASIU and vistamis K antagonist, and circet textonologiship or factors (e.g. textonologiship) Stop NASIU and vistamis K antagonist, and circet textonologiship or factors (e.g. textonologiship) Stop NASIU and vistamis (e.g. textonologiship)	Medication variable METADATA ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA	A Medication code A Medication code A Medication code Anticoogulants	B Medication code	Omitted due to difficulty in o	CODE	NOTES NOTES 1. msald medication variable	Limitations/Issues			
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ID	Description		Medication code	Diagnosis code								
		ICD9 / CCS for ICD9	Benzodiazepines			_		_				
0.0	Stop benzodiazepines for ≥ 4 weeks (no indication for longer treatment; all benzodiazepines should be withdrawn	ICD10 / CCS for ICD10										
D5. Benzodiazepines for >4 weeks	gradually if taken for more than 4 weeks as there is a risk of causing a benzodiazepine withdrawal syndrome if				STOPP K1 is a broader ca	regory so this is excluded						
	stopped abruptly).	Medication variable										
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues				
			Antipsychotics (except quetiapine, clozapine, and pimavanserin)	Parkinson disease and Lewy body disease								
D6. Antipsychotics in	Stop antipsychotics (i.e. other than quetiapine or dozapine) in those with	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10		332, 333.0, 331.6, 331.82 G20, G21, G22, G23, G31.83, G31.85	A	A & B						
parkinsonism/LBD	parkinsonism or Lewy Body Disease (risk of severe extra-pyramidal symptoms)	Medication variable	antipsychotics_beers_park		*	AGD						
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues				
			Anticholinergic medications to treat EPS (e.g., benztropine)	Antipsychotics								
		ICD9 / CCS for ICD9										
D7. Anticholinergics to treat EPS	Stop anticholinergics/antimuscarinics to treat extra-pyramidal side-effects of neuroleptic medications (risk of	ICD10 / CCS for ICD10		Omitted due to difficulty in dete	rmining reason for use of med	lications to treat EPS (and sh	ows up in anticholinergic doma	in)				
	anticholinergic toxicity).	Medication variable										
METADATA	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues				
		ICD9 / CCS for ICD9	Anticholinergic medications from Beer's Table 7									
	Stop anticholinergics/antimuscarinics in						This criterion applies to all patients in the dementia cohort.					
D8. Anticholinergics in dementia/delirium	patients with delirium or dementia (risk of exacerbation of cognitive impairment).				A	A	"Anticholinergics/antimuscar nics" overlaps with	i				
			anticholinergics_table_7				anticholinergic medications from Beer's Table 7					
METADATA ID	METADATA Description	METADATA	A Medication code Antipsychotics	B Diagnosis code Schizophrenia	C Diagnosis code Bipolar disorder	RISK	CODE	NOTES	Limitations/Issues			
				ICD9 295 (Shizophrenic								
				disorders), 297 (delusional disorders), 298 (other nonorganic psychoses), 301.2	ICD9 296 (Episodic mood disorders) OR CCS 5.8.1							
				(Shizoid personality disorder), OR CCS 5.10 (Schizophrenia and other psychotic disorders)	(Bipolar disorders)							
	Stop neuroleptic antipsychotic in patients with behavioral and psychological symptoms of dementia	ICD9 / CCS for ICD9		,				We exclude patients with diagnosis code for schizophrenic	Excluded "unless symptoms are severe and			
D9. Antipsychotics in BPSD	(BPSD) unless symptoms are severe and other non-pharmacological treatments have failed (increased risk			ICD 10 F20-F29 (Schizophrenia,	ICD10 F30 (manic episode),	А	A & (IB IC)	disorders/psychosis or bipolar disorder. 2. Medication definition includes all	other non- pharmacological treatments have failed"			
	of stroke).	ICD10 / CCS for ICD10		schizotypal, and delusional disorders) OR CCS MBD001 (Schizophrenia spectrum and	F31 (bipolar affective disorder) OR CCS MBD003 (Bipolar and related			antipsychotics (1st and 2nd generation)	treatments have railed			
				other psychotic disorders)	disorders)							
		Medication variable	Antipsychotics all									
METADATA	METADATA		.,,,,,,,,,									
		METADATA	A	В	RISK	CODE	NOTES	Limitations/Issues				
ID	Description	ICD9 / CCS for ICD9	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues				
D10. Neuroleptics as	Stop neuroleptics as hypnotics, unless sleep disorder is due to psychosis or dementia (risk of confusion,	ICD9 / CCS for ICD9				-	NOTES	Limitations/Issues				
D10. Neuroleptics as hypnotics	Stop neuroleptics as hypnotics, unless sleep disorder is due to psychosis or demental (risk of contision, hypotension, extra-pyramidal side effects, falls).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable			operationalizing (and overlap i	vith D9 given that entire coh						
D10. Neuroleptics as	Stop neuroleptics as hypnotics, unless sleep disorder is due to psychosis or demental (risk of contision, hypotension, extra-pyramidal side effects, falls).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	A Medication code	Omitted due to difficulty in 18 B Diagnosis code	sperationalizing (and overlap t C Diagnosis code	with D9 given that entire coh Diagnosis code	ort is patients with dementia) E Vital sign	F Medication Beta-blocker, digoxin,	RISK	CODE	NOTES	Limitations/Issues
D10. Neuroleptics as hypnotics	Stop neuroleptics as hypnotics, unless sleep disorder is due to psychosis or dementa frisk of confusion, hypotension, extra-psyamidal side effects, falls). METADATA Description	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	A	Omitted due to difficulty in a	operationalizing (and overlap v	Diagnosis code Meart block 426.0, 426.10, 426.12,	ort is patients with dementia)	F Medication	RISK	CODE	NOTES	Limitations/Issues
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D10. Neuroleptics as hypoteles METADATA D11. Orlis with bradycardia/heart block METADATA D12. Phenothiarines METADATA D D13. Levodopa or dopamine agonists for benign esponists for benign espo	Stop neurolepites as hypoteits, unless sleep placeder is due to psychosis or dements in first of conductor. hypotension, extra eyramaid side effects, fails). Stop acetylchybinesterase inhibitors with a known history of persistent bradgered (e. Old beard in the properties of the pr	ICDD / CCS for ICDD ICDD / CCS for ICDD Medication variable METADATA ICDD / CCS for ICDD METADATA ICDD / CCS for ICDD Medication variable METADATA	A. Medication code Cholinesterase inhibitors Chelinesterase inhibitors Chelinesterase inhibitors Chelinesterase inhibitors Chelinesterase inhibitors A. Medication code Levolopa & deparative agenesis A. Medication code First generation antihistamines first_gen_antihistamine A. Medication code diquoti	Omitteed due to difficulty in: B Diagnosis code Syncope 780.2 RSS Diagnosis code Omitted as this is co Diagnosis code B Diagnosis code	C Diagnosis code Ricolycardia 427.8 149.5, R00.1 RISK C Diagnosis code Ricolycardia 27.8 27.8 27.8 27.8 27.8 27.8 27.8 27.8	Dibignosis code Neor block Meror block A 250, 426.10, 426.12, 426.3, 426.5, 146.6, 426.5 Method block Method	CODE A & B & IC A & TDD greater than 125- up(day) & B E C	F Medication Medicatio	Limitations/Issues	A & [B within 1 year C within 1 year D within 1 year E within 1 year F (overlapping		Limitations/issues
D10. Neurolepiica as hypoteks Neurolepiica as Neu	Stop neuroleptics as hypototics, unless sleep glacorder is due to psychosis or dementar first of confusion. Psychosis or dementar first of confusion with all snown history of persistent the psychosis of confusion or dementar first or dementar despitioned sproge or concurrent treatment with drugs that reduce heart are such as better dementar first or despition of psychope or concurrent first meritar despition first or despition of psychope or concurrent first despition. Psychope or concurrent first despition of despition o	ICDD / CCS for ICDD ICDD / CCS for ICDD Medication variable METADATA ICDD / CCS for ICDD Medication variable ICDD / CCS for ICDD	A Medication code Cholinesterose inhibitors Chelinesterose inhibitors Chelinesterose inhibitors Chelinesterose inhibitors Chelinesterose inhibitors Chelinesterose inhibitors A Medication code Eurodopa & dopamine aganists Medication code First generation antihistamines Sersa, gen_antihistamine A Medication code dipoxin A Medication code dipoxin	Omitted due to difficulty in: Diagnosis code Syncore 780.2 RSS Diagnosis code Cirrietted as this is ex Cirrietted as this is ex Biagnosis code Braignosis code Circitated as this is ex Circitated as this is ex Diagnosis code Renige esential fremov 781.0, 333.1 G25.0 Diagnosis code CVS Stoge d or higher 585.4, 585.5, 585.6 NIB.4, NIB.5, NIB.6 Diagnosis code	C Diagnosis code 149.5, ROO.1 RISK C Diagnosis code 149.5, ROO.1 RISK A C C C C C C C C C C C C C C C C C C	Unit D9 given that entire cof Diagnosis code Part 186x 125.0, 425.12, 426.12, 426.13, 426.14,	ort is patients with dementia) E Vital sign Heart rate <60 beats/min NOTES CODE (A & B & IC NOTES	F Medication Medicatio	Limitations/Issues	A & [B within 1 year C within 1 year D within 1 year E within 1 year F (overlapping		Limitations/Issues
D10. Neuroleptics as hyporotics Metadata D11. Oritis with bradycardis/heart block METADATA D12. Phenothissines METADATA D 13. Levedopa or dopamine agonists for being a sential trenor dopamine agon	Stop neurolegitics as hypotoxics, unless sleep glacorder is alle to psychosis or dementar first of confusion. Psychosis or dementar first or dementar	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA ICD9 / CCS for ICD10 ICD10 /	A Medication code Cholinesterose inhibitors Cholinesterose inhibitors Cholinesterose inhibitors Cholinesterose inhibitors Cholinesterose inhibitors A Medication code Medication code Medication code First generation annihistamines First gen_antihistamine A Medication code disposin All Medication code Direct thrombin inhibitors	Omitted due to difficulty in: Billiansis code Syncope 780.2 R55 Billiansis code Omitted as this is co Billiansis code Benign essential tempor 781.0, 333.1 G25.0 Billiansis code CXD Stope of or higher CXD Stope of or higher CXD Stope of or higher SSS-0, 385.5, 385.6 N18.4, N18.5, N18.6	C Diagnosis code 8/10/2/8 A 27.8 149.5, R00.1 RISK C Diagnosis code 427.8 149.5, R00.1 RISK C Diagnosis code 228.3 239.3 230.3 231.83, G31.85 RISK A C Liboratory value Cystorior C Calculated eGFR < 30 C Liboratory value Cystorior C	Dibignosis code Neor block Meor block Method block Met	CODE A & B & IC A & TDD greater than 125- up(day) & B E C	F Medication Medicatio	Limitations/Issues	A & [B within 1 year C within 1 year D within 1 year E within 1 year F (overlapping		Limitations/Issues
D10. Neurolegistic as hypototics with physiotics of the physiotics	Stop neurologitics as hypototics, unless sleep glacorder is due to psychosis or dements in first of constulation, hypotomistics of dements in first of constulation, hypotomistics or dements in first of constulation. Proceedings of the construction of the constructio	ICD9 / CCS for ICD9 ICD30 / CCS for ICD30 Medication variable METADATA ICD9 / CCS for ICD3 ICD30 / CCS for ICD30 ICD30 / CCS for	A Medication code Cholinesterase inhibitors Chelinesterase inhibitors Chelinesterase inhibitors Chelinesterase inhibitors A Medication code Levadopa & dopamine agonists parkinson A Medication code First generation antihistamines first_gen_antihistamine A Medication code digosin A Medication code digosin A Medication code Direct streambes minibitors thrombin	Omitted due to difficulty in: B Diagnosis code 5yncope 780.2 R55 Diagnosis code Cmitted as this is co Bening essential tremor 781.0, 333.1 G25.0 B Diagnosis code B Diagnosis code B Diagnosis code CVD Stoge of or higher 500 Stoge of or higher	C Diagnosis code 8 molycordio 427.8 149.5, R00.1 RISK C Diagnosis code 427.8, 149.5, R00.1 RISK A C Liboratory value Cystotion C Calculated eGFR < 30 C Liboratory value Cystotion C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30 C Calculated eGFR < 30	Unit D9 given that entire cot Diagnosis code Hart Block 425.0, 425.0, 425.1, 425.1, 426.1, 426.1, 426.1, 426.1, 426.4, 426.1, 426.6, 426.9, 426.1, 426.4, 426.1, 426.6, 426.9, 426.8, 426.9, 426.8, 426.9, 426.8, 426.9, 426.8, 426.9, 426.8, 426.9, 426.8, 426.9, 426.8, 42	core spatients with dementia) E Vital slap - K60 beats/min NOTES CODE A & B & IC NOTES CODE (A & T00 greater than 125 CODE CODE CODE CODE	F Medication Medication Metro-ficker, digonin, difficeren, verapomil beta_blocker, digoxin, verapomil Limitations/Issues I. Parkinson medication variables includes levoriops and dopamine agenits 2. Exclude diagnosis of Parkinson disease, secondary Parkinson disease, secondary Parkinson disease, to the secondary Pa	Limitations/Issues	A & 8 within 1 year 0 within 1 year 1 within 1 year 5 within 1 year 6 within 1 year 6 within 1 year 6 within 1 year 6 wordsping prescription with A)		Limitations/Issues

ID	Description		Medication code	Diagnosis code	Laboratory value					
E3. Factor Xa inhibitors if	Stop factor Xa inhibitors (e.g. rivaroxaban, apixaban) if eGFR < 15	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Factor Xa inhibitors	CKD Stage 5 or higher 585.5, 585.6 N18.5, N18.6	Cystatin C	A	A & (B C)			
eGFR < 15 METADATA	ml/min/1.73m2 (risk of bleeding) METADATA	Medication variable METADATA	factor_Xa	В	Calculated eGFR < 15	RISK	CODE	NOTES	Limitations/Issues	
ID	Description	ICD9 / CCS for ICD9	Medication code NSAIDs (all)	Diagnosis code CKD Stage 3 or higher 585.3, 585.4, 585.5, 585.6	Laboratory value Cystatin C					
E4. NSAIDs if eGFR < 50	Stop NSAID's if eGFR < 50 ml/min/1.73m2 (risk of deterioration in renal function).	ICD10 / CCS for ICD10 Medication variable	nsaid	N18.3, N18.4, N18.5, N18.6	Calculated eGFR < 50	А	A & (B C)	Using a definition of CKD Stage 3 or higher although technically CKD Stage 3 starts at eGFR 60		
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	C Laboratory value	RISK	CODE	NOTES	Limitations/Issues	
ES. Colchicine if eGFR <	Stop colchicine if eGFR < 10 ml/min/1.73m2 (risk of colchicine	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	colchicine	CKD Stage 5 or higher 585.5, 585.6 N18.5, N18.6	Cystatin C	A	A & (B C)			
10 METADATA	toxicity) METADATA	Medication variable METADATA	A	В	Calculated eGFR < 10	RISK	CODE	NOTES	Limitations/Issues	
ID	Description	ICD9 / CCS for ICD9	Medication code metformin	Diagnosis code CKD Stage 4 or higher 585.4, 585.5, 585.6	Laboratory value Cystatin C					
E6. Metformin if eGFR < 30	ml/min/1.73m2 (risk of lactic acidosis).	ICD10 / CCS for ICD10 Medication variable	metformin	N18.4, N18.5, N18.6	Calculated eGFR < 30	А	A & (B C)			
METADATA ID	METADATA Description	METADATA	A Medication code Metoclopramide or	C Diagnosis code Parkinson disease and Lewy	RISK	CODE	NOTES	Limitations/Issues		
F1. Prochlorperazine or	Stop prochlorperazine or metoclopramide with Parkinsonism	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	prochlorperazine	body disease 332, 333.0, 331.6, 331.82 G20, G21, G22, G23, G31.83, G31.85			Metoclopramide medication code includes			
metodopramide with Parkinsonism	(risk of exacerbating Parkinsonian symptoms).	Medication variable	metoclopramide	G31.85	A	A & B	metoclopramide and prochlorperazine			
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
	Stop PPI for uncomplicated peptic ulcer	ICD9 / CCS for ICD9	High dose PPI							
F2. PPIs at full dose	disease or erosive peptic esophagitis at full therapeutic dosage for > 8 weeks (dose reduction or earlier discontinuation indicated).	ICD10 / CCS for ICD10			A (>8 weeks or 60 days)	A (>8 weeks or 60 days)				
METADATA	METADATA	Medication variable METADATA	A	В	RISK	CODE	NOTES	Limitations/Issues		
ID	Description		Medication code	Diagnosis code						
	Stop drugs likely to cause constipation (e.g. antimuscarinic/anticholinergic	ICD9 / CCS for ICD9								
F3. Drugs likely to cause constipation	doune oral iron opinide saranamil	ICD10 / CCS for ICD10			Omitted due to diffic	culty in operationalizing				
	chronic constipation where non- constipating alternatives are available (risk of exacerbation of constipation).	Medication variable								
METADATA	METADATA	METADATA	А	В	RISK	CODE	NOTES	Limitations/Issues		
ID	Description	ICD9 / CCS for ICD9	Medication code	Diagnosis code						
	Stop oral elemental iron doses greater than 200 mg daily (e.g. ferrous fumarate> 600 mg/day, ferrous sulphate > 600 mg/day, ferrous	ICD10 / CCS for ICD10								
F4. High-dose iron	gluconate> 1800 mg/day; no evidence	Medication variable			Omitted due to rarity of peo	ple receiving prescription iro	1			
	of enhanced iron absorption above these doses).	wedication variable								
METADATA ID	METADATA Description	METADATA	A Medication code	B Medication code Inhaled corticosteroids, antimuscarinic, beta-	RISK	CODE	NOTES	Limitations/Issues		
		ICD9 / CCS for ICD9	Theophylline	adrenergics						
G1. Theophylline as monotherapy in COPD	Stop theophylline as monotherapy for COPD (safer, more effective alternative; risk of adverse effects due to narrow therapeutic index).	ICD10 / CCS for ICD10 Medication variable			Omitted due to diffic	ulty in operationalizing				
METADATA		METADATA	A	В	RISK	CODE	NOTES	Limitations/Issues		
METADATA ID	Description		A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
ID	Description Stop systemic corticosteroids instead of inhaled corticosteroids for maintenance.	ICD9 / CCS for ICD9	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
METADATA ID G2. Systemic conticosteroids for COPD	Description Stop systemic corticosteroids instead of inhaled corticosteroids for maintenance therapy in moderate-severe COPD (unnecessary exposure to long-term side-effects of systemic corticosteroids		A Medication code				NOTES			
ID G2. Systemic	Stop systemic corticosteroids instead of inhaled corticosteroids for maintenance therapy in moderate-severe COPD (unnecessary exposure to long-term	ICD9 / CCS for ICD9	A Medication code							
ID G2. Systemic	Description Stop systemic corticosteroids instead of inhaled corticosteroids for maintenance therapy in moderate severe COPD (unnecessary exposure to long-term side-effects of systemic controlosteroids and effective inhaled therapies are available)	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	A Medication code					h)	Limitations/Issues	
G2. Systemic corticosteroids for COPD	Description Stop systemic controsteroids instead of inhalest controsteroids for maintenance inhalest controsteroids for maintenance inhalest controsteroids and inhalest controsteroids and effective inhalest offeropies are available) METADATA Description	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	А	Omitted due to difficulty in oper	ationalizing (definition of mo	derate/severe COPD, excludii	ng alternative reasons for steroic	h)	Limitations/Issues	
G2. Systemic corticosteroids for COPD METADATA ID G3. Antimuscarinic	Description Step systemic conticusteensis instead of instead conticused in maintenance thereby in moderate-sever CDPD (uninnecessary sepour to long-term side effects of systemic conticusteroids and effective inhields therepies are available) METADATA Description Step anti-muscarinic bronchodillators (e.g. juratropium, tiotropium) with a history of narrow angle glacuscan (en)	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA	A Medication code Anti-muscarinic	Omitted due to difficulty in oper	ationalizing (definition of mo C Diagnosis code 8PH/urinary retention	derate/severe COPD, excludio	ng alternative reasons for steroid	h)	Limitations/hssues	
G2. Systemic corticosteroids for COPD METADATA	Description Stop systemic continues ends instead of sinked continues to the sinked continues of the management through in moderate owner CDPD (unmerceasing years) and soften the sinked therapies are sinked effects of systemic continues and effective inhales therapies are sinked therapies are sinked therapies are sinked therapies and effective inhales the sinked therapies are sinked therapies are sinked the sinked	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	A. Medication code Marti-muscarinic branchodilators	Omitted due to difficulty in opes B Diagnosis code Narrow angle glaucome 356.2	c Diagnosis code 8PH/urinary retention 600°, 788.2°	derate/severe COPD, excludii	ng alternative reasons for steroic	h)	Limitations/fissues	
G2. Systemic corricosteroids for COPD METADATA G3. Antimuscarinic bronchodilators with specific comorbidities	Description Stop systemic contrasteroids instead of inhabed contrasteroids for maintenance therapy in moderate-sever CDFD (unnecessary sepace to long-term side effects of systemic corticosteroids and effective shided therapies are available) METADATA Description Stop anti-muscarinic bronchodilators (e.g., ipastropium, storopium) with a history of narrow angle glaucoma (my substancy of surviva angle glaucoma (my control cont	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	A Medication code Anti-macramic bencheditatory inhaled_etichoinergic A	Omitted due to difficulty in open B Diagnosis code Narrow angle placecomp 356.2 H40.2	c Diagnosis code 8PH/urinary retention 600°, 788.2°	derate/severe COPD, excludio	ng alternative reasons for steroid	h)	Limitations/fissues	
G2. Systemic corticosteroids for COPD METADATA G3. Antimuscarinic bronchodilators with specific comorbidities	Description Stop systemic continues and discussed of available continues for manners and and continues for manners and and continues are supported by the systemic continues are swelled for manners and effective highest therapies are available. METADATA Description Stop anti-muscarinic bronchodilators (e.g., ipartopium, biotropium) with a hatery of narrow angle glacutoms (may north or formation of marrow angle glacutom (may north or formation (may cause uninary retention).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	A. Medication code Marti-muscarinic branchodilators	Omitted due to difficulty in opes B Diagnosis code Narrow angle glaucome 356.2	ationalizing (definition of mo C Diagnosis code BPH/urinory retression 600°, 788.2° N40, R33	derate/severe COPD, excludi RISK	ng alternative reasons for steroic CODE A & (B C)	NOTES	Limitations/haues	
G3. Systemic conticosteroids for COPD METADATA ID G3. Antimuscarinic bronchodilators with specific comorbidities METADATA ID G4. Benzo and	Description Stop systemic corticosterouls instead of inhaled contributerouls for maintenance through it is made to the inhaled contributerouls for maintenance through it moderate-sever CDPD (unnecessary sepour to long term side effects of systemic contributerouls and effective thinks of the inhale of the inh	ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD10 Medication variable METADATA ICD10 / CCS for ICD10 Medication variable METADATA	Medication code Anti-micronine branchodistors inhaled_entichoinergic A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle placecomp 356.2 H40.2	ationalizing (definition of mo	derate/severe COPD, excludi RISK	ong alternative reasons for steroid CODE A & (B C) NOTES	NOTES	Limitations/ksues	
G2. Systemic conficonteroids for COPD METADATA ID G3. Antimuscarinic bronchodilators with specific comorbidities METADATA ID	Description Stop systemic contrasteroids instead of inhabited contrasteroids from maintenance through in moderate-sever CDPD (jumneessary sepace to long term side effects of systemic contrasteroids and effective shaded thereignes are available) METADATA Description Stop anti-muscarinic bronchodilators (e.g. juratropium, storopium) with a history of narrow angle glaucoma (my cascratate glaucoma) or bladder control without confine with a most control with a modern control with a	ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD10 Medication variable METADATA ICD10 / CCS for ICD10 Medication variable METADATA	Medication code Anti-micronine branchodistors inhaled_entichoinergic A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle placecomp 356.2 H40.2	ationalizing (definition of mo	derate/swere COPD, excluding BISK. A	ong alternative reasons for steroid CODE A & (B C) NOTES	NOTES	Limitations/ksues	
G2. Systemic corticosteroids for COPD METADATA ID G3. Antimuscarlinic bronchodilators with specific comorbidities METADATA ID G4. Benzo and G4. Benzo and METADATA METADATA	Description Stop systems contracted of inhald controlled on the inhald controlled on maintenance through it made to the inhald controlled on the inhald controlled on the inhald inh	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METABATA ICD9 / CCS for ICD10 Medication variable METABATA ICD9 / CCS for ICD10 ICD10 / CCS for ICD10	Medication code Anti-micronine branchodistors inhaled_entichoinergic A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle placecomp 356.2 H40.2	ationalizing (definition of mo	derate/swere COPD, excluding BISK. A	ong alternative reasons for steroid CODE A & (B C) NOTES	NOTES NOTES Limitations/Issues		Limitations/Issues
G3. Antimuscarinic bronchodistors with specific comorbidities METADATA ID G3. Antimuscarinic bronchodistors with specific comorbidities METADATA ID G4. Benno and acute/cfnowic respiratory acute acute/cfnowic respiratory	Description Stop systemic continuences instead of instances of instan	ICD9 / CCS for ICD9 Medication variable METADATA Medication variable METADATA ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD9 METADATA ICD9 / CCS for ICD9 METADATA ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD9 Medication variable Medication variable	A Medication code Anti-macramic bencheditatory inhaled_etitichoinergic A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle glaucome 356.2 H40.2 B Diagnosis code B Diagnosis code B STAND CONTRACTOR	ationalizing (definition of mo C Diagnosis code BPH/Initiary yeteration 600*, 786.2.** N440, R33 R5K. Omitted due to lack of info	derate/severe COPD, excludio RISIX A CODE	ong alternative reasons for steroid CODE A & (B C) NOTES	NOTES NOTES Limitations/Issues		Limitations/Issues
G3. Antimuscarinic bronchodilators with specific comorbidities METADATA ID G3. Antimuscarinic bronchodilators with specific comorbidities METADATA ID G4. Benzo and acute/choicir espirationy failure	Description Stop systemic conticosteroids instead of inhabit controlsteroids for maintenance threigh inhabit controlsteroids for maintenance threigh in moderate-sever CDPD (jurneecasive peops to leng-term side effects of systemic controlsteroids and effects of systemic controlsteroids and effects of systemic controlsteroids. METADATA Description METADATA Description Stop bearcodisceptines with acute or chronic respiratory failure (e. gib exit of properties). METADATA Description Stop bearcodisceptines with acute or chronic respiratory failure (e. gib 2 4.0 Mp = gib 2 0.0 Mp = gib 2 0.0 4.0 Mp = gib 2 0.0	ICDB / CCS for ICDB Medication variable METADATA ICDB / CCS for ICDB Medication variable METADATA MEGDATA METADATA ICDB / CCS for ICDB MEDICATOR / CCS for ICDB MEDICATOR / CCS for ICDB MEDICATOR / CCS for ICDB METADATA METADATA METADATA METADATA METADATA METADATA METADATA METADATA METADATA	A Medication code Anti-muzcarinic bross-hodilators inhaled_anticholonergic A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow anale aleascama 33.6.2 H40.2 H40.2 B Diagnosis code Wistory of PLUS Chiberling \$50.275.3315.53247,5327,3325,5345,5378	ationalising (definition of ma C Diagnosis code BPH/sining/yestention 600*, 782.2* N40, R33	derate/severe COPD, excluding the severe COPD, e	ong alternative reasons for steroid CODE A & (B C) NOTES	NOTES NOTES Limitations/Issues		Limitations/Issues
G2. Systemic corticosteroids for COPD MRTADATA ID G3. Antimuscarinic bronchodilators with specific comorbidities MRTADATA ID G4. Bento and acute/chieses respectory failure MRTADATA ID MRTADATA ID	Description Stop systemic continuences instead of inshed continuences for maintenance through it makes the inshed continuences for maintenance through it moderate-sever CDPD (jurnecessary separate to large form sale effects of systemic contrastration). METADATA Description METADATA Description (may cause unique several systemic contrastration for any contrastration for any contrastration for systemic contrastration for separatory failure. METADATA Description Stop non-steroidal anti-inflammatory drug (MSAID) other than CDX2 selective agents with short or systemic contrastration of respiratory failure).	ICDB / CCS for ICDB Medication variable METADATA ICDB / CCS for ICDB Medication variable METADATA MEGDATA METADATA ICDB / CCS for ICDB MEDICATOR / CCS for ICDB MEDICATOR / CCS for ICDB MEDICATOR / CCS for ICDB METADATA METADATA METADATA METADATA METADATA METADATA METADATA METADATA METADATA	A Medication code Anti-muzcarinic bross-hodilators inhaled_anticholonergic A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle glaucome 36.6.2 H40.2 B Diagnosis code Biagnosis code Nation of PUD, Gi bireding 530.7,5317,5327,5337,5327,5337,5327,5337,5337,533	ationalising (definition of ma C Diagnosis code BPH/sining/yestention 600*, 782.2* N40, R33	derate/severe COPD, excluding the severe COPD, e	ong alternative reasons for steroid CODE A & (B C) NOTES	NOTES NOTES Limitations/Issues		Limitations/Issues
G2. Systemic corticosteroids for COPD MRTADATA ID G3. Antimuscarinic bronchodilators with specific comorbidities MRTADATA ID G4. Bento and acute/chieses respectory failure MRTADATA ID MRTADATA ID	Description Stop systems contracted for instead of exhabited contracted for maintenance through it may be a substitute of the contracted for maintenance through it moderate-sever CDPD (unnecessary separate of the contracted for the contract	ICDB / CCS for ICDB Medication variable METADATA ICDB / CCS for ICDB Medication variable METADATA MEGDATA METADATA ICDB / CCS for ICDB MEDICATOR / CCS for ICDB MEDICATOR / CCS for ICDB MEDICATOR / CCS for ICDB METADATA METADATA METADATA METADATA METADATA METADATA METADATA METADATA METADATA	A Medication code Anti-muscarinic branchodistors inhaled_enticholnergic A Medication code Medication code Medication code Medication code	Omitted due to difficulty in open B Diagnosis code Narrow anale aleascama 33.6.2 H40.2 H40.2 B Diagnosis code Wistory of PLUS Chiberling \$50.275.3315.53247,5327,3325,5345,5378	ationalising (definition of ma	derate/severe COPD, excluding the severe COPD, e	A & (B C) NOTES	NOTES Limitations/Issues		Limitations/Issues
G3. Antimuscarinic bronchodiators with specific comorbidists with specific comorbidists MATADATA ID G4. Bense and acute/chonic registratory failure METADATA ID H2. NSAIDs with G1 issue unless PPI/PI2 antagonat	Description Stop systemic contracteroris instead of enhanced controlled on the controlled of the cont	ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	A Medication code Anti-muscarinic branchodistors inhaled_enticholnergic A Medication code Medication code Medication code Medication code	Omitted due to difficulty in open B Diagnosis code Narrow anale aleascama 33.6.2 H40.2 H40.2 B Diagnosis code Wistory of PLUS Chiberling \$50.275.3315.53247,5327,3325,5345,5378	ationalizing (definition of mo C Diagnosis code BPH/armay retention 600°, 788.2° N40, R33 RISK. Omitted due to lack of info C Medication code PPI	derate/severe COFO, excludion and a second a	A & (B C) NOTES	NOTES Limitations/Issues		Limitations/Issues
G2. Systemic corticostereds for COPD G3. Antimuscarinic bronchodilators with specific comorbidities swith swith specific comorbidities swith specific comorbidities swith swith specific comorbidities swith specific como	Description Stop systemic conficusioneroids instead of inhabed contributeroids for maintenance threinigh with moderate-sever CDPD (jurnecessary operated to provide the provided of the provi	ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD9 Medication variable METADATA METADATA ICD9 / CCS for ICD9 Medication variable METADATA META	A Medication code Anti-muzcarinic bronch-deliators whaled_anticholinergic A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle glasscame 35.6.2 H40.2 B Diagnosis code Diagnosis code Patrony of PLD, GI bleeding 530.7, 531*, 532*, 533*, 53	ationalizing (definition of mo C Chapnosis code BPH/simony retention 600°, 788.2° N40, R33 RISK. Omitted due to lack of info C Medication code PPI ppI	derate/severe COPD, excludion RISK A CODE Transform on respiratory failure D Medication code H2 ontogonat	A & (B C) NOTES RISK:	NOTES Limitations/Issues CODE A&B&I(C D)		Limitations/Issues
G2. Systemic Corticosteroids for COPD METADATA ID G3. Antimuscalinic bronchodilators with specific comorbidities with specific comorbidities METADATA ID G4. Benzo and acute/chronic respiratory failure METADATA ID METADAT	Description Stop systemic corticosteroids instead of inhabed contributeroids for maintenance through its moderate-sever CDPD (unnecessary possure to long-term side effects of systems controlated and effective inhabed bisrapies are providedly) METADATA Description Stop anti-muscarinic bronchodilistors (e.g. ipratropium, totropulm) with a hostory of farrow angle glacutors (input to the control of the contro	ICDB / CCS for ICDB Medication variable METADATA ICDB / CCS for ICDB ICDB / CCS for ICDB / CCS for ICDB ICDB / CCS for ICDB / CCS	A Medication code Anti-muzcarinic bronch-deliators whaled_anticholinergic A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle alascome 35.6.2 H40.2 H40.2 B Diagnosis code Bitagnosis code Bitagnosis code Fistory of PLO, Cl. blueding 58.02, 12, 22, 52, 53, 53, 53, 52, 53, 53, 52, 53, 53, 53, 53, 53, 53, 53, 53, 53, 53	ationalizing (definition of mo C Chapnosis code BPH/simony retoration 600°, 788.2° N40, R33 RISK. Omitted due to lack of info C Medication code PPI ppI	A CODE D Medication code H2 antogonist h2a CODE	ng alternative reasons for steroic CODE A & (B Q) NOTES	NOTES Limitations/Issues CODE A&B&I(C D)		Limitations/Issues
G2. Systemic corticostereids for COPD METADATA ID G3. Antimuscarinic bronchodilators with spenific comorbaficas METADATA ID G4. Benzo and acute/urhonic respiratory failure METADATA ID	Description Stop systemic conticosteroids instead of inshed controleroids for maintenance through inhaled controleroids for maintenance through in moderate-sever CDPD (jurnecessary separate to leng term sale effects of systemic controleroids and effective and several controleroids and effective and several controleroids and effective and several properties and effective available) METADATA Description METADATA Description (may cause urinary retention). METADATA Description (SS) Stop been adveraging and the several severa	ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD9 Medication variable METADATA METADATA ICD9 / CCS for ICD9 Medication variable METADATA META	A Medication code Anti-muzcarinic bronch-deliators whaled_anticholinergic A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle alascome 35.6.2 H40.2 H40.2 B Diagnosis code Bitagnosis code Bitagnosis code Fistory of PLO, Cl. blueding 58.02, 12, 22, 52, 53, 53, 53, 52, 53, 53, 52, 53, 53, 53, 53, 53, 53, 53, 53, 53, 53	ationalizing (definition of mo C Diagnosis code BPH/sirinary retention 600° 788.2° N40, R33 RISK. Omitted due to lack of info C Medication code PPI RISK.	A CODE D Medication code H2 antogonist h2a CODE	ng alternative reasons for steroic CODE A & (B Q) NOTES	NOTES Limitations/Issues CODE A&B&I(C D)		Umitations/Issues
G2. Systemic corricosteroids for COPD G3. Antimuscarinic bronchodistors with typeofic comorbidities METADATA ID G4. Benzo and soute/chronic respiratory failure METADATA ID METADATA ID MI. NSAIDs with GI issues METADATA ID MI. NSAIDs with GI issues METADATA ID MI. NSAIDs with GI issues METADATA ID METADAT	Description Stop systemic contensional instead of inhaled controllerands for maintenance through inhaled controllerands for maintenance through in moderate-sever CDPD (jurneecasive popular of the property in moderate-sever CDPD (jurneecasive popular of the property in moderate-sever CDPD (jurneecasive popular of the property in several property in several property in the property of the property follows of the property of the	ICDB / CCS for ICDB Medication variable METADATA ICDB / CCS for ICDB ICDB / CCS for ICDB / CCS for ICDB ICDB / CCS for ICDB / CCS	A Medication code Anti-muzcarinic bronch-deliators whaled_anticholinergic A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle alascome 35.6.2 H40.2 H40.2 B Diagnosis code Bitagnosis code Bitagnosis code Fistory of PLO, Cl. blueding 58.02, 12, 22, 52, 53, 53, 53, 52, 53, 53, 52, 53, 53, 53, 53, 53, 53, 53, 53, 53, 53	ationalizing (definition of mo C Diagnosis code BPH/surinary retention 600° 788.2° N40, R33 RISK. Omitted due to lack of info C Medication code PPI RISK.	A CODE D Medication code H2 antogonist h2a CODE	ng alternative reasons for steroic CODE A & (B Q) NOTES	NOTES Limitations/Issues CODE A&B&I(C D)		Limitations/Issues
G2. Systemic corticosteroids for COPD G3. Antimuscarinic broadfoldstors with Appendic composition of the COPD G3. Antimuscarinic broadfoldstors with Appendic composition of the Coppendic of t	Description Stop systemic corticosteroids instead of inhabed controlorateroids for maintenance through inhabed controlorateroids for maintenance through in moderate-sever CDPD (jumnecessary separate of the property in moderate-sever CDPD (jumnecessary separate of the property of the p	ICDB / CCS for ICDB Medication variable METADATA ICDB / CCS for ICDB Medication variable	A Medication code Anti-macrainic brancholisters inhaled_enticholinergic A Medication code A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Alarrow angle absocome 356.2 H40.2 Diagnosis code Diagnosis code Nistory of PUD, Gi bleeding 550.2 * \$31.532*, \$32.5 * \$34.578* \$22.1, K57, K26, K27, K26, K37, K36, K37, K37, K37, K37, K37, K37, K37, K37	ationalising (definition of mo C Diagnosis code BPH/curinary retrosion 600° 788.2° N40, R33 RISK Omitted due to lack of info C C C C C C C C C C C C C C C C C C C	A CODE D Me dication code h2a entosponie code code code code code code code cod	ng alternative reasons for steroid CODE A & (B Q) NOTES RISK A NOTES	NOTES Limitations/Issues CODE A & B & ((C D)) Limitations/Issues		Limitations/Issues
G2. Systemic corticosteroids for COPD METADATA ID G3. Antimuscarinic bronchodilators with specific committed bronchodilators	Description Stop systemic continuences of instead of inshall continuences therepy is moderate-sever CDPD (unnecessary separate therepy is moderate-sever CDPD (unnecessary separate se	ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD9 Medication variable	A Medication code Anti-macrainic brancholisters inhaled_enticholinergic A Medication code A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle also-come 35-6-2 H40-2 B Diagnosis code Diagnosis code Battary of PUD, Gi bleeding 30.0-7, 5317, 5327, 5387, 522, 532, 5327, 532, 532, 532, 532, 532, 532, 532, 532	cationalizing (definition of mo	A CODE A CODE D Medication code H2 antisiponist CODE	A & (B C) NOTES RISK.	NOTES Limitations/Issues CODE A & B & ((C D)) Limitations/Issues		Limitations/Issues.
G2. Systemic corticosteroids for COPD METADATA ID G3. Antimuscarlinic bronchodilators with specific comorbidities METADATA ID G4. Benro and acute/schonic respiratory failure METADATA ID H12. NSAIDs with Gi issues with specific comorbidities METADATA ID H12. NSAIDs with Gi issues with specific comorbidities of the specific comorbi	Description Stop systemic conficusioneroids instead of inhabed controlleroids for maintenance through it is made to make the control of the	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA ICD9 / CCS for ICD9 Medication variable	A Medication code Anti-macrainic brancholisters inhaled_enticholinergic A Medication code A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle also-come 35-6-2 H40-2 B Diagnosis code Diagnosis code Battary of PUD, Gi bleeding 30.0-7, 5317, 5327, 5387, 522, 532, 5327, 532, 532, 532, 532, 532, 532, 532, 532	ationalising (definition of mo C Diagnosis code BPH/curinary retrosion 600° 788.2° N40, R33 RISK Omitted due to lack of info C C C C C C C C C C C C C C C C C C C	A CODE A CODE D Medication code H2 antisiponist CODE	A & (B C) NOTES RISK.	NOTES Limitations/Issues CODE A & B & ((C D)) Limitations/Issues		Limitations/Issues
G2. Systemic conticosteroids for COPD METADATA ID G3. Antimuscarinic bronchodilators with specific comorbidities MITADATA ID G4. Benzo and acute/orbonic respiratory failure METADATA ID H1. NSAIDs with G3 issue unless PPI/H2 antagonist metadata ID H2. NSAIDs and severe hypertension/heart failure METADATA ID H3. NSAIDs for DA where Tylenol has not been trice.	Description Stop systemic conficusionerods instead of inhabed controlleroids for maintenance through it is made to the inhabed controlleroids for maintenance through it moderate-sever CDPD (jurnecessary special) and inhabed through it is made of fective limited broughes are settled. METADATA Description METADATA Description METADATA Description with a subject of the properties of the	ICD9 / CCS for ICD9 ICD10 / CCS for ICD1 Medication variable METADATA ICD9 / CCS for ICD9 Medication variable	A Medication code Anti-macrainic brancholisters inhaled_enticholinergic A Medication code A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle also-come 35-6-2 H40-2 B Diagnosis code Diagnosis code Battary of PUD, Gi bleeding 30.0-7, 5317, 5327, 5387, 522, 532, 5327, 532, 532, 532, 532, 532, 532, 532, 532	etionalizing (definition of mo C playrosis code BPH/curinary retreation 600°, 788.2° N40, R33 RISK Omitted due to lack of info Medication code PPI RISK RISK	derate/severe COPD, excludion and a second a	A & (B C) NOTES RISK A NOTES	NOTES Limitations/Issues CODE A & B & I(C D) Limitations/Issues Limitations/Issues		Limitations/Issues
G2. Systemic corticosterroids for COPD METADATA ID G3. Antimuscarrinc bronchodiators with specific commitment of the c	Description Stop systemic conficusioneroids instead of inhabed controlleroids for maintenance through it is made to make the control of the	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA ICD9 / CCS for ICD9 Medication variable	A Medication code Anti-macrainic brancholisters inhaled_enticholinergic A Medication code A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle also-come 35-6-2 H40-2 B Diagnosis code Diagnosis code Battary of PUD, Gi bleeding 30.0-7, 5317, 5327, 5387, 522, 532, 5327, 532, 532, 532, 532, 532, 532, 532, 532	cationalizing (definition of mo	A CODE A CODE D Medication code H2 antisiponist CODE	A & (B C) NOTES RISK.	NOTES Limitations/Issues CODE A & B & ((C D)) Limitations/Issues		Limitations/Issues
G2. Systemic corticosteroids for COPD G3. Antimuscarinic bronchodistors with specific comorbidities METADATA ID G4. Benro and acute/s/thonic respiratory failure METADATA ID H2. NSAIDs with GI issues unless PPI/H2 antagonist failure METADATA ID H2. NSAIDs and severe hypertension/heart failure METADATA ID H3. NSAIDs for OA wheret METADATA ID	Description Stop systemic conticosteroids instead of inhaled controlocations for maintenance through it makes the inhaled controlocation of maintenance through it moderate-sever CDPD (jurnecessary separate of ingent and effective several controlocation and effective several se	ICD9 / CCS for ICD9 ICD10 / CCS for ICD1 Medication variable METADATA ICD9 / CCS for ICD9 Medication variable	A Medication code Anti-macarinic brancholisters inhaled_enticholinergic A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle albuscome 356.2 H40.2 H40.2 Diagnosis code Diagnosis code Nettroy of PLO, Giberelino 550.2*, 531*, 532*, 533*, 532*, 533*, 532*, 534*, 532*	etionalizing (definition of mo C playrosis code BPH/curinary retreation 600°, 788.2° N40, R33 RISK Omitted due to lack of info Medication code PPI RISK RISK	derate/severe COPD, excludion and a second a	A & (B C) NOTES RISK A NOTES	NOTES Limitations/Issues CODE A & B & I(C D) Limitations/Issues Limitations/Issues		Limitations/issues
G2. Systemic conficosteroids for COPD G3. Antimuscarinic bronchodilators with specific comorbidities with specifi	Description Stop systemic conticosteroids instead of inhabitation inhabitation continuated to the inhabitation continuated co	ICD9 / CCS for ICD9 ICD19 / CCS for ICD19 Medication variable METADATA ICD9 / CCS for ICD9	A Medication code Anti-macarinic brancholisters inhaled_enticholinergic A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle albuscome 356.2 H40.2 H40.2 Diagnosis code Diagnosis code Nettroy of PLO, Giberelino 550.2*, 531*, 532*, 533*, 532*, 533*, 532*, 534*, 532*	ationalizing (definition of mo Clapposis code BPH/urinary retention 600°, 788.2° N40, R33 RISK Omitted due to lack of info C Medication code PPI RISK BSSK BSSK BSSK RISK	derate/severe COPD, excludion and a second a	A & (B C) NOTES RISK A NOTES	NOTES Limitations/Issues CODE A & B & I(C D) Limitations/Issues Limitations/Issues		Limitations/lissues
G2. Systemic corticosterroids for COPD METADATA ID G3. Antimuscarrinc bronchodiators with specific commitment of the c	Description Stop systemic conticosteroids instead of inhabitation of inhabita	ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD9 ICD10 / CCS for ICD9	A Medication code Anti-macarinic brancholisters inhaled_enticholinergic A Medication code A Medication code A Medication code A Medication code	Omitted due to difficulty in open B Diagnosis code Narrow angle albuscome 356.2 H40.2 H40.2 Diagnosis code Diagnosis code Nettroy of PLO, Giberelino 550.2*, 531*, 532*, 533*, 532*, 533*, 532*, 534*, 532*	ationalizing (definition of mo Clapposis code BPH/urinary retention 600°, 788.2° N40, R33 RISK Omitted due to lack of info C Medication code PPI RISK BSSK BSSK BSSK RISK	RISE A CODE remation on respiratory failure D Medication code HZ antogonist CODE	A & (B C) NOTES RISK A NOTES	NOTES Limitations/Issues CODE A & B & I(C D) Limitations/Issues Limitations/Issues		Limitations/Issues

Part			ICD9 / CCS for ICD9							
The column	H5. Corticosteroids for OA	mono-articular pain) for osteoarthritis		Omitted due to difficulty	in operationalizing (OA is very con	nmon; when looking at overla	p between OA and	corticosteroid, the use of co	ticosteroid is likely for another conditi	on)
Marche M	METADATA	effects).	Medication variable METADATA	A	В	С	RISK	CODE	NOTES	Limitations/Issues
		Description								,
Part		months) for chronic treatment of gout	ICD9 / CCS for ICD9							
	H6. Long-term NSAID or colchicine for gout	allopurinol, febuxostat) (xanthine-	ICD10 / CCS for ICD10	Omitted o	due to difficulty in operationalizing	(even with diagnosis code fo	gout, NSAID coul	d be for different indication; h	ard to tell if there is a contraindication	to allopurinol)
March	METADATA			٥		DICA	CODE	NOTES	Limitations/Issues	
Marian		Description	miliana.		ASCVD	NJN	CODE	1012	Ellitations/1330c3	
Property of the content	H7. COX-2 selective	concurrent cardiovascular disease			V45.82, V45.81, 36.0, 36.1 I20*, I21*, I22*, I24*, I25*,		A 2. D			
Marches Marc		(increased risk of myocardial infarction and stroke)	Medication variable	cox2						
Marches Marc	METADATA ID	METADATA Description	METADATA	A Medication code	B Medication code		RISK	CODE	NOTES	Limitations/Issues
The column	H8. NSAID and	Stop NSAID with concurrent		NSAID	Corocosteroios	m		A 9 0 1		Many people may b
Mathematical Mat	PPI prophylaxis	(increased risk of peptic ulcer disease)		nsaid	steroids					getting PPIs over th counter
Contact Cont			METADATA	A Medication code		RISK	CODE	NOTES	Limitations/Issues	
Part				Oral bisphosphonate	esophaqitis, GI hemorrhaqe					
Part		with a current or recent history of upper gastrointestinal disease i.e. dysphagia, esophagitis, gastritis, duodenitis, or peptic ulcer disease, or			(Barrett's enophageus), 531 (gastret senophageus), 531 (gastre cluer), 532 (poolera lucer), 533 (papita ulaer), 533 (papita ulaer), 533 (papita ulaer), 533 (papita ulaer), 532 (papita), 537 (other disorders) of Storach and duodenish), 537 (other disorders) of Storach and duodenish), 528 (gastrointestatian Hemornhage), 22.2 (planormally of secretion of gastrin) XOI (enophageis), X22.1 (planormally of secretion of gastrin) XOI (enophageis), X22.7 (Barrett's), Coppita (laer), X22 (gastris and duodenish), X21 (clored ciaesea of ottomoch and clared with the company of the	Α	A & 8 within	1 year		
Marie			Medication variable	oral_bisphosphonate						
Securing Continues of the continue of third continue of the	A ACTUA DI ATUA	AAEWA DAWA	******				DAGIA	0005	NOTES	41-14-41
Part			METADATA				RISK	CODE	NOTES	Limitations/Issues
1. Section algority 1. Section of plans	II. Bladder antimuscinarics with	Stop antimuscarinic drugs with dementia, or chronic cognitive impairment (risk of increased confusion, agitation) or narrow-angle glaucoma (risk of acute exacerbation of glaucoma), or thronic prostatisim (risk of acute succession of glaucoma), or thronic prostatisim (risk of acute succession of glaucoma), or thronic prostatisim (risk of acute succession of glaucoma), or thronic prostatism (risk of acute succession of glaucoma), or thronic prostatism (risk of acute succession of glaucoma), or thronic prostatism (risk of acute succession of glaucoma), or thronic prostatism (risk of acute succession of glaucoma), or thronic prostatism (risk of acute succession of glaucoma), or thronic prostatism (risk of acute succession of glaucoma), or thronic prostation of glaucoma, or thronic prostation or thronic prostation of glaucoma, or thronic prostation or thronic prostation or thronic pr	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Bladder antimuscarinic drugs	Narrow angle glaucoma 365.2	BPH/urinary retention 600*, 788.2*			NOTES	Limitations/Issues
Mariana Mari	11. Bladder antimuschanics with certain conditions	Description Stop antimuscarinic drugs with dements, or chronic cognitive impairment (risk of increased confusion, agitation) or narrow algosucom (not a deate exacrebation of glaucoma), or dronic prostation (risk of urinary retention). METADATA METADATA	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	Bladder antimuscarinic drugs antimuscarinics	Narrow angle glaucoma 365.2 H40.2	8PH/urinary retention 600*, 788.2* N40, R33	А	A		
Mariabatian	11. Bladder antimuschanics with certain conditions	Description Stop antimuscarrint drugs with dements, or chronic cognitive impairment (fixed for reased confusion, agilation) or narrow angle glaucoma (fixed cate escarebation of glaucoma), or chronic prostation (fixed for interview of unimary retention). METADATA Description	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA ICD9 / CCS for ICD9	Bladder antimuscarinic drugs antimuscarinics A Medication code	Narrow angle glaucoma 365.2 H40.2 B Diagnosis code	8PH/urinary retention 600°, 788.2° N40, R33	А	A		
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METADATA METADATA METADATA A B B BSK CODE NOTES Limitations/Issues ID Description Medication code Diagnosis code Anthropyres Hypogenosism	II. Bladder antimuschance with certain conditions METADATA ID 12. Selective elpha-1 blockers in orthoctatic hypothesis orthoctatic hypothesis of the certain conditions METADATA ID 13. Beta-blockers with Frequent hypothesis orthoctatic hypothesis or orthoctatic hypothesis of the certain orthoctatic hypothesis or orthoctatic hypothesis orthoctation or orthoctation orthoctatio	Description Stop antimuscarinic drugs with dementia, or chronic cognitive impairment; fixe of increased confusion, agistion) or narrow-angle glaucoma, fixed acute exacerbation of glaucoma), or droven prostation (nix of control protestians). METADATA Description Stop selective alpha-1: Blockers in those with symptomistic orthostatic hypotension or mucritation syncep (nix of practitation). METADATA Description Stop sulphonylureas with a long duration of action (e.g. glibenclassid). METADATA Description Stop sulphonylureas with a long duration of action (e.g. glibenclassid). METADATA Description Stop publications in diabetes, mellitus with hegent fallure) METADATA Description METADATA Description Stop petrogens with a history of breast cancer or venous thromboembolism (increased risk of recurrence). METADATA	ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD9 Medication variable METADATA ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA ICD9 / CCS for ICD10 Medication variable METADATA	Bladder antimuscarinic drugs antimuscarinics A Medication code Alpha of Blockers A Medication code Long acting sulfonpluress (Arborrapemile, gimpride, giphanie, gip	B Diagnosis code B Diagnosis code Diagnosis code Diagnosis code Diagnosis code Omtorior (hypotension Code (hypotension) Diagnosis code Omtorior (hypotension) Diagnosis code Omtorior (hypotension) Code (hypotension) Diagnosis code Omtorior (hypotension) Diagnosis code	BPU4/eninary retention 600°, 783.2° N40, R33 C Diagnosis code Spricope Omitted due to diffici RISK A RISK A RISK L RISK A	A & B CODE A & B CODE A & A & B CODE	A CODE NOTES 1. Same as Be NOTES 1. Same as Be NOTES A & (B	NOTES Limitations/fissues unitations/fissues Limitations/fissues NOTES	Limitations/Issues
Androgens Hypogonadism	11. Bladder antimucionarios with certain conditions METADATA 10 12. Selective signa-1 blookers in orthociation for the political polit	Description Stop antimuscarinic drugs with dementa, or chronic cognitive impairment; firsk of increased confusion, agistioni or narrow angle glaucoma, or chronic cognitive impairment; firsk of increased glaucoma, or chronic protatism (risk of increased or distinary retention). METADATA Description Stop selective alpha-1 blockers in those with symptomic corthostatic hypotension or mecturisms syncopy (risk of proceptating recurrent syncopy) METADATA Description Stop thiszolidenediones (e.g. resignatione, plogistrational in particulary or heart failure) Stop beta-blockers in diabetes mellitus with frequent hypotypeamic playoid (risk of suppressing bypotypeamic synppairm). METADATA Description Stop petrogens with a history of breast cancer or venous thromboembolism (increased risk of recurrence). METADATA Description	ICD9 / CCS for ICD9 MCD10 / CCS for ICD10 Medication variable METADATA ICD9 / CCS for ICD10 Medication variable METADATA	Bladder antimuscarinic drugs antimuscarinics A Medication code A A Medication code Long-acting sufonylures (ritiopropamide, gimperide, opharite, gliocate IB) suffonylures LA A Medication code tod A Medication code tod A Medication code tod A Medication code tod A Medication code Etrogens A Medication code	B Diagnosis code	BPU4.crinary retention 600°, 783.2° N40, R33 C Diagnosis code Sercope Omitted due to difficil RISK A RISK A RISK BD2, R31°, R32°, I26° RISK RISK	A & B CODE A & CODE A & CODE	A & (B NOTES 1. Same as Be NOTES 1. Same as Be NOTES 1. Same as Be NOTES	Limitations/Issues Limitations/Issues Limitations/Issues AGTES I G	Limitations/Issues
	II. Bladder antimuconarics with certain conditions III. Bladder antimuconarics with certain conditions III. Long-acting antimuconarics with properties and	Description Stop antimuscarinic drugs with dements, or chronic cognitive impairment; first of increased confusion, agistioni or narrow angle glaucoma (final dealer escription). METADATA Description Stop selective alpha-1: blockers in those with symptomatic orthostatic hypotension or mucrustics syncopy (risk of precipitating recurrent syncopy). METADATA Description Stop safekonylursas with a long duration of including recurrent syncopy (risk of precipitating recurrent syncopy). METADATA Description Stop this accidence done in the selection of the selection of heart failure). METADATA Description Stop this accidence dones (e.g. roxigitazione, pioglitazione) in patients with heart for confusione, programatic synchronic confusione, programatic synchronic confusione, programatic	ICD9 / CCS for ICD9 MEDIO / CCS for ICD10 Medication variable METADATA ICD9 / CCS for ICD10 Medication variable METADATA	Bladder antimuscarinic drugs antimuscarinics A Medication code A A Medication code A A Medication code A A A Medication code A A A A A A A A A A A A A A A A A A A	B Diagnosis code	BPH/Arinary retention 600°, 783.2° N40, R33 C Diagnosis code Sproope Greated due to difficulty A RISK A RISK A RISK	A RISK CODE A CODE CODE A CODE CODE A CODE A CODE A CODE A CODE	A CODE 1. Same as Be NOTES 1. Same as Be NOTES 1. Same as Be NOTES A & (B	NOTES Limitations/fissues ers orderia Limitations/fissues Limitations/fissues NOTES NOTES	Limitations/Issues

16. Androgens in absence of specific indication	Stop androgens (male sex hormones) in the absence of primary or secondary hypogonadism (risk of adrogen toxicity; no proven benefit outside of the hypogonadism indication).	ICD10 / CCS for ICD10 Medication variable	androgens	E29.1, E89.5, Q98.0, Q98.1, Q98.2, Q98.4	A	A & IB	1. Same as Beers criteria	
METADATA ID	METADATA Description	METADATA	A Medication code Benzodiazepines	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues
K1. Benzodiazepines	Stop benzodiazepines (sedative, may cause reduced sensorium, impair balance).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	benzo		A	A	Same as sedative-hypnotics benzo variable	
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues
K2. Antipsychotics	Stop neuroleptic drugs (may cause gait dyspraxia, Parkinsonism).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable		Omitte	d as this category is covered	l in D9 (dementia with BPSD sy	mptoms)	
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues
K3. Vasodilator drugs	Stop vasodilator drugs (e.g., alpha-1 receptor blockers, caldium channel blockers, long-acting nitrates, ACE inhibitors, angiotensin i receptor blockers,) with persistent postural hypotension i.e. recurrent drop in systolic blood pressure 2 20mmHg (risk of syroope, falls).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable			Omitted due to diff	iculty in operationalizing		
METADATA D	METADATA Description	METADATA	A Medication code eszopiclone, zaleplon, zolaidem	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues
K4. Hypnotic Z-drugs	Stop hypnotic Z-drugs e.g. zopiclone, zolpidem, zaleplon (may cause protracted daytime sedation, ataxia).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable			А	А	Same as Beers criteria variable	
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues
L1. Opioids	Stop use of oral or transdermal strong opioids (morphine, oxycodone, fentaryl, bupercorphine, diamorphine, methadone, tramadol, pethidine, pentazonica) as first line therapy for mild pain (WHO analgesic ladder not observed).				Omitted due to difficulty in	operationalizing first-line thera	py	
METADATA D	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues
L2. Opioids without laxative	Stop use of regular (as distinct from PRN) opioids without concomitant laxative (risk of severe constipation).	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable		Omitted du	e to difficulty in operationa	lizing as many people receives	axatives OTC	
METADATA ID	METADATA Description	METADATA	A Medication code Anticholinergics	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues
M. Concomitant use of two or more drugs with anticholinergic properties	Stop concomitant use of two or more drugs with antimuscarinic/anticholinergic properties	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	anticholinergics_table_7		A & A	A & A (overlapping prescriptions for 2 drugs with anticholinergic properties)		

				2019 Beers crite						
METADATA	Cr METADATA Description	METADATA	erican Geriatrics Society 2019 U		ia for Potentially Inappropria	te Medication Use in Older	notes	Limitations/Issues		
ID .			2st generation antihistomines	Diagnosis code						
First generation antihistamines	Brompheriramine, Carbinoxamine, Chlorpheriramine, Clemastine, Cyproheptadine, Deubrompheriramine, Deut/Yospheriramine, Dimerhydrinata, Diphenhydramine (oral), Dorylamine, Hydroxylne, Medizine, Promethazine, Pyrilamine, Tripoldine	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	first_gen_antihistarrine_beers		A	A				
METADATA ID	METADATA Description	METADATA	A Medication code Antiporkinson Anticholinergics	B Diagnosis code	RISK	CODE	NOTES	Limitations/issues		
Antiparkinsonian agents	Benztropine and trihexyphenidyl	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Mortication variable	Antiporkinson Anticholinergics ac_park		Α	А				
METADATA D	METADATA Description	Medication variable METADATA	A Medication code Antisposmodics	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
Antispasmodics	Atropine (excludes ophthalmic), Belladonna alkaloids, Clidinium-chlordiazepaxide, Dicyclomine Homatropine (excludes opthalmic), Hyposyamine, Methacopolarnine, Propantheline, Scopolarnine	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	antispasmodics_beers		A	A				
METADATA	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
Dipyridamole, oral short-	Directifamole and short arting frags not	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Dipyridamole		Α.	A	1. Excludes aspirin-			
acting	apply to the extended-release combination with aspirin) METADATA	Medication variable METADATA	Dipyridamole	8	c	RISK	dipyridamole combination	NOTES	Limitations/Issues	
0	Description	ICD9 / CCS for ICD9	Medication code Nitrofurantoin	Diagnosis code CKD Stage 4 or higher 585.4, 585.5, 585.6	Laboratory value Cystotin C					
Nitrofurantoin	Nitrofurantoin has potential for pulmonary toxicity, hepatoxicity, and peripheral neuropathy, especially with long-term use. Axxid in individuals with creatinine clearance <30 mL/min or for long-term suppression	10040 LOSS 5 10040	nitrofurantoin	N18.4. N18.5. N18.6	Calculated eGFR < 30	A	(A & (B C)) (A & days supply >= 30)	Criterion will apply to two different scenario (first, in those who are on nitrofusantorin and have eGFR < 30; second, in those who are on long-term suppression defined as number of pills > 30 over a 3 month period)	s	
TETADATA	METADATA Description	METADATA	A Medication code	B Diaznosis code	B Diaznosis code	RISK	CODE	NOTES	Limitations/Issues	
			Alpha 1 blacker	CCS 10.2.1 (hyperplasia of prostate) and CCS 10.1.8	PTSD SCO® 500* (adjustment reaction -					
Peripheral alpha-1 blockers or treatment of hypertension	Doxazosin, prazosin, terazosin	ICD9 / CCS for ICD9		prostate) and CCS 10.1.8 (genitourinary symptoms and ill-defined conditions)	CCS M8D007 (trauma- and stress-	, A	A & (IS IC)	Alpha-1 blockers are indicated for other conditions (e.g., BPV/LUTS) which we try to exclude.		
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		ICD10 / CCS for ICD10		CCS GEN012 (hyperplasia of prostate) and CCS GEN008 (urinary incontinence)	related disorders) or ICD10 F43 (reaction to severe stress, and adjustment disorders)			exclude		
		Medication variable	alpha_1_beers							
RETADATA •	METADATA Description	METADATA	A Medication code CNS alpha aganists (guanabers, guanfacine, methyldope, reserpine > 0.3 mg/day)	RISK	CODE	NOTES	Limitations/Issues			
Central alpha-agonists	Aucid clonidine for first-line treatment of hypertension. Aucid other CNS alpha-agonists (guarabenz, guardacine, methyldopa, reseripine > 0.1 mg/day)	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	cns_alpha_agonists	A	A	"Avoid clonidine for first-li- treatment" was not taken in account due to difficulty in operationalizing	to .			
METADATA	METADATA Description	Medication variable METADATA	cns_alpha_agonists A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
Disopyramide	Avoid disopyramide (may induce heart failure; strongly anticholinergic)		disopyramide		Α.	A				
ETADATA	strengly anticholinergic) METADATA Description	Medication variable METADATA	disopyramide A Medication code	B Diaznosis code	RISK	CODE	NOTES	Limitations/Issues		
Dronaderone	Avoid dronaderone in individuals with permanent atrial fibrillation or severe/recently decompensated heart failure	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10			Omitted due to rarity of use an	nd not included in Medi-Span classi	fication		1	
ETADATA	severe/recently decompensated heart failure METADATA Description	Medication variable	A	8	RISK	CODE	NOTES	Limitations/Issues		
•			Medication code Diponin	Diaznosis code SVT (AF/AFL)						
Digoxin for first-line treatment of AF or heart failure	Avoid this rate control agent as first line therapy for atrial fibrillation. Avoid as first-line therapy for heart failure. If used for atrial fibrillation or heart failure, would dosages >0.125 mg/day	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable			Omitted due to	difficulty in operationalizing				
ETADATA	METADATA Description	METADATA	A Medication code nifedipine, immediate release	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
ifedipine, immediate release	Avoid nifedipine, immediate release (potential a for hypotension; risk of precipitating myocardial ischemia)	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable			A	A	Medication definition excludes ER formulations			
ETADATA	METADATA Description	Medication variable METADATA	nifedipine A Medication code	8 Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
			amiodorone	Heart failure						
Amiodarone	Avoid as first-line therapy for AF unless patient has HF or substantial LVH	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10			Omitted due to	difficulty in operationalizing				
METADATA D	METADATA Description	Medication variable METADATA	A Medication code Antidecressants	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
Antidepressants	Avoid amitriptyline, amoxapine, clomipramine, desipramine, doxepin > 6 mg/day, imipramine, nortriptyline,	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10			A	A	Same variable as the strongly anticholinergic		-	
RETADATA	mg/day, imipramine, nortriptyline, paroxetine, protriptyline, trimipramine METADATA	Medication variable METADATA	antidepressants_AC	8	c		strongly anticholinergic antidepressants	CODE	NOTES	Limitations/Issues
•	Description		Medication code Antipsychotics (2st and 2nd gen)	Diagnosis code Schizophrenio	Diagnosis code Sipolar disorder	Medication code Antiemetics (Prochlorperazine a Promethazine)				
Antipsychotics, first (conventional) and second	Avold, except in schlapphrenia or bipolar disoster, or for short-term use as antiemetic	KD9 / CCS for KD9		ICD9 295 (Shluophrenic disorders), 297 (delusional disorders), 298 (other nonorganic psychoses), 301.2 (Shleeid personality disorder), OR CCS 5.10 (Schleophrenia and other psychotic disorders)	ICD9 296 (Episodic mood disorders) OR CCS 5.8.1 (Bipolar disorders)		A	A & (IB IC [IO & days supply < 30)		Very difficult to operationalize Short-term use a sinterestic during chemotherapy." We
(atypical) generation	during chemotherapy	ICD10 / CCS for ICD10		ICD 10 F20-F29 (Schizophrenia schizotypal, and delusional disorders) OR CCS MBD001 (Schizophrenia spectrum and other psychotic disorders)	CD10 F30 (manic episode), F31 (bipolar affective disorder) OR CCS MBD003 (Bipolar and related disorders)					exclude prescriptions <30 days fo prochlorperazine/promethazine.
		Medication variable	antipsychotics_1st_gen, antipsychotics_2nd_gen			antiemetics				
METADATA D	METADATA Description	METADATA	A Medication code Borbitusphs	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
Barbiturates	Avoid Amobarbital, Butabarbital, Butalbital, Mephobarbital, Pentobarbital, Phenobarbital, Secobarbital	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	barbiturates		A	A				
ETADATA	METADATA Description	METADATA	A Medication code Senzodiozeolnes	B Diaznosis code	RISK	CODE	NOTES	Limitations/Issues		
Benzodiazepines	Aucid Alprazolam, Estazolam, Lorazepam, Orazepam, Temazepam, Trinzolam, Chlordiazeposide (alone or in combination with amitriptyline or clidinium), Clonazepam,	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10			A	A	Same variable as the sedative-hypnotics variable			
ETADATA	Clorazepate, Diazepam, Flurazepam METADATA	Medication variable METADATA	benzo A	8	RISK	CODE	NOTES	Limitations/issues		
	Description	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Medication code Mearobomate	Diaznosis code						
Meprobamate ETADATA	Avoid meprobamate (high rate of physical dependence; sedating) METADATA	ICD10 / CCS for ICD10 Medication variable METADATA	meprobamate A	8	RISK	CODE	NOTES	Limitations/issues		
Nonbenzodiezepine,	Description	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Medication code eszoaiclone, zoloslan, zolosdem	Diaznosis code						
benzodiazepine receptor agonist hypnotics (Z-drugs)	Avoid eszopicione, zaleplon, zolpidem	Medication variable	z_drug		A	A				
ETADATA	METADATA Description	METADATA ICD9 / CCS for ICD9	A Medication code Engoloid mesylate or isoxiuprine	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues		
Ergoloid mesylates, isoxiuprine IETADATA	Avoid engoloid mesylates (dehydrogenated engot alkaloids) and isoxiuprine METADATA Description	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA	ergoloid_isoxiuprine A Medication code	B Diaznosis code	RISK	CODE	NOTES	Limitations/Issues		
	Avoid methylitestosterone or testosterone	ICD9 / CCS for ICD9	Testosterone	Hypogonodism ICD 9 257.1, 257.2, 758.7 ICD 10 E29.1, E89.5, Q98.0,				Not able to operationalize "with clinical		
Androgens	unless indicated for confirmed hypogenadism with clinical symptoms	Medication variable	androgens	Q98.1, Q98.2, Q98.4	A	A & IB		symptoms"		
METADATA	METADATA	METADATA	A	В	RISK	CODE	NOTES	Limitations/Issues		

	Description		Medication code Desiccoted thwold (park, beef)	Diaznosis code								
Desiccated thyroid	Avoid desiccated thyroid (concerns about	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Desiccoled thursid (park, beet)			A	Defined based on Thyroic	i				
Described thyroid	cardiac effects, safer alternatives available)	Medication variable	desiccated_thyroid		^		(Pork), Thyroid (Beef), and Thyroid Strong tablets					
METADATA ID	METADATA Description	METADATA	A Medication code	B Diaznosis code	RISK	CODE	NOTES	Limitations/Issues				
		ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Estropans				1 Fatrogen medication					
Estrogens with or without progestins	Avoid systemic estrogen (oral and topical patch)	Medication variable	estrogens		A	A	Estrogen medication variable definition excludes vaginal cream/tablets					
METADATA	METADATA	METADATA	A	В	RISK	CODE	NOTES	Limitations/Issues				
ID	Description		Medication code Growth hormone	Diaznosis code								
Growth hormone	Avoid except for patients rigorously diagnosed with GH deficiency due to an established etiology	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10		253.2 (panhypopit), 253.3 (pituitary dwarfem), 253.4 (other artheric pituitary disorders), 253.7 (latrogenic pituitary disorders), 253.7 (latrogenic pituitary disorders), 253.9 (unspecified disorder) E23* (hypofunction and other	A	A & IB		Not able to confirm that diagnosis of GH deficiency was well established				
				disorders of the pituitary aland)								
METADATA	METADATA	Medication variable METADATA	growth_hormone		RISK	CODE	NOTES	Limitations/Issues				
ID	Description	INLIADATA	Medication code	Diagnosis code	nun.	COOL	NOILS	Limitationalisades				
Insulin, sliding scale		ICD9 / CCS for ICD9 ICD10 / CCS for ICD10			Omitted as not able to determine	if participant is receiving sliding scale	insulin					
METADATA	METADATA Description	Medication variable METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues				
ib		ICD9 / CCS for ICD9	meastrol	Diagnosis code								
Megestral	Avoid megistrol	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	megestrol		A	A						
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues				
Long-acting sulfonylureas	Chlorpropamide, glimepiride, glyburide	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Lana-actina sulfanduma		A	A	_					
METADATA	METADATA	Medication variable METADATA	sulfonylurea_LA A	8	RISK	CODE	NOTES	Limitations/Issues				
ID	Description		Medication code Metoclossomide	Diaznosis code Gostroparesis								
Metoclopramide	Avoid unless for gastroparesis with duration of use not to exceed 12 weeks except in rare	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10		536.3 K31.84	Α.	4 9 19		Only factor in metoclopramide use in absence of gastroparesis diagnosis. Do not				
Metoclopramide	of use not to exceed 12 weeks except in rare cases	ICD10 / CCS for ICD10 Medication variable	metoclopramide_beers	n31.84	Α	A & IB		absence of gastroparesis diagnosis. Do not factor in "duration of use not to exceed 12 weeks" due to difficulty in determining this.				
METADATA	METADATA Description	Medication variable METADATA	A	B Diaznosis code	RISK	CODE	NOTES	Limitations/Issues				
ID	Description		Medication code Mineral of	Diaznosis code								
Mineral oil, cral	Avoid oral mineral oil	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10			Omitted due to	difficulty in operationalizing						
		Medication variable							and a	1001		students of
METADATA ID	METADATA Description	METADATA	METADATA	A Medication code	B Diagnosis	Medication code	Medication code	E Medication code	RISK	CODE	NOTES	Limitations/Issues
				891	Barrett's esophogus, GI ulcer, esophoaitis. GI hemorrhape	Anticoogulant (e.g., worfarin, facto Xa inhibitor, direct thrombin inhibitors)	Anv NSAID	Conticosteroids				
991	Avoid scheduled PPI use for 38 weeks unless for high-risk patients	ICD9 / CCS for ICD9	KD9 / CCS for KD9		530.1 (escophaginia, 530.2 (uicer of escophaguni, 3-20.85 (Barrent's escophaguni, 3-25 (Barrent's escophaguni) uicer, 3-25 (gastroine uicer), 3-25 (gastroine of stemach and ducelemmi, 3-27 (gastroinestinial hammorhaguni, 2-25.1 (barrentiality of secretion of gastrin) X20 (escophaginia, X2.2.1 (cicer of secophaginia, V2.2.1 (cicer of s				A & Continuous dusation > 8 weeks (60 days)	A & Duration > 8 weeks & [IB IC (overlapping prescription) ID (overlapping prescription) IE		Might not capture all people who
		KD10 / CCS for KD10	ICD10 / CCS for ICD20 Medication variable	ppi	esophagal, 322.7 (Barrett's esophagal, 325.2 (Barrett's and Buoderithal, 321 (other diseases of damach and douderinal), 322 (other diseases of damach and barrett's system - include GI hemorrhage), Elot 6 (precised secretion of gastris)	anticongulant	nasid	steroids		(overlapping prescription)]	uncomplicated gastroophapal reflux disease. 3. This definition of PP secludes PPI/NSAD combinations, PPVaspini combinations, and Pypini treatment combinations.	
		Medication variable										
METADATA ID	METADATA Description	METADATA	A Medication code	B Diagnosis code	RISK	CODE	NOTES	Limitations/Issues				
METADATA ID Meperidine	Description	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	A Medication code Meperidine	8	RISK	CODE						
ID	Description Avoid	ICD9 / CCS for ICD9	A Medication code	B Diagnosis code								
Meperidine	Description	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	A Medication code Majorinism majoridine A Medication code	B Diagnosis code C Medication code	A	A	NOTES	Limitations/Issues				
Meperidine	Description Avoid METADATA Description Avoid description 3125 mg/day, Dictionars, Diffurial, Establic, Feroporten,	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	A Medication code Mejornidine mejoridine A Medication code MSAID/ fesciulina COX2 inhibitorsi	B Diagnosis code C Medication code	A	A	NOTES	Limitations/Issues				
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Non-selective peripheral alpha-1 blockers in syncope	peripheral alpha-1 blockers cause orthostatic blood pressure changes and should be avoided in older adults whose syncope may be due to orthostatic hypotension.		alpha_1_beens			A	A & [B C]				
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Tertiary TCAs in syncope	Tertiary TCAs increase the risk of orthostatic hypotension or bradycardia		tca_tertiary					A	A & [B C D E]		
METADATA ID	METADATA Description	METADATA	A Medication code Selected antipsychotics	B Diaznosis code Sviscose	C Diaznosis code Broducardio	D Diaznosis code Heart block	E Diaznosis code Orthostotic hypotension	RUSIK	CODE	NOTES	imitations/Issues
Antipsychotics in syncope	Chlorpromazine, thioridazine, and clarizapine increase the risk of orthostatic hypotension or	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10		780.2 RSS	427.8 149.5, R00.1	426.0, 426.10, 426.12, 426.13, 426.6. 426.9. 746.86 144.1, 144.2, 144.3, 145.5, 145.9, Q24.6	458	Α.	A&[B C D E]		
Antipsychotics in syncope	bradycardia		antipsychotics_beers_3					^	VARIATEDIE		
METADATA ID	METADATA Description	METADATA	A Medication code	B Diaznosis code	C Diaznosis code	D Diaznosis code	E Diaznosis code	RUSK	CODE	NOTES I	imitations/tssues
Medications in setting of definium	Anticholinergics, antipsychotics, steroids, H2 antagonists, berzos, meperidine	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable				Omitted due to o	ifficulty in operationalizing in f	fair manner from claims data.			
METADATA ID	METADATA Description	Medication variable METADATA	A Medication code	B Diagnosis code	C Diagnosis code	D Diagnosis code	E Diagnosis code	RISK	CODE	NOTES	imitations/Issues
Certain medications with	Antiepileptics, antipsychotics, beruros, antidepressants, opioids		Omitted	due to difficulty in operationally	ing in fair manner from claims data. B	ers criteria does not say to avoid in eer	neral but has certain caveats su	sch as "avoid unless safer alternatives are not avail	able" or "avoid except for paid	management in the setting of severe	icute pain."
history of falls or fractures	antidepressants, opioids	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable		Parkinson disease, Parkinson							
		ICD9 / CCS for ICD9	Antiemetics (metoclopramide,	plus syndromes, Lewy Body dementia 332, 333.0, 331.6, 331.82							
Antiemetics (metoclopramide, prochlorperazine, promethazine) in Parkinson	Avoid anti-emetics with anti-dopaminergic properties due to potential to worsen parkinsonian symptoms	ICD10 / CCS for ICD10		G20, G21, G22, G23, G31.83, G31.85	A	A & B					
disease	METADATA	Medication variable METADATA	antiemetics_beers	В	RISK	CODE	NOTES	Limitations/Issues			
ID DI	Description		Antipsychotics (except quetiopine,	Diagnosis code Parkinson disease, Parkinson plus syndromes, Lewy Body							
Antipsychotics (except quetiapine, clozapine, and pirmavanserin) in Parkinson disease	Avoid dopamine-receptor antagonists due to potential to worsen parkinsonian symptoms	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	cloreaine, and pimavenserini	dementia 332, 333.0, 331.6, 331.82 G20, G21, G22, G23, G31.83, G31.85	A	A&B					
disease METADATA		Medication variable METADATA	antipsychotics_beers_park A Medication code		RISK	CODE	NOTES	Limitations/Issues			
IB	Description		Medication code	Diagnosis code							
		ICD9 / CCS for ICD9									
history of gastric or duodenal ulcers	Aspirin > 325 mg/day may exacerbate existing ulcers or cause new/additional ulcers	ICD10 / CCS for ICD10			Omitted due to ran	ity of prescription for aspirin					
		Medication variable									
METADATA ID	METADATA Description	METADATA	Medication code	B Diaznosis	C Medication code	RISK	CODE	NOTES	Limitations/Issues		
	Avoid non-COX-2-selective NSAIDs with	ICD9 / CCS for ICD9		530.2 fulcer of esophaeus).	PPI or misoarastol						
Non-COX-2-selective NSAIDs with history of gastric or duodenal ulcers	s history of gastric/duodenal ulcer unless other alternatives are not effective and patient can take gastroprotective agent (ie, proton-pump inhibitor or misoprostol)	ICD10 / CCS for ICD10		K25 (gastric ulcer), K26 (duodenal ulcer), K27 (peptic ulcer), K28 (gastrojejunal ulcer)		A	A & B but exclude if [8 & C present]		Many people likely get PPI OTC		
	inhibitor or misoprostol)	Medication variable	nsaid_3		ppi_misoprostol					I	
METADATA	METADATA Description	METADATA	A Medication code	B Diagnosis code	S Laboratory value	RUSK	CODE	NOTES	Limitations/Issues		
			NSAIDs (includes combinations; excludes topicals, ophthalmics)	CKD Stage 4 or higher 585.4, 585.5, 585.6	Cystotin C						
NSAIDs in CKD stage 4 or		ICD9 / CCS for ICD9									
ngre presume cestance -	< Avoid NSAIDs (all) in CKD stage 4 or higher	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	nsaid	N18.4, N18.5	eGFR < 30 based on Cystatin C	A	A & [B C]				
	< Avoid NSAIDs (all) in CKD stage 4 or higher	ICD10 / CCS for ICD10 Medication variable Laboratory value		N18-4, N18-5	eGFR < 30 based on Cystatin C conversion when collected during HRS blood draw						
30) METADATA ID		ICD10 / CCS for ICD10 Medication variable	Medication code Estropen (oral and transdermal,	N18.4, N18.5 B Diagnosis code		A		Limitations/bases			
METADATA ID	METADATA Description Accord extremes and transformal forderses	ICD3 / CCS for ICD30 Medication variable Laboratory value METADATA ICD9 / CCS for ICD3 ICD3 / CCS for ICD3	nsaid A. Medication code Extraper (oval and transdormal, extituting intraveginal)	N18.4, N18.5	conversion when collected during HRS blood draw		NOTES 1. Estrogens medication variable definition excludes	Limitations/house			
METADATA ID Estrogen in urinary incontinence in women	METADATA Description Avoid extrogen oral and transfermal (excludes intravaginal extrage) in women with uninary incontinence (all types) METADATA	ICD3 / CCS for ICD30 Medication variable Laboratory value METADATA ICD9 / CCS for ICD3 ICD3 / CCS for ICD3	nsaid A Selection code Selection code Extrager (cord and stansdermal, extrading straveginal) estragers A	NIE-4, NIE-5 Diagnosis code Chrinory inconstituence 786.3 NI9-3, NI9-4, NI2-2	conversion when collected during HIS blood draw RISK	CODE	NOTES 1. Estrogens medication	Limitations/houses			
Estrogen in urinary incontinence in women	METADATA Description Anoid extragen and and transformal (encludes intravegate distingue) in women with unlary intravegate distingue) in women with unlary intravegate distingue). The METADATA Description Best described	ICD10 / CCS for ICD20 Medication variable Laboratory value METADATA ICD0 / CCS for ICD0 ICD10 / CCS for ICD10 Medication variable MMETADATA	A Medication code Dropping load and rounselvered, exclusing information and code an	B Diagnosis code Diagnosis code District Paris	conversion when collected during HIS blood draw RISK. A & female	A & female & B	NOTES 1. Estrogens medication variable definition excludes intravaginal estrogen	Limitations/house			
Estrogen in urinary incontinence in women METADATA ID Peripheral alpha-1 blockers in women with urinary incontinence	METALISETA Anoid entregation Anoid entregation and informationmal (includes intravegation) in some with unlawy exceptionaries (all types) METALISETA Out of persphered (piths 1 World on Metaliseta, parasits, and Metaliseta) unlawy reconstruction (all types)	ICD9 / CC5 for ICD3D Medication variable Laboratory value ICD9 / CC5 for ICD9 ICD10 / CC5 for ICD9 Medication variable METADATA ICD9 / CC5 for ICD9 Medication variable MCTADATA ICD9 / CC5 for ICD9 Medication variable	A Medication code Entropie for and transformat, anticologie code and transformat, anticologie code and transformat, anticologie code and transformation code. Medication code. Perspiratural spike-1 blockers (desagness, creasurs, presents) spike-1, Lecro.	E Diagnais cole Diagnais cole Diagnais cole Diagnais cole Diagnais cole Elitary incontinence Diagnais cole Usino incontinence 788.3 N39.3, N39.4, R32	Conversion when collected during HIS Stood draw RISK A & female RISK	A & female & B CODE A & female & B	NOTES 1. Estrogens medication variable definition educies intranaginal estrogen NOTES	Limitations/hours			
Estrogen in urinary incontinence in women METADATA Peripheral alpha-1 blockers women with urinary	SIEULIOITA Clausiption Anoid entregen and and transformal (includes intranspired entregen) in summer with orlary scanning and displayed in summer with orlary scanning and transpired entregen (in the control of the c	ICD J CCS for ICD3D Medication variable Laboratory value METADATA ICD J CCS for ICD3D Medication variable METADATA ICD J CCS for ICD3D Medication variable METADATA	Maciliation code disregard joint and foresdormed, exhibition code disregard joint and foresdormed, exhibition interruption() Maciliation code. Americanion code. Spiritual Jacobs April Jacobs	NIEA, NIES Diagranis code Diagranis code Sitrony incollinance NIES J., NIES A, NIES A	conversion when collected during HISE listed during HISE listed during HISE. A & Semale RISE. A & Semale RISE.	A & female & B	NOTES 1. Estrogens medication variable definition educies intranaginal estrogen NOTES	Limitations/house Limitations/house	Einstations/feases		
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SETADATA SUPPLY INTERPRETATION EXPLANTA INTERPRETATION DETADATA DETADATA DETADATA SUPPLY INTERPRETATION SUPPLY INTERPRETATION STORY STATEMENT OF THE PROPERTY OF THE P	Secretarian And description And description of and send-and journal interests of the secretarian of position continues (all types) Continues (all types) Description And proposal diplact blockes pleasures, provides, and leastered in women with when your procedures (all types) METIGATA Description Lineary procedures (all types) METIGATA Description Lineary procedures (all types)	EXDS / CCS for EXDS Children within Likerstony within Likerstony within Likerstony within Likerstony within Likerstony within Likerston within Likerston within Likerston for EXDS ACCS for EXDS	Medication code Medication code Entropes fire and strondormal, entitless personaged entropes Medication code Propinging and behavior Audication code Aud	N18.4, N18.5 Diagnosis code Diagnosis code Strong incontinuous N19.1, N19.4, N19. N19.1, N19.4, N19. Diagnosis code N19.1, N19.4, N19. COS 10.1 Diagnosis code CCS 10.1 Diagnosis code CCS 10.1 Diagnosis code CCS 407002 Diagnosis code	Communication and Control during William Cont	A & female & 2 CODE A & female & 2 CODE A & female & 2 MISS MISS A & mails	NOTES 1. Extragens medication to the control of th	Limitation/house	Limitationshaus		
Estrapari in univery incontinence in women METADATA. 10 Periphenel alpha 1 Modern Service incontinence in women with univery incontinence in women women with univery incontinence. 10 15 15 15 15 16 17 18 18 18 18 18 18 18 18 18	STEDERS. Straffelm And charge or di and transformal (secludes intrinsupprise original) in summe with sultary instrument of single original in summe with sultary instrument of single original in summe with sultary instrument original in summe with sultary protection and forecastion, protection and forecastion, protection or discount of systems or discount or summer with sultary instrument or summer with summer with summer with summer with summer with summer summer or summer summe	SCOD (CCS for SCDD COD (CCS for	Medication raise Medication raise Entropes for and invasional, calculating interespect calculating interespect And inter	N18.4, N18.5 Diagnosis code Diagnosis code Strong incontinuous N19.1, N19.4, N19. N19.1, N19.4, N19. Diagnosis code N19.1, N19.4, N19. COS 10.1 Diagnosis code CCS 10.1 Diagnosis code CCS 10.1 Diagnosis code CCS 407002 Diagnosis code	Communication and Control during William Cont	A & female & B CODE A & female & B E E E E E E E E E E E E E E E E E E	NOTES 1. Extregens medication to the control of th	Limitations/hours	Limitationshase		
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Estrapari in univery incontinence in women METADATA. 10 Periphenel alpha 1 Modern Service incontinence in women with univery incontinence in women women with univery incontinence. 10 15 15 15 15 16 17 18 18 18 18 18 18 18 18 18	Acceptance of the program of and transformal (pecludes intrinsical program of and transformal (pecludes intrinsical program) in summer with subsequences of an application of the program	ECOS / CCS for ECOS COS / CCS for ECOS ECOS / CCS	Modication code Modication code Modication code Acrospo in our des removiment, continuent code continuent code code code code code code code code code code code code code code code code code	n STEER, NIEES Diagnosis code Diagnosis code Diagnosis code STEER ST	Committee of the control of the cont	A & formation & B CODE A & formation & B A & formation & B A & monitor A & monitor A & monitor CODE	NOTES 1. Strangers and Surface under definition excludes under definition excludes under definition excludes under definition excludes NOTES A & made & [b] [] [Limitation/house	Limitations/bases		
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Estrapari in unitary incentinence in women harmonia. In the street incentinence in women harmonia. In the street incentinence in women with unitary women with unitary women with unitary street incention in the street in the st	Acceptance of the program of and transformal (pecisions or information of pecisions or information of pecisions or information of pecisions or information of pecisions of the p	ECOD / CCS for ECOD COD / CCS for ECOD COD / CCS for ECOD ECOD / CCS	Medication code Medication code Medication code Medication code According interception According	n N1EA, N1ES Diagnosis code CCS 52.2.1 (hyperplass of prosted) CCS 62.9.2.2 (hyperplass of prosted) CCS 62.9.2.3 (hyperplass of prosted)	Commence of the Commence of th	CODE All formir & B CODE All formir & B All formir & B All main All main CODE CODE	NOTES 1. Surgen enablation until the manufacture enablation enabl	Lambations/Noise Moltes Lambations/Noise Lambations/Noise	Limitation/locus		
Extraction in universe to the control of the contro	Account of the process of and transformal process of any transformal process of any transformation of the process of the proce	ECON / CCS for ECON ECON / CC	Medication code Medication code Entropes fire dark transdermed, entirely attempted of transdermed, entirely attempted o	Diagnosis code Diagnosis code Diagnosis code N29.3, N29.4, N22 Diagnosis code N29.3, N39.4, N22 S CCS 102.12 (hyperplasa of product) CCS (CDN2) (hyperplasa of product)	Commence of the Commence of th	CODE A& formire & B CODE A& formire & B A& formire & B RESC A& make A& make CODE COD COD	NOTES 1. European endication	Lambations/Noise Moltes Lambations/Noise Lambations/Noise	Limitationshaus		
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Estraces in universe procession of the second of the secon	Acceptable of the process of and transformal (procludes controlled on the process of and transformal (procludes controlled on the process of	ECON / CCS for ECON ECON / CC	Medication code Medication code Medication code Another increases	nile A. Nill S Diagnosis code Diagnosis code Diagnosis code Diagnosis code 10	Construct on the large page of	A & formula & B CODE A & formula & B A & formula & B A & male A & male A & male CODE CODE "The with cardion collection" CODE CODE "The with cardion collection" CODE CODE "The with cardion collection"	NOTES 1. Energen medication 1. Energy medication 1.	Lambardans/Nases Lambardans/Nases Lambardans/Nases Lambardans/Nases Lambardans/Nases	Limitationshase		
Extragation in universe processing in the state of the st	Amount durings and and send-deni jourishes continued and send-deni jourishes continued and send-deni jourishes continued and speed continued and s	ECON / CCS for ECON CON /	Medication code Medication code Medication code Another increases	N18.4, N18.5 Diagnosis code Diagnosis code Sinoy Incontinuory El 3 N19.3, N19.6, N19 Sinoy Incontinuory N19.3, N19.6, N19 Sinoy Incontinuory CCS 10.2.1 (Prycorplass of product) CCS 10.2.1 (Prycorplass of product) CCS 10.2.2 (Prycorplass of product) CCS 10.2.3 (Prycorplass of product) CCS 10.2.3 (Prycorplass of product) CCS 10.2.3 (Prycorplass of product) CCS COMPANIES (Prycorplass of prod	Committed as this is	A & formula & B CODE A & formula & B A & formula & B A & male A & male A & male CODE CODE "The with cardion collection" CODE CODE "The with cardion collection" CODE CODE "The with cardion collection"	NOTES 1. European enatication 1. European en	Lambardonsylvason TACHES Lambardonsylvason Lambardonsylvason Lambardonsylvason Lambardonsylvason Lambardonsylvason Lambardonsylvason	- initiations/koos		
Extragation in universe processing in the state of the st	Amount outrops and and transform (proclude control and transform (proclude control and transform) (MEDIA (CES DE CES) LIBERTANA MEDIA (CES DE CES) MEDIA (CES DE CES DE	Medication code Medication code Medication code Medication code Anticological code Medication code Anticological code Medication code Medication code Medication code Anticological code Medication code Medication code Anticological code Anticological code Medication code Anticological code Distriction code Anticological code Antico	nile A. Nill S Diagnosis code Diagnosis code Diagnosis code Diagnosis code 10	Committed as this is	A & Immin & B CODE A & Immin & B CODE A & Immin & Immin & Immin CODE CODE """ """ """ """ """ """ """ """ """	NOTES 1. Extrapris medication variable Administration extrades variable Administration extrades A. & make 6 [8 C] A. & make 6 [9 C] NOTES NOTES NOTES	Lambations/Name Lambations/Name Lambations/Name Lambations/Name Lambations/Name Lambations/Name	Limitation/Naus	Uminisians/hours	
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			ACEI, ARB, aliskinen, or potassium-								
RAS inhibitors combined	RAS inhibitor (ACE, ARB, aliskiren) or potassium-sparing diuretics (amiloride,	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	sparina diuretic	CKD Stape 3a or higher	Omitted	due to difficulty in determin	ng inappropriateness				
METADATA D	triamterene) and another RAS inhibitor in	Medication variable METADATA	A Medication code	Medication code	RISK	CODE		NOTES	Limitations/issues		
			aninids	benzadiozeaines							
pioid and benzodiazepines	Incresed risk of overdose with opioids and				A & B	i	A& 8	Requires overlapping prescriptions for opioids and	i		
	beruodiazepines	ICD9 / CCS for ICD9						benzodiazepines			
METADATA	METADATA Description	ICD10 / CCS for ICD10 Medication variable METADATA	opioids A Medication code	benzo B Medication code	RISK	CODE		NOTES	Limitations/Issues		
,		ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	apioids	gabapentin/pregabalin					Not able to factor in some exceptions, such a	rs	
Opioids and gabapentin/pregabalin	Increased risk of severe sedation-related adverse events with opioids and gabapentin/pregabalin	Medication variable	opioids	gabapentinoids	A & B		A & B	 Requires overlapping prescriptions for opioids and gabapentin/pregabalin 	transitioning from opioid therapy to gabapent d or pregabalin, or when using gabapentinoids reduce opioid dose, although caution should used in all circumstances	in to be	
ETADATA	METADATA Description	METADATA	A Medication code	B Disenseis code	RISK	CODE		NOTES	used in all circumstances Limitations/Issues		
	DEALEGUE	ICD9 / CCS for ICD9	Anticholineraic from Table 7	Anticholineraic from Table 7							
		ICD10 / CCS for ICD10						Requires overlapping			
Anticholinergic and anticholinergic	Increased risk of cognitive decline	Medication variable	anticholinergics_table_7	anticholinergics_table_7	A & B		A & B	prescription for medications in Table 7 of Beer's list	s		
RETADATA	METADATA	METADATA				RISK		CODE	NOTES	Limitations/Issues	
)	Description	ICD9 / CCS for ICD9	Medication code	Medication code	Medication code	IUSA		CODE	NOIS	Limisationizasias	
ombination of three or mor	Antidepressants (TCAs, SSRs, and SNRts), antipsychotics, antiepileptics, benzodiazepines and nonbenzodiazepine,	ICD10 / CCS for ICD10	antidepressants, tca, antiepileptic,	antidepressants, tca,	antidepressants, tca,	antiepileptic,	A&B&C	A & B & C (overlapping			
CNS-active drugs	benzodiazepine receptor agonist hypnotics (ie, "Z-drugs"), and opioids	Medication variable	antipsychotics_1st_gen, antipsychotics_2nd_gen, beruo, z_drug, opioids	antipplieptic, antipsychotics_1st_gen, antipsychotics_2nd_gen, benzo, z_drug, opioids	antipsychotics_1st_gi antipsychotics_2nd_g z_drug, opioids	in, sen, benzo,		prescriptions)			
ETADATA D	METADATA Description	METADATA	A Medication code	B Medication code Corticosteroids (excludes	RISK	CODE		NOTES	Limitations/Issues		
Corticosteroids and NSAIDs	Avoid due to increased risk of peptic urker disease or GI bleeding	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	NSAID (includes oil NSAIDs)	southelmic and topicals	Omitted	due to difficulty in determin	ng inappropriateness				
(oral or parenteral)	disease or GI bleeding METADATA Description	Medication variable METADATA	A Medication code	8 Medication code	RISK	CODE		NOTES	Limitations/Issues		
Lithium & ACEis	Avoid due to increased risk of lithium toxicity	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	fithium	ACE	Omitted	due to difficulty in determin	ng inappropriateness				
TADATA	METADATA Description	Medication variable METADATA	A Medication code	B Medication code	RISK	CODE		NOTES	Limitations/Issues		
ithium and loop diuretics	Avoid due to increased risk of lithium toxicity	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Athium	loop diuretics	Omitted	due to difficulty in determin	ng inappropriateness				
ETADATA	METADATA Description	Medication variable METADATA	A Medication code	B Medication code	RISK	CODE		NOTES	Limitations/issues		
veripheral alpha-1 blockers		ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Peripheral alpha-1 blockers (doxazasin, prazasin, terazosin)	Loop diuretics							
and loop duretics	diuretics in older women	Medication variable METADATA	A	В	Omitted o	due to difficulty in determin	ng mappropriateness	NOTES	Limitations/Issues		
	Description Increased risk of phenytoin toxicity with TMP- SMX		Medication code aherotain	Medication code TMP-SMX		due to difficulty in determin					
Phenytoin and TMP-SMX IETADATA	METADATA	Medication variable METADATA	A	B Medication code	RISK	due to difficulty in determin	ng inappropriateness	NOTES	Limitations/Issues		
hecohyline and cimetidine	Description Increased risk of theophylline toxicity	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Medication code Theophylline	Medication code cimetidine	Outro 4	due to difficulty in determin					
Theophyline and cimetidine	METADATA	Medication variable METADATA	A	8	RISK	cont	ng inappropriateress	NOTES	Limitations/Issues		
Theophylline and ciprofloxacin	Description Increased risk of theophylline toxicity	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Medication code Theophylline	Medication code ciprofloxacin	Omitted	due to difficulty in determin					
ciprofloxacin ИЕТАДАТА	METADATA Description	Medication variable METADATA	A Medication code	B Medication code	RISK	CODE	ing inappropriate install	NOTES	Limitations/Issues		
Warfarin and amiodanone	Description Increased risk of bleeding	KD9 / CCS for KD9 KD10 / CCS for KD10	Medication code worforin	amiodorone	Omitted	due to difficulty in determin	na inarrorriatoress		_		
METADATA	METADATA Description	Medication variable METADATA	A Medication code	8 Medication code	RISK	CODE	ing inappropriate install	NOTES	Limitations/Issues		
Warfarin and ciprofloxacin	Increased risk of bleeding	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	worferin	ciprofloxacin	Omitted	due to difficulty in determin	ne inappropriateness				
METADATA	METADATA Description	Medication variable METADATA	A Medication code	8 Medication code	RISK	CODE		NOTES	Limitations/Issues		
Warfarin and macrolides		1000 / 00% See 1000	worferin	Macrolides (except azithromycin)		_					
Warfarin and macrolides (excluding azithromycin)	Increased risk of bleeding	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA			Omitted o	due to difficulty in determin	ng inappropriateness	NOTES	Limitations/issues		
	Description		Medication code worforin	Medication code 7MP-SMX							
Warferin and TMP-SMX TETADATA	Increased risk of bleeding METADATA	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA	A	В	Omitted o	due to difficulty in determin	ng mappropriateness	NOTES	Limitations/Issues		
	Description		Medication code worforin	Medication code NSAIDs (includes all NSAIDs)							
Warfarin and NSAIDs	Increased risk of bleeding	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable			Omitted	due to difficulty in determin	ng inappropriateness				
METADATA D	METADATA Description	METADATA	A Medication code ciproflowacin	5 Diaznosis code	C Laboratory value Cystotin C	RISK		CODE	NOTES	Limitations/Issues	
Ciprofloxacin with reduced kidney function	Dose reduction when CrCl < 30 ml/min	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable					ficulty in defining dose n				
RETADATA D	METADATA Description	METADATA	A Medication code TMP-SMX	B Diagnosis code CKD Stage 5 or higher	C Laboratory value Cystotin C	RISK		CODE	NOTES	Limitations/Issues	
TMP-SMX with reduced kidney function	Dose reduction if CrO 15-29 mL/min, avoid if CrO < 15 mL/min	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA	tmp smx	585.5, 585.6 N18.5. N18.6	Calculated eGFR < 15		A	A & [B C]	We only focus on CrCl < 15/min (not factoring in dose reduction for CrCl 15-29)	all characters of	
METADATA D	METADATA Description		A Medication code amiloride	Diagnosis code CKD Stage 4 or higher	C Laboratory value Cystotin C	RISK		CODE	NOTES	Cimitations/Issues	
Amiloride with reduced kidney function	Avoid with CrCl < 30	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable	amiloride	585.4, 585.5, 585.6 N18.4, N18.5, N18.6	Calculated eGFR < 30		A	A & [B C]	MOTES	Limitations/issues	
	METADATA Description	METADATA	A Medication code apixoban	B Diagnosis code CKD Stage 4 or higher 583.4, 585.5, 585.6 N18.4, N18.5, N18.6	C Laboratory value Cystotin C	RISK		CODE	NOTES	Limitations/189046	
Apixaban with reduced kidney function TADATA	Avoid with CrCl < 25 METADATA	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA	apixaban A		Calculated eGFR < 25	RISK	A	A & [B C]	We apply CrCl <25 as CKD Stage 4 or highe NOTES	Limitations/issues	
0	METADATA Description	ICD9 / CCS for ICD9	Medication code debisotron	Diamosis code CKD Stope 4 or higher 585.4, 585.5, 585.6	Custotin C	RISK				Emilianos SSS SS	
Dabigatran with reduced kidney function SETADATA	Avoid with CrCl < 30 METADATA	ICDS / CCS for ICD10 ICD10 / CCS for ICD10 Medication variable METADATA	dabigatran A	N18.4. N18.5. N18.6	Calculated eGFR < 30	RISK	A	A & [B C]	NOTES	Limitations/Issues	
•	Description Reduce dose if CrCl 20-59 mL/mir; avoid if		Medication code dofetilide	Diamosis code OXD Stope 4 or higher 585.4, 585.5, 585.6	Laboratory value Critotin C	N. M.					
Dofetilide with reduced kidney function	CrCl < 20 METADATA	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA	dofetilide A	N18.4. N18.5. N18.6	Calculated eGFR < 20	RISK	A	A & [B C]	We only focus on CrCl < 20 (not factoring i dose reduction) NOTES	Limitations/Issues	
Edoxaban with reduced	Description Reduce dose if CrCl 20-59; avoid if CrCl < 15 or	ICD9 / CCS for ICD9	Medication code edoxaban	Diaznosis code CKD Stage 5 or higher 585.5, 585.6	Laboratory value Cystotin C						
Edoxaban with reduced kidney function METADATA	> 95 mL/min METADATA	ICD10 / CCS for ICD10 Medication variable METADATA	edoxaban A	N18.5, N18.6	Calculated eGFR < 15	or > 95	A	A & [B C]	NOTES	Limitations/Issues	
•	Description	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10	Medication code	Diagnosis code	Laboratory value Cystotin C						
Enoxaparin with reduced kidney function	Reduce dose if CrCl < 30 METADATA	Medication variable METADATA	A	В	c	Omitted due to dif	ficulty in defining dose n	CODE	NOTES	Limitations/Issues	
1	Description	ICD9 / CCS for ICD9	Medication code fondpoorinux	Diagnosis code CKD Stope 4 or higher 585.4, 585.5, 585.6	Laboratory value Cvitotin C						
Fondaparinux with reduced kidney function	Avoid if CrCl < 30	ICD10 / CCS for ICD10 Medication variable	fondaparinux	N18.4. N18.5. N18.6	Calculated eGFR < 30		A	A & [B C]			
IETADATA	METADATA	METADATA	A	В	с	D		£	RESK	CODE	
•	Description Nonvalvular atrial fibrillation: reduce dose if OCLUS 50 pet forto period if OCLUS and forto.	ICD9 / CCS for ICD9	Medication code rivaroxaban	Diamosis code SVT (AF/AFL) 427.0, 427.3	Diaznosis code VTE 452.453*.415.1*	Laboratory Costotin C	value	Laboratory value Costotin C	Α.	48 (0) 1 (0) 1 (0) 1 (0)	
Rivaroxaban with reduced	CrCl 15-50 mL/min; avoid if CrCl <15 mL/min; Venous thromboembolism treatment and for	ICD10 / CCS for ICD10 Medication variable	rivarosaban A Medication code	87.1.148* B	180*. 181*. 182*. 126*	Calculated RISK	GFR < 15	Calculated eGFR < 30	NOTES	A & [(B D) (C E)] Limitations/Issues	
Rivaroxaban with reduced kidney function	MFTADATA	INLIADAIA		Diagnosis code	Laboratory value						
kidney function METADATA D Spironolactone with reduces	METADATA Description	ICD9 / CCS for ICD9	Medication code spironalactone	Diagnosis code CKD Stage 4 or higher 585.4, 585.5, 585.6	Cystotin C		A	48 8 1 41			
kidney function METADATA D Spironolactone with reduced kidney function METADATA	METADATA Description d Avoid if CrCl < 30 METADATA	ICD9 / CCS for ICD9 ICD10 / CCS for ICD10 Medication variable METADATA	spironalactone spironalactone A	585.4, 585.5, 585.6 N18.4, N18.5, N18.6 B	Calculated eGFR < 30	RUSK	A	A & [B C]	NOTES	Limitations/Issues	
kidney function TTADATA ironolactone with reduces kidney function ETADATA friamberene with reduced	METADATA Description d Avoid if CrCl < 30 METADATA Description	ICD10 / CCS for ICD10 Medication variable METADATA	spironolactone	585.4, 585.5, 585.6 N18.4, N18.5, N18.6 B				CODE	NOTES	Limitations/Issues	
kidney function METADATA D Spironolectone with reduces	METADATA Description d Avoid if CrCl < 30 METADATA	ICD10 / CCS for ICD10 Medication variable	spironolactone spironolactone A Medication code	585.4, 585.5, 585.6	Calculated eGFR < 30 C Laboratory value	RUSK	A		NOTES NOTES	Limitations/issues Limitations/issues	

			dulosetine	CKD Stope 4 or higher	Cystotin C					
Districting with reduced		ICD9 / CCS for ICD9		585.4.585.5.585.6						
	Avoid if CrCl < 30	ICD10 / CCS for ICD10		N18.4, N18.5, N18.6			A	A & [B C]		
kidney function		Medication variable	duloxetine		Calculated eGFR < 30					
IETADATA	METADATA	METADATA	4	8	C	RUSK		CODE	NOTES	Limitations/Issues
)	Description		Medication code	Diagnosis code	Laboratory value				NOTES	Little Control of the
	DELIBORE		medication code	Distribut Code	Cystotin C					
		ICD9 / CCS for ICD9								
Gabapentin with reduced	Reduce dose if CrCl < 60	ICD10 / CCS for ICD10				Omitted due to difficu	ilty in defining dose redu	ection		
kidney function		Medication variable								
IETADATA	METADATA	METADATA	Δ.	8	c	RISK		CODE	NOTES	Limitations/Issues
1	Description		Medication code	Diagnosis code	Laboratory value					
					Cystetin C					
evetiracetam with reduced		ICD9 / CCS for ICD9								
evetiracetam with reduced kidney function	Reduce dose if CrCl < 80	ICD10 / CCS for ICD10				Omitted due to difficu	ilty in defining dose redu	ection		
kidney function		Medication variable								
IETADATA	METADATA	METADATA	A	8	c	RUSK		CODE	NOTES	Limitations/Issues
)	Description		Medication code	Diagnosis code	Laboratory value					
					Cystotin C					
Prezabalin with reduced		ICD9 / CCS for ICD9								
kidney function	Reduce dose if CrCl < 60	ICD10 / CCS for ICD10				Omitted due to difficu	ilty in defining dose redu	ection		
		Medication variable								
IETADATA	METADATA	METADATA	A	В	c	RISK		CODE	NOTES	Limitations/Issues
)	Description		Medication code	Diagnosis code	Laboratory value					
			tramadol ER	CKD Stope 4 or higher	Cvstatin C					
Tramadol with reduced	Reduce immediate-release dose if CrCl < 30:	ICD9 / CCS for ICD9		585.4, 585.5, 585.6						
kidney function	avoid extended release if CrCl < 30	ICD10 / CCS for ICD10		N18.4. N18.5. N18.6			A	A & [B C]	Omitting dose reduction criteria	
		Medication variable	tramadol_ER		Calculated eGFR < 30					
IETADATA	METADATA	METADATA	A	В	c	RUSK		CODE	NOTES	Limitations/Issues
)	Description		Medication code	Diaznosis code	Laboratory value					
					Cystotin C					
2 antagonists with reduced	Reduce dose of cimetidine, famotidine.	ICD9 / CCS for ICD9					ilty in defining dose redu			
kidney function	nizatidine, or ranitidine when CrCl < 50	ICD10 / CCS for ICD10				Omittee due to dimici	ary in destring dose red	coon		
		Medication variable								
IETADATA	METADATA	METADATA	A	В	c	RUSK		CODE	NOTES	Limitations/Issues
)	Description		Medication code	Diaznosis code	Laboratory value					
					Cystotin C					
Colchicine with reduced		ICD9 / CCS for ICD9					ilty in defining dose redu			
kidney function	Reduce dose if CrCl < 30	ICD10 / CCS for ICD10				Omittee due to dimici	ary in destring dose red	coon		
		Medication variable								
IETADATA	METADATA	METADATA	A	8	c	RISK		CODE	NOTES	Limitations/Issues
	Description		Medication code	Diagnosis code	Laboratory value					
			probenecid	CKD Stage 4 or higher	Cystotin C					
Probenecid with reduced	Avoid if OCLy 30	ICD9 / CCS for ICD9		585.4, 585.5, 585.6			A	A & IB I CI		
		ICD10 / CCS for ICD10		N18.4, N18.5, N18.6	Calculated eGFR < 30		^	ve la l cl		
kidney function		Medication variable	probenecid							