Journal of the American Heart Association

ORIGINAL RESEARCH

Association Between Copayment and Adherence to Medications for Pulmonary Arterial Hypertension

Erin M. Schikowski, MD; Gretchen Swabe, MSc; Stephen Y. Chan, MD, PhD; Jared W. Magnani, MD, MSc

BACKGROUND: Pharmacologic treatment for pulmonary arterial hypertension (PAH) improves exercise capacity, functional class, and hemodynamic indexes. However, monthly prescription costs often exceed $4000. We examined associations between (1) medication copayment and (2) annual household income with adherence to pulmonary vasodilator therapy among individuals with PAH.

METHODS AND RESULTS: We used administrative claims data from an insured population in the United States to identify individuals diagnosed with PAH between 2015 and 2020. All individuals had ≥1 medication claim for endothelin receptor antagonists, phosphodiesterase type-5 inhibitors, prostanoids or prostacyclin receptor agonists, or the soluble guanylate cyclase stimulator riociguat. We defined copayments as low, medium, or high, as determined by their distributions for each medication class. Annual household income was categorized as <$40 000, $40 000 to $74 999, and ≥$75 000. The primary outcome was medication adherence, defined by proportion of days covered ≥80%. We studied 4025 adults (aged 65.9±13.3 years; 71.2% women). Compared with those with annual household income ≥$75 000, individuals in the <$40 000 and $40 000 to $74 999 categories had no significant differences in medication adherence. Compared with those with low copayments, individuals with high copayments had decreased adherence to prostanoids (odds ratio [OR], 0.36 [95% CI, 0.20–0.65]; *P*<0.001) and combination therapy with endothelin receptor antagonist and phosphodiesterase type-5 inhibitor (OR, 0.61 [95% CI, 0.38–0.97]; *P*=0.03).

CONCLUSIONS: We identified associations between copayment and adherence to prostanoids and combination therapy among individuals with PAH. Copayment may be a structural barrier to medication adherence and merits inclusion in studies examining access to pharmacotherapy among individuals with PAH.

Key Words: medication adherence ■ phosphodiesterase 5 inhibitors ■ pulmonary arterial hypertension ■ receptors, epoprostenol ■ riociguat ■ soluble guanylyl cyclase

See Editorial by Cantres-Fonseca and Kennedy.

Pulmonary arterial hypertension (PAH) is a progressive disease characterized by increased pulmonary artery pressure and pulmonary vascular resistance, ultimately leading to right ventricular failure. Targeted therapies include endothelin receptor antagonists (ERAs), phosphodiesterase type-5 inhibitors (PDE5), prostanoids and prostacyclin receptor agonists, and the soluble guanylate cyclase stimulator (sGCS) riociguat. Access to these medications is crucial, as early intervention improves exercise capacity, functional class, and hemodynamic indexes.[1–5] However, medical therapy is costly, carries the risk of serious adverse effects, and requires frequent monitoring by specialists.[1,6]

In the past decade, randomized controlled trials have demonstrated multiple benefits to combination therapy.[3,7–9] In treatment-naïve individuals, initial

Correspondence to: Jared W. Magnani, MD, MSc, 3609 Forbes Avenue, Second floor, Pittsburgh, PA 15213. Email: magnanij@pitt.edu

Supplemental Material is available at https://www.ahajournals.org/doi/suppl/10.1161/JAHA.122.026620

For Sources of Funding and Disclosures, see page 8.

JAHA is available at: www.ahajournals.org/journal/jaha

CLINICAL PERSPECTIVE

What Is New?

- In a data set of insured individuals with pulmonary arterial hypertension, medication copayment was associated with adherence to disease-specific therapies.
- Individuals with higher copayments had markedly decreased adherence to prostanoids and combination therapy with endothelin receptor antagonists and phosphodiesterase type-5 inhibitors.

What Are the Clinical Implications?

- Recognizing copayments as structural barriers to pulmonary vasodilator adherence may inform shared decision making about therapy initiation in those with pulmonary arterial hypertension.
- Efforts should be made to incorporate copayment into studies examining barriers to medication adherence to pulmonary vasodilator therapies.

Nonstandard Abbreviations and Acronyms

ERA	endothelin receptor antagonist
PAH	pulmonary arterial hypertension
PDC	proportion of days covered
PDE5	phosphodiesterase type-5 inhibitors
sGCS	soluble guanylate cyclase stimulator

combination therapy with the ERA ambrisentan and PDE5 tadalafil resulted in a lower risk of clinical failure events compared with either medication when used as monotherapy.[10] Moreover, hospitalization for worsening PAH was markedly decreased in the combination therapy group compared with the pooled-monotherapy group. The addition of an ERA to background PDE5 therapy has an array of clinical benefits as well.[7]

Although effective, pharmacologic treatment carries substantial economic burden, with mean monthly prescription cost estimated at $4590.[11] Treatment is generally lifelong, and individuals with low-risk features can be expected to live for at least 5 years. Thus, the cost of combination therapy over time is significant.[12]

In the United States, a large population of insured individuals are responsible for paying a share of prescription costs. As such, there is growing interest in the relation between drug pricing and prescription access.[13] Previous studies have demonstrated that increases in copayment, specifically, are related to decreased adherence to lipid-lowering agents and antihypertensives.[14,15] Moreover, lowering out-of-pocket medication costs has been associated with reduced health care disparities for those with chronic cardiovascular disease.[16–19]

Given the high cost of pulmonary vasodilators, we undertook this study to understand how medication copayment and household income relate to adherence to pulmonary vasodilator therapy for PAH. Our dual hypotheses were that (1) higher copayment and (2) annual household income would be associated with decreased adherence to disease-specific medications in individuals with PAH.

METHODS

Study Population

Data were acquired from Optum's De-identified Clinformatics Data Mart (Eden Prairie, MN; optum.com; and hereafter described as Optum). These data are commercially licensed and as such the authors do not have the authority or permission to either share them or provide access to them. Interested parties may obtain the data directly from Optum, as per licensing agreements. Optum data consist of administrative claims for inpatient, outpatient, emergency department, pharmacy, and laboratory services for individuals with commercial insurance or Medicare Advantage in the United States. Because data are deidentified, informed consent is waived. Claims data include *International Classification of Diseases, Ninth Revision* (*ICD-9*), and *International Classification of Diseases, Tenth Revision* (*ICD-10*), codes; Current Procedural Terminology, Version 4, procedure codes; Healthcare Common Procedure Coding System Level II codes; and site of service codes. The University of Pittsburgh Institutional Review Board approved this study as exempt given the deidentified nature of the data.

Individuals were identified as having PAH by *ICD-9* code 416.0 and *ICD-10* code I27.0 between January 1, 2015, and September 30, 2020. To reduce the risk of misclassification, we used a 2-component algorithm requiring all individuals to have both diagnostic coding for PAH and use of disease-specific treatment with pulmonary vasodilators (ERAs, PDE5, prostanoids, or sGCS).[20] Because PDE5 are commonly used to treat erectile dysfunction, we included only those who filled prescriptions for (1) sildenafil at 20 to 80 mg per dose with frequency of dosing greater than once daily and (2) tadalafil dosed at ≥40 mg per day. A flowchart describing the development of the study cohort is presented in Figure S1.

Individuals were characterized by medication class: ERAs, PDE5, prostanoids, or sGCS. Use of combination therapy was defined by overlapping pharmacy claims for ERAs and PDE5 for ≥90 days without discontinuation of either medication during the observation period. If an individual switched to a different

medication within the same class, he or she was retained in the original cohort for that medication class.

Exposures: Medication Copayment and Household Income

Medication copayments and deductibles were obtained from pharmacy claims from the date of service provision. Whether an individual paid any deductible toward his/her medication prescriptions was assessed as a binary variable, consistent with the approach used in other literature describing deductibles and medication adherence.[21] Annual household income was acquired by Optum from an independent database (the AmeriLINK Consumer Marketing Database). The original data used to determine household income are not available for the authors' analysis or review independent of their provision by Optum. Estimates of household income were derived using the ZIP+4, a highly specific indicator of neighborhood residence >130 indicators of household income (eg, Internal Revenue Service data, home value at the address level, financial credit, loans, and similar data describing consumer resources). These data are compared with monthly surveys of >30 000 households considered to be a nationally representative cross-section of the US population to validate estimated and reported household income.[22] Annual household income is categorized by Optum as <$40 000, $40 000 to $49 999, $50 000 to $59 999, $60 000 to $74 999, $75 000 to $99 999, and ≥$100 000.

Outcomes

The primary outcome was medication adherence, estimated by proportion of days covered (PDC). PDC is defined as the number of days' supply dispensed during the observation period divided by the number of days from the first medication fill through either the end of follow-up or medication discontinuation.[23] Adherence was calculated for each medication class and combination therapy, and does not capture those individuals who were prescribed but did not fill a medication. We focused on oral medications only because of lack of dosing and frequency data for parenteral pulmonary vasodilators. Individuals were considered adherent if they achieved PDC ≥80%, a standard threshold for pharmacologic adherence in PAH and other conditions.[24,25] Those using combination therapy were not included in adherence analyses for ERAs or PDE5.

We assessed PDC for combination therapy by first defining a combination therapy window starting at the latest chronological date of the first fill for PDE5 or ERA. The combination therapy window ended at the minimum of either end of enrollment or discontinuation for either ERA or PDE5, where discontinuation was defined as ≥60 days without the ERA or PDE5. The discontinuation date was considered to be the date on which the last supply ended. The denominator was the sum of total days of follow-up for the combination therapy window. ERA and PDE5 claims were considered separately to account for asynchronous filling. The numerator was the sum of total days of medication supply for each medication class during the observation window.

Covariates

Age, sex, and insurance type were ascertained from insurance enrollment. Race and ethnicity were provided by Optum and derived from a combination of publicly available records (such as drivers' licenses) or validated algorithms incorporating US Census–based racial and ethnic neighborhood composition, residential zip code, and first and last name.[22,26] Race and ethnicity categories are mutually exclusive and include Asian, Black, Hispanic, White, or unknown. *ICD-9* and *ICD-10* codes were used to identify comorbidities from inpatient and outpatient claims before the first medication fill, as listed in Table S1. Comorbidities were selected using the Elixhauser Comorbidity Index.[27,28] Systemic sclerosis, amphetamine use, chronic kidney disease, and interstitial lung disease were included as separate covariates because of their associations with pulmonary hypertension.

Estimates of educational attainment were determined similar to household income using commercial data. These data were provided by Optum and categorized as <12th grade, high school diploma, some college, or bachelor degree or higher. Insurance type included commercial insurance and Medicare Advantage. For individuals with Medicare, the database indicates use of low-income subsidies and dual eligibility for Medicaid and Medicare.

Because deductible contributes to out-of-pocket expenses, we adjusted for the presence of deductible, as a dichotomous variable, paid toward pulmonary vasodilator medications.

Statistical Analysis

We examined the distributions of continuous and categorical variables for the entire cohort and by medication class. Copayment was standardized to a 30-day medication supply. Copayments were classified as low, medium, or high based on their distributions. For ERAs, prostanoids, sGCS, and combination therapy, "low" copayment was defined as <$30; "medium" was defined as $30 to 99; and "high" was defined as ≥$100. For PDE5, few individuals had copayment ≥$100; thus, copayment categories were modified to define "low" as <$15; "medium" as $15 to $49; and "high" as ≥$50. Given the distributions of annual household income, we combined categories as <$40 000, $40 000 to $74 999, and ≥$75 000. Those with unknown annual household income were excluded from analyses in which annual household income was an independent variable.

We used multivariable-adjusted logistic regression models to relate (1) copayment and (2) annual household income to odds of PDC ≥80% for each medication class and combination therapy. We performed sequential multivariable-adjusted regression analyses using 3 models. In model 1, we adjusted for age, sex, race, and ethnicity. In model 2, we adjusted for the variables included in model 1 plus comorbidities as determined by the number of conditions from the Elixhauser Comorbidity Index. Systemic sclerosis, amphetamine use, chronic kidney disease, and interstitial lung disease were included as separate binary covariates. Model 3 included adjustment for all the variables included in model 2, in addition to household income (excluded when used as an independent variable), educational attainment, insurance type (commercial, low-income subsidy program, Medicare, and dual Medicare/Medicaid eligibility), and deductible paid toward pulmonary vasodilator medications. We tested for interactions between annual household income and copayment. To isolate the effect of annual household income on adherence, we adjusted for copayment in the income analyses.

A sensitivity analysis was performed in which individuals with <12 months of continuous follow-up were excluded from multivariable-adjusted regression analyses. As a supplementary analysis, we repeated the multivariable-adjusted regression analyses using the same categories for classification of copayments (ie, "low" copayment was defined as <$30; "medium" as $30–$99; and "high" as ≥$100) for all medications. Statistical analyses were performed using SAS software version 9.4 (SAS Institute, Cary, NC). The threshold for statistical significance was $P<0.05$.

RESULTS

Patient Characteristics

Individuals were identified as having PAH by *ICD-9* and *ICD-10* codes between January 1, 2015, and September 30, 2020. We restricted the cohort to individuals with ≥1 medication claim for ERAs, PDE5, prostanoids, or sGCS (n=5147). A small number of individuals was excluded for having age of <18 years or unknown sex (n=148) and for having <90 days enrollment after index prescription (n=497). Individuals with claims for injectable medications were excluded (n=482) because of lack of available data about dosage and amount supplied. This process yielded a final cohort of 4025 individuals, as depicted in Figure S1. Median follow-up was 20.0 months (interquartile range, 10.5–34.8 months) after the first medication claim.

Mean age was 65.9±13.3 years, and 71.2% were women (Table 1). Race and ethnicity categories were distributed as follows: 51.6% White race, 18.5% Black race, 9.6% Hispanic ethnicity, and 2.2% Asian race. The most common educational attainment was some college (43.6%), followed by high school diploma (29.4%), bachelor degree or higher (9.8%), and <12th grade education (0.4%). Of the cohort, 27% had annual household income <$40 000, and 23.7% had annual household income ≥$75 000. Annual household income data were missing or unknown for 1073 (26.7%). Medicare beneficiaries made up a majority of the cohort (79.0%). Fifteen percent were dually eligible for Medicare and Medicaid, and 16.5% were enrolled in a low-income subsidy program. Prevalent comorbidities included hypertension (65.5%), chronic pulmonary disease (42.8%), congestive heart failure (41.2%), diabetes (35.4%), and valvular disease (31.7%), as listed in Table S2.

Copayment Distributions

Copayment distributions by medication class are presented in Figure 1. Median 30-day copayment was $45.25 for ERAs, $11.05 for PDE5, $60.08 for prostanoids, $45.00 for sGCS, and $31.60 for combination therapy. Distributions were skewed across all medication classes because of the presence of outliers with high copayments.

We explored the interaction between annual household income and copayment (Table S3). Among individuals in the lowest annual household income category, there were no differences in adherence between those with high versus low copayments.

Medication Adherence

In the fully adjusted multivariable analysis (model 3), we observed decreased odds of achieving PDC ≥80% among individuals with high copayments for prostanoids (odds ratio [OR], 0.36 [95% CI, 0.20–0.65]; $P<0.001$) and combination therapy (OR, 0.61 [95% CI, 0.38–0.97]; $P=0.03$) relative to individuals with low copayments, as demonstrated in Table 2 and Figure 2. Compared with those with low copayments, having a high copayment was associated with nearly 2-fold greater odds of reaching PDC ≥80% for those on PDE5 (OR, 1.86 [95% CI, 1.34–2.59]; $P<0.001$). Compared with those with annual household income ≥$75 000, individuals in the <$40 000 and $40 000 to $74 999 categories had no significant differences in medication adherence to any of the pulmonary vasodilator medications or combination therapy (Table 3). These findings were similar in a subgroup analysis that included only those individuals (n=3735) with ≥12 months of continuous enrollment after the first medication fill (Table S4). Modifying the copayment classification for PDE5 did not change the relation between copayment and adherence to this class of medication (Table S5).

Table 1. Cohort Characteristics for Individuals Receiving Treatment for PAH

Characteristic	All eligible (n=4025)	ERAs (n=974)	PDE5 (n=2123)	Prostanoids (n=652)	sGCS (n=528)	ERA+PDE5 (n=927)
Demographic characteristics						
Age, mean (SD), y	65.9 (13.3)	65.5 (12.9)	68.1 (12.8)	62.6 (12.4)	64.8 (13.1)	61.3 (13.2)
Female sex	2866 (71.2)	746 (76.6)	1439 (67.8)	498 (76.4)	389 (73.7)	701 (75.6)
Race or ethnicity						
Asian	89 (2.2)	22 (2.3)	49 (2.3)	10 (1.5)	8 (1.5)	21 (2.3)
Black	744 (18.5)	190 (19.5)	358 (16.9)	105 (16.1)	124 (23.5)	180 (19.4)
Hispanic	387 (9.6)	80 (8.2)	227 (10.7)	65 (10)	37 (7)	90 (9.7)
Unknown	730 (18.1)	196 (20.1)	366 (17.2)	149 (22.9)	102 (19.3)	167 (18.0)
White	2075 (51.6)	486 (49.9)	1123 (52.9)	323 (49.5)	257 (48.7)	469 (50.6)
Educational attainment						
<12th Grade	15 (0.4)	2 (0.2)	10 (0.5)	1 (0.2)	1 (0.2)	4 (0.4)
High school	1183 (29.4)	303 (31.1)	632 (29.8)	167 (25.6)	157 (29.7)	250 (27.0)
Some college	1755 (43.6)	393 (40.4)	926 (43.6)	283 (43.4)	228 (43.2)	419 (45.2)
Bachelor's degree or higher	393 (9.8)	94 (9.7)	219 (10.3)	65 (10)	49 (9.3)	90 (9.7)
Unknown	679 (16.9)	182 (18.7)	336 (15.8)	136 (20.9)	93 (17.6)	164 (17.7)
Annual household income, $						
<40 000	1108 (27.5)	304 (31.2)	558 (26.3)	151 (23.2)	155 (29.4)	238 (25.7)
40 000–49 999	276 (6.9)	62 (6.4)	162 (7.6)	33 (5.1)	29 (5.5)	53 (5.7)
50 000–59 999	281 (7.0)	47 (4.8)	154 (7.3)	46 (7.1)	37 (7)	74 (8.0)
60 000–74 999	333 (8.3)	70 (7.2)	172 (8.1)	50 (7.7)	35 (6.6)	85 (9.2)
75 000–99 000	415 (10.3)	95 (9.8)	215 (10.1)	77 (11.8)	54 (10.2)	107 (11.5)
≥100 000	539 (13.4)	136 (14)	285 (13.4)	100 (15.3)	80 (15.2)	127 (13.7)
Unknown	1073 (26.7)	260 (26.7)	577 (27.2)	195 (29.9)	138 (26.1)	243 (26.2)
No. of Elixhauser comorbidities, median (Q1–Q3)	5 (3–9)	5 (2–8)	6 (3–9)	4 (2–7)	5 (2–9)	4 (2–7)
Systemic sclerosis	296 (7.4)	88 (9.0)	129 (6.1)	69 (10.6)	27 (5.1)	100 (10.8)
Amphetamine use	13 (0.3)	3 (0.3)	6 (0.3)	2 (0.3)	2 (0.4)	3 (0.3)
Chronic kidney disease	1627 (40.4)	359 (36.9)	1021 (48.1)	212 (32.5)	197 (37.3)	264 (28.5)
Interstitial lung disease	587 (14.6)	131 (13.5)	340 (16.0)	93 (14.3)	57 (10.8)	130 (14.0)
Medicare beneficiary	3180 (79.0)	767 (78.8)	1756 (82.7)	492 (75.5)	404 (76.5)	664 (71.6)
Dual Medicare/ Medicaid eligibility	603 (15.0)	131 (13.5)	328 (15.5)	100 (15.3)	70 (13.3)	149 (16.1)
Low-income subsidy program	663 (16.5)	174 (17.9)	344 (16.2)	112 (17.2)	90 (17.1)	163 (17.6)
Follow-up, median (Q1–Q3), mo	20.0 (10.5–34.8)	19.1 (10.3–34.4)	18.7 (9.7–33.9)	22.2 (12.4–37.3)	21.5 (12.5–37.9)	25.1 (13.5–38.6)
30-d Copay, median (Q1–Q3), $		45.25 (1.76–554.46)	11.05 (1.95–43.10)	60.08 (0.82–725.72)	45.00 (1.14–526.74)	31.60 (0.53–209.47)
Any deductible	1664 (41.34)	483 (49.6)	694 (32.7)	322 (49.4)	266 (50.4)	506 (54.6)

Data are given as number (percentage), unless otherwise indicated. ERA indicates endothelin receptor antagonist; PAH, pulmonary arterial hypertension; PDE5, phosphodiesterase type-5 inhibitors; Prostanoids, prostanoids and prostacyclin receptor agonists; Q1, quartile 1; Q3, quartile 3; and sGCS, soluble guanylate cyclase stimulators.

DISCUSSION

We used a nationally representative claims database to determine associations between (1) copayment and (2) annual household income with pulmonary vasodilator adherence among individuals with PAH. We determined that high copayments were associated with markedly decreased adherence to prostanoids and combination therapy compared with those with lower copayments. In contrast, we determined that annual household income was not associated with medication adherence. Our examination of the interaction of copayment and

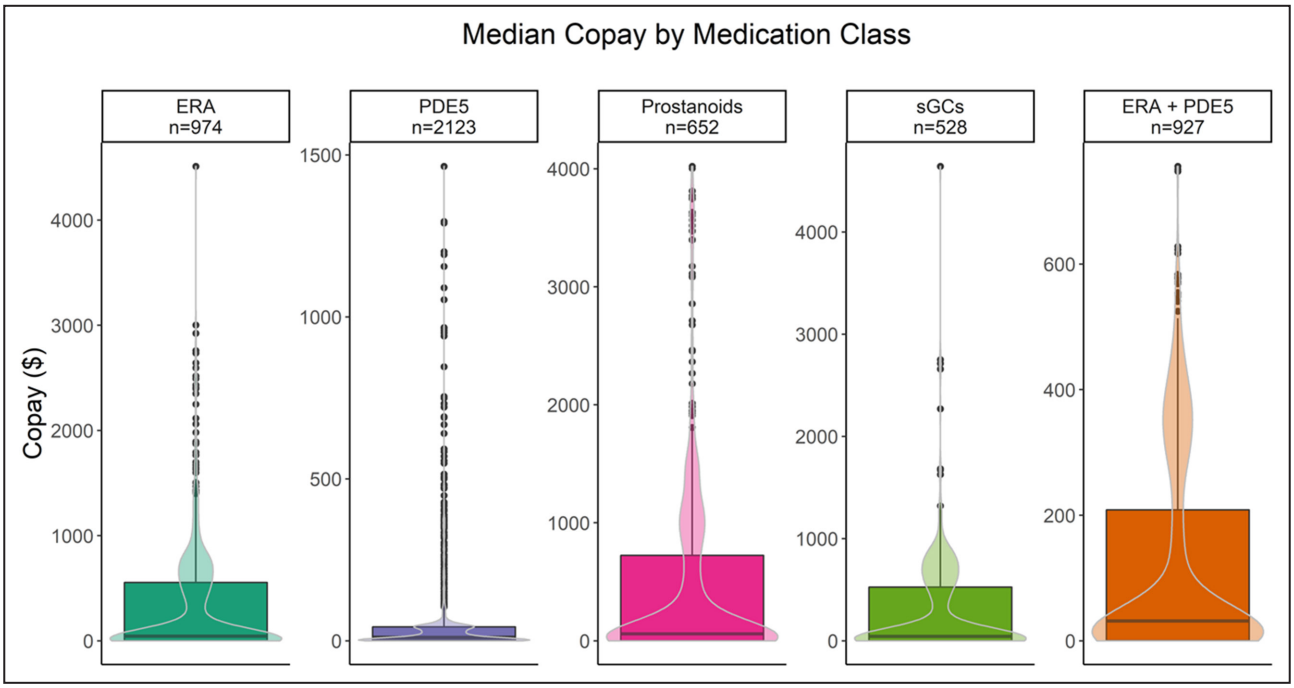

Figure 1. Median 30-day copayment (in dollars) for endothelin receptor antagonists (ERAs), phosphodiesterase type-5 inhibitors (PDE5), prostanoids and prostacyclin receptor agonists (Prostanoids), soluble guanylate cyclase stimulators (sGCS), and combination therapy with ERA and PDE5.
The top and bottom of each box indicates the 75th and 25th percentiles, respectively.

household income indicated that household income has limited effect on the associations between copayment and adherence observed herein. Our results indicate the importance of medication copayment toward the assessment of adherence. Just as important, our findings underscore the essential relevance of including copayments and medication affordability in the provision of specialized treatments for a disease such as PAH.

Several mechanisms may elucidate how copayment may influence adherence to prostanoids and combination therapy in PAH. We expect that individuals with limited insurance (ie, those who are underinsured) may find copayments excessively expensive. Second, individuals with limited financial assets need to prioritize mundane necessities over medications in the setting of limited resources.[29,30] Finally, for those with a chronic disease, costs related to diagnosis and treatment may result in progressive depletion of financial assets and ultimately the decreased ability to afford copayment costs. Contrary to our hypothesis, we identified that high copayments for PDE5 were associated with adherence to this medication, even after we modified copayment categorization (reported in Table S5). The absence of association between copayment and PDE5 adherence may be attributable to the fact that this class of PAH medications is less expensive than other pulmonary vasodilators and available as a generic medication.

Our results extend literature reporting copayment costs to medication adherence among individuals with common chronic conditions, such as hypertension and hyperlipidemia,[14,15,31,32] to a highly specialized disease. For those with PAH, higher levels of adherence are associated with clinical outcomes, such as decreased hospitalization rates.[8,25] Identifying copayment as a structural barrier to medication adherence has implications for improving patient outcomes and reducing hospitalizations. High copayments contribute to financial toxicity, which propels disparities in health outcomes according to wealth.[30] Our results suggest the importance of discussing copayments with patients when considering therapies for PAH, essential to shared decision making, as well in the determination of their adherence to costly medications. We particularly note that our estimates of the association of copayment to medication adherence are conservative, as they do not capture the effect of copayment on the failure to fill even a single prescription of therapy. The association of copayment to initiation of prescribed medications merits consideration in further analyses of adherence in PAH.

There are several strengths of this study. We used data from a large database of administrative claims, thereby enhancing the generalizability of our findings. Our use of administrative claims data reduced selection bias by facilitating inclusion regardless of treatment facility. We consider the selection by diagnosis rather than facility or regimen as noteworthy given that individuals with PAH seen at specialty centers are presently more likely to receive combination therapies.[33]

Table 2. OR (95% CI) for Adherence, Defined by PDC ≥80%, by Copayment Category for Individuals Using ERAs, PDE5, Prostanoids, and sGCS

Model	Copayment	ERAs (n=974)	PDE5 (n=2123)	Prostanoids (n=652)	sGCS (n=528)	ERA+PDE5 (n=927)
1	Low	Referent	Referent	Referent	Referent	Referent
	Medium	2.04 (1.16–3.57), *P*=0.01	1.04 (0.84–1.28), *P*=0.74	1.09 (0.55–2.15), *P*=0.80	0.93 (0.50–1.71), *P*=0.81	0.89 (0.54–1.46), *P*=0.64
	High	1.01 (0.67–1.53), *P*=0.95	1.85 (1.36–2.51), *P*<0.001	0.48 (0.29–0.79), *P*=0.004	0.68 (0.38–1.19), *P*=0.17	0.66 (0.43–1.01), *P*=0.05
2	Low	Referent	Referent	Referent	Referent	Referent
	Medium	1.96 (1.12–3.45), *P*=0.02	1.03 (0.83–1.27), *P*=0.81	1.10 (0.56–2.19), *P*=0.78	0.92 (0.5–1.72), *P*=0.80	0.88 (0.53–1.46), *P*=0.62
	High	0.98 (0.65–1.48), *P*=0.92	1.82 (1.34–2.47), *P*<0.001	0.49 (0.29–0.81), *P*=0.005	0.66 (0.37–1.17), *P*=0.15	0.65 (0.42–0.99), *P*=0.05
3	Low	Referent	Referent	Referent	Referent	Referent
	Medium	1.82 (0.94–3.50), *P*=0.07	1.08 (0.84–1.38), *P*=0.55	0.96 (0.45–2.05), *P*=0.91	0.87 (0.41–1.84), *P*=0.70	0.71 (0.43–1.17), *P*=0.17
	High	0.91 (0.51–1.62), *P*=0.74	1.86 (1.34–2.59), *P*<0.001	0.36 (0.20–0.65), *P*<0.001	0.63 (0.30–1.31), *P*=0.21	0.61 (0.38–0.97), *P*=0.03

Model 1 adjusted for age, sex, race, and ethnicity. Model 2 adjusted for model 1 covariates and Elixhauser comorbidities, systemic sclerosis, amphetamine use, chronic kidney disease, and interstitial lung disease. Model 3 adjusted for model 2 covariates and household income, educational attainment, insurance type, and presence of deductible paid toward medications. For ERAs, Prostanoids, sGCS, and ERA+PDE5, "low" was defined as <$30; "medium" as $30 to $99; and "high" as ≥$100. For PDE5, "low" was defined as <$15; "medium" as $15 to $49; and "high" as ≥$50. ERA indicates endothelin receptor antagonist; OR, odds ratio; PDC, proportion of days covered; PDE5, phosphodiesterase type-5 inhibitors; Prostanoids, prostacyclin receptor agonists; and sGCS, soluble guanylate cyclase stimulators.

Second, we used PDC as an objective measure of medication adherence that accurately indicates assessment of medication adherence with claims data.[34] Finally, the study spans a period of time following the publication of a contemporary trial that demonstrated the benefits of combination therapy in PAH.[10]

Our analysis also has important limitations that merit consideration. First, we recognize that administrative claims have potential for diagnostic misclassification as they are intended foremost for billing purposes rather than research. Using *ICD-9* and *ICD-10* codes to identify individuals with PAH is particularly challenging, as historical diagnostic classification systems failed to distinguish other, more common, forms of pulmonary hypertension from PAH.[35] To reduce the risk of misclassification, we used a 2-component algorithm requiring diagnostic coding plus disease-specific treatment to identify individuals with PAH, in accordance with an expert panel's recommendation for using a standardized method to identify PAH using administrative claims data.[20] Second, our analysis used estimates of annual household income and educational attainment, which have been integrated with Optum data. These data were derived from a third-party, commercial vendor, precluding their verification, and have potential for misclassification given they are not available at the

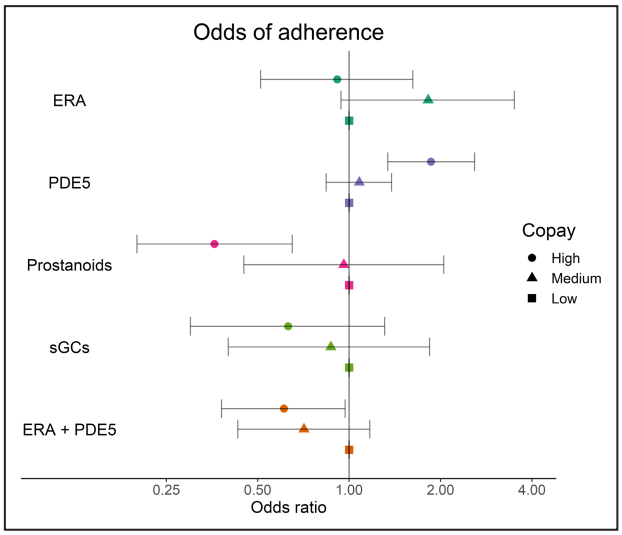

Figure 2. Odds ratio and 95% CI for adherence, defined by proportion of days covered ≥80%, by copayment category* for individuals using endothelin receptor antagonists (ERAs), phosphodiesterase type-5 inhibitors (PDE5), prostanoids and prostacyclin receptor agonists (Prostanoids), and soluble guanylate cyclase stimulators (sGCS).†

*For ERAs, Prostanoids, sGCS, and ERA+PDE5, "low" was defined as <$30; "medium" as $30 to $99; and "high" as ≥$100. For PDE5, "low" was defined as <$15; "medium" as $15 to $49; and "high" as ≥$50. †Adjusted for age, sex, race, and ethnicity, Elixhauser comorbidities, systemic sclerosis, amphetamine use, chronic kidney disease, interstitial lung disease, annual household income, educational attainment, insurance type, and presence of deductible paid toward medications.

Table 3. Association Between Annual Household Income and Likelihood (OR) of Medication Adherence, Defined by PDC ≥80%

Variable	Model 1		Model 2		Model 3	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value	OR (95% CI)	*P* value
ERAs (n=714)						
≥$75 000	Referent		Referent		Referent	
<$40 000	0.77 (0.45–1.29)	0.32	0.81 (0.47–1.39)	0.44	0.93 (0.57–1.71)	0.81
$40 000–$74 999	0.94 (0.52–1.69)	0.83	0.98 (0.54–1.77)	0.94	1.05 (0.56–2.00)	0.87
PDE5 (n=1546)						
≥$75 000	Referent		Referent		Referent	
<$40 000	0.82 (0.62–1.08)	0.16	0.86 (0.65–1.15)	0.3	0.87 (0.63–1.20)	0.39
$40 000–$74 999	0.78 (0.59–1.03)	0.08	0.79 (0.60–1.05)	0.1	0.80 (0.59–1.08)	0.14
Prostanoids (n=457)						
≥$75 000	Referent		Referent		Referent	
<$40 000	0.82 (0.44–1.51)	0.52	0.85 (0.45–1.60)	0.61	0.77 (0.39–1.52)	0.45
$40 000–$74 999	0.85 (0.45–1.59)	0.6	0.85 (0.45–1.63)	0.63	0.93 (0.47–1.84)	0.83
sGCS (n=390)						
≥$75 000	Referent		Referent		Referent	
<$40 000	0.65 (0.34–1.25)	0.2	0.63 (0.32–1.24)	0.18	0.58 (0.28–1.20)	0.15
$40 000–$74 999	0.98 (0.47–2.07)	0.96	1.00 (0.47–2.14)	0.99	0.96 (0.43–2.16)	0.92
ERA+PDE5 (n=685)						
≥$75 000	Referent		Referent		Referent	
<$40 000	0.72 (0.41–1.26)	0.25	0.72 (0.41–1.28)	0.27	0.68 (0.35–1.30)	0.24
$40 000–$74 999	0.63 (0.36–1.10)	0.11	0.64 (0.36–1.13)	0.13	0.62 (0.34–1.13)	0.12

Model 1 adjusted for age, sex, race, and ethnicity. Model 2 adjusted for model 1 covariates and Elixhauser comorbidities, systemic sclerosis, amphetamine use, chronic kidney disease, and interstitial lung disease. Model 3 adjusted for model 2 covariates and household income, educational attainment, insurance type, and presence of deductible paid toward medications. ERA indicates endothelin receptor antagonist; OR, odds ratio; PDC, proportion of days covered; PDE5, phosphodiesterase type-5 inhibitors; Prostanoids, prostanoids and prostacyclin receptor agonists; and sGCS, soluble guanylate cyclase stimulators.

individual level. Third, administrative claims are divorced from the electronic medical record; thus, we do not have information about adverse medication effects that may have resulted in termination of therapies. Fourth, generalizability of our findings to noninsured individuals is limited. However, we expect that uninsured individuals face additional financial obstacles and challenges that limit their access to the agents described herein. Fifth, given limited information about dosing and frequency, we were unable to measure adherence to parenteral prostanoids, which have demonstrated improved mortality for those with PAH.[36] Finally, PDC is an estimate of medication adherence and does not indicate whether an individual actually took the medication. However, PDC is well validated as a measure of adherence,[37,38] and directly observed therapy or further record of actual drug use is beyond the capacity of this analysis or any similar analysis using claims data.

CONCLUSIONS

In summary, we identified an association between medication copayment and adherence in individuals with PAH receiving advanced therapies, specifically prostanoids and combination therapy. These estimates were consistent after adjustment for an array of comorbid conditions and social factors, including household income and education. In contrast, household income was not related to medication adherence in PAH. Our results extend understanding of copayment as a definitive barrier to medication adherence. Our findings have implications for access to treatment and the promotion of equitable care for individuals with PAH.

ARTICLE INFORMATION

Received April 27, 2022; accepted August 17, 2022.

Affiliations

Department of Medicine, University of Pittsburgh Medical Center, Pittsburgh, PA (E.M.S., S.Y.C., J.W.M.); School of Medicine, University of Pittsburgh, Pittsburgh, PA (G.S., J.W.M.); Vascular Medicine Institute, University of Pittsburgh School of Medicine, Pittsburgh, PA (S.Y.C.); and Center for Research on Health Care, Department of Medicine, University of Pittsburgh, Pittsburgh, PA (J.W.M.).

Sources of Funding

This study was supported by National Institutes of Health (NIH) grant R38 HL150207 (to Dr Schikowski). Dr Chan is supported by NIH grants R01HL124021 and R01HL122596 and American Heart Association grant

18EIA33900027. Dr Magnani is supported by NIH grants K24HL160527, R33HL144669, and R01HL143010.

Disclosures

Dr Chan has served as a consultant for United Therapeutics and Acceleron Pharma; Dr Chan is a director, officer, and shareholder in Synhale Therapeutics; Dr Chan has held research grants from Actelion, Bayer, and Pfizer. Dr Chan has filed patent applications on the targeting of metabolism in pulmonary hypertension. All the other authors have no disclosures.

Supplemental Material

Tables S1–S5
Figure S1

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SUPPLEMENTAL MATERIAL

Table S1. Diagnostic codes (International Classification of Disease-9 and -10; CPT codes). ICD-9 and ICD-10 codes used to determine Elixhauser comorbidities, tobacco use, hyperlipidemia, and interstitial lung disease.

Condition	ICD-9 and ICD-10 Codes
CHF	I09.81,I11.0,I13.0,I13.2,I50.1,I50.20,I50.21,I50.22,I50.23,I50.30,I50.31,I50.32,I50.33,I50.40,I50.41,I50.42,I50.43,I50.810,I50.811,I50.812,I50.813,I50.814,I50.82,I50.83,I50.84,I50.89,I50.9,I51.81,I97.130,I97.131,O29.121,O29.122,O29.123,O29.129,R57.0,Z95.811,Z95.812,398.91,402.01,402.11,402.91,404.01,404.03,404.11,404.13,404.91,404.93,428.0,428.1,428.2,428.3,428.4,428.5,428.6,428.7,428.8,428.9
Valvular disease	A18.84,A32.82,A39.51,A52.03,B33.21,B37.6,I01.1,I01.8,I01.9,I02.0,I05.0,I05.1,I05.2,I05.8,I05.9,I06.0,I06.1,I06.2,I06.8,I06.9,I07.0,I07.1,I07.2,I07.8,I07.9,I08.0,I08.1,I08.2,I08.3,I08.8,I08.9,I09.1,I09.89,I33.0,I33.9,I34.0,I34.1,I34.2,I34.8,I34.9,I35.0,I35.1,I35.2,I35.8,I35.9,I36.0,I36.1,I36.2,I36.8,I36.9,I37.0,I37.1,I37.2,I37.8,I37.9,I38.X,I39.X,M32.11,Q22.0,Q22.1,Q22.2,Q22.3,Q22.4,Q22.5,Q22.6,Q22.8,Q22.9,Q23.0,Q23.1,Q23.2,Q23.3,Q23.4,Q23.8,Q23.9,T82.01XA,T82.01XD,T82.01XS,T82.02XA,T82.02XD,T82.02XS,T82.03XA,T82.03XD,T82.03XS,T82.09XA,T82.09XD,T82.09XS,T82.221A,T82.221D,T82.221S,T82.222A,T82.222D,T82.222S,T82.223A,T82.223D,T82.223S,T82.228A,T82.228D,T82.228S,T82.6XXA,T82.6XXD,T82.6XXS,Z95.2,Z95.3,Z95.4,932.0,932.1,932.2,932.3,932.4,394.0,394.1,394.2,394.3,394.4,394.5,394.6,394.7,394.8,394.9,395.0,395.1,395.2,395.3,395.4,395.5,395.6,395.7,395.8,395.9,396.0,396.1,396.2,396.3,396.4,396.5,396.6,396.7,396.8,396.9,397.0,397.1,397.9,424.0,424.01,424.02,424.03,424.04,424.05,424.06,424.07,424.08,424.09,424.10,424.11,424.12,424.13,424.14,424.15,424.16,424.17,424.18,424.19,424.20,424.21,424.22,424.23,424.24,424.25,424.26,424.27,424.28,424.29,424.30,424.31,424.32,424.33,424.34,424.35,424.36,424.37,424.38,424.39,424.40,424.41,424.42,424.43,424.44,424.45,424.46,424.47,424.48,424.49,424.50,424.51,424.52,424.53,424.54,424.55,424.56,424.57,424.58,424.59,424.60,424.61,424.62,424.63,424.64,424.65,424.66,424.67,424.68,424.69,424.70,424.71,424.72,424.73,424.74,424.75,424.76,424.77,424.78,424.79,424.80,424.81,424.82,424.83,424.84,424.85,424.86,424.87,424.88,424.89,424.90,424.91,424.92,424.93,424.94,424.95,424.96,424.97,424.98,424.99,746.3,746.4,746.5,746.6,V42.2,V43.3
Pulmonary circulation disorders	I27.0,I27.1,I27.2,I27.20,I27.21,I27.22,I27.23,I27.24,I27.29,I27.81,I27.82,I27.83,I27.89,I27.9,I28.0,I28.1,I28.8,I28.9,415.11,415.12,415.13,415.14,415.15,415.16,415.17,415.18,415.19,416.0,416.1,416.2,416.3,416.4,416.5,416.6,416.7,416.8,416.9,417.9
Peripheral vascular disorders	A52.00,A52.01,A52.02,A52.09,I70.0,I70.1,I70.201,I70.202,I70.203,I70.208,I70.209,I70.211,I70.212,I70.213,I70.218,I70.219,I70.221,I70.222,I70.223,I70.228,I70.229,I70.231,I70.232,I70.233,I70.234,I70.235,I70.238,I70.239,I70.241,I70.242,I70.243,I70.244,I70.245,I70.248,I70.249,I70.25,I70.261,I70.262,I70.263,I70.268,I70.269,I70.291,I70.292,I70.293,I70.298,I70.299,I70.301,I70.302,I70.303,I70.308,I70.309,I70.311,I70.312,I70.313,I70.318,I70.319,I70.321,I70.322,I70.323,I70.328,I70.329,I70.331,I70.332,I70.333,I70.334,I70.335,I70.338,I70.339,I70.341,I70.342,I70.343,I70.344,I70.345,I70.348,I70.349,I70.35,I70.361,I70.362,I70.363,I70.368,I70.369,I70.391,I70.392,I70.393,I70.3

	98,I70.399,I70.401,I70.402,I70.403,I70.408,I70.409,I70.411,I70.412,I70.413,I70.418,I70.419,I70.421,I70.422,I70.423,I70.428,I70.429,I70.431,I70.432,I70.433,I70.434,I70.435,I70.438,I70.439,I70.441,I70.442,I70.443,I70.444,I70.445,I70.448,I70.449,I70.45,I70.461,I70.462,I70.463,I70.468,I70.469,I70.491,I70.492,I70.493,I70.498,I70.499,I70.501,I70.502,I70.503,I70.508,I70.509,I70.511,I70.512,I70.513,I70.518,I70.519,I70.521,I70.522,I70.523,I70.528,I70.529,I70.531,I70.532,I70.533,I70.534,I70.535,I70.538,I70.539,I70.541,I70.542,I70.543,I70.544,I70.545,I70.548,I70.549,I70.55,I70.561,I70.562,I70.563,I70.568,I70.569,I70.591,I70.592,I70.593,I70.598,I70.599,I70.601,I70.602,I70.603,I70.608,I70.609,I70.611,I70.612,I70.613,I70.618,I70.619,I70.621,I70.622,I70.623,I70.628,I70.629,I70.631,I70.632,I70.633,I70.634,I70.635,I70.638,I70.639,I70.641,I70.642,I70.643,I70.644,I70.645,I70.648,I70.649,I70.65,I70.661,I70.662,I70.663,I70.668,I70.669,I70.691,I70.692,I70.693,I70.698,I70.699,I70.701,I70.702,I70.703,I70.708,I70.709,I70.711,I70.712,I70.713,I70.718,I70.719,I70.721,I70.722,I70.723,I70.728,I70.729,I70.731,I70.732,I70.733,I70.734,I70.735,I70.738,I70.739,I70.741,I70.742,I70.743,I70.744,I70.745,I70.748,I70.749,I70.75,I70.761,I70.762,I70.763,I70.768,I70.769,I70.791,I70.792,I70.793,I70.798,I70.799,I70.8,I70.90,I70.91,I70.92,I71.00,I71.01,I71.02,I71.03,I71.1,I71.2,I71.3,I71.4,I71.5,I71.6,I71.8,I71.9,I72.0,I72.1,I72.2,I72.3,I72.4,I72.5,I72.6,I72.8,I72.9,I73.01,I73.1,I73.81,I73.89,I73.9,I74.01,I74.09,I74.10,I74.11,I74.19,I74.2,I74.3,I74.4,I74.5,I74.8,I74.9,I75.011,I75.012,I75.013,I75.019,I75.021,I75.022,I75.023,I75.029,I75.81,I75.89,I77.0,I77.1,I77.2,I77.3,I77.4,I77.5,I77.6,I77.70,I77.71,I77.72,I77.73,I77.74,I77.75,I77.76,I77.77,I77.79,I77.810,I77.811,I77.812,I77.819,I77.89,I77.9,I78.0,I78.1,I78.8,I78.9,I79.0,I79.1,I79.8,I99.8,I99.9,K31.811,K31.819,K55.1,K55.8,K55.9,Z95.820,Z95.828,440.X,440.1,440.2,440.3,440.4,440.5,440.6,440.7,440.8,440.9,441.00,441.01,441.02,441.03,441.04,441.05,441.06,441.07,441.08,441.09,441.10,441.11,441.12,441.13,441.14,441.15,441.16,441.17,441.18,441.19,441.20,441.21,441.22,441.23,441.24,441.25,441.26,441.27,441.28,441.29,441.30,441.31,441.32,441.33,441.34,441.35,441.36,441.37,441.38,441.39,441.40,441.41,441.42,441.43,441.44,441.45,441.46,441.47,441.48,441.49,441.50,441.51,441.52,441.53,441.54,441.55,441.56,441.57,441.58,441.59,441.60,441.61,441.62,441.63,441.64,441.65,441.66,441.67,441.68,441.69,441.70,441.71,441.72,441.73,441.74,441.75,441.76,441.77,441.78,441.79,441.80,441.81,441.82,441.83,441.84,441.85,441.86,441.87,441.88,441.89,441.90,442.0,442.1,442.2,442.3,442.4,442.5,442.6,442.7,442.8,442.9,443.1,443.2,443.3,443.4,443.5,443.6,443.7,443.8,443.9,444.21,444.22,444.71,449.X,557.1,557.9,V43.4
Hypertension (uncomplicated)	I10.X,I16.0,I16.9,O10.011,O10.012,O10.013,O10.019,O10.02,O10.03,401.1,401.9,642.00,642.01,642.02,642.03,642.04

Hypertension (complicated)	H35.031,H35.032,H35.033,H35.039,I11.0,I11.9,I12.0,I12.9,I13.0,I13.10,I13.11,I13.2,I15.0,I15.1,I15.2,I15.8,I15.9,I16.1,I67.4,O10.111,O10.112,O10.113,O10.119,O10.12,O10.13,O10.211,O10.212,O10.213,O10.219,O10.22,O10.23,O10.311,O10.312,O10.313,O10.319,O10.32,O10.33,O10.411,O10.412,O10.413,O10.419,O10.42,O10.43,O10.911,O10.912,O10.913,O10.919,O10.92,O10.93,O11.1,O11.2,O11.3,O11.4,O11.5,O11.9,O16.1,O16.2,O16.3,O16.4,O16.5,O16.9,401.0,402.00,402.01,402.02,402.03,402.04,402.05,402.06,402.07,402.08,402.09,402.10,402.11,402.12,402.13,402.14,402.15,402.16,402.17,402.18,402.19,402.20,402.21,402.22,402.23,402.24,402.25,402.26,402.27,402.28,402.29,402.30,402.31,402.32,402.33,402.34,402.35,402.36,402.37,402.38,402.39,402.40,402.41,402.42,402.43,402.44,402.45,402.46,402.47,402.48,402.49,402.50,402.51,402.52,402.53,402.54,402.55,402.56,402.57,402.58,402.59,402.60,402.61,402.62,402.63,402.64,402.65,402.66,402.67,402.68,402.69,402.70,402.71,402.72,402.73,402.74,402.75,402.76,402.77,402.78,402.81,402.82,402.83,402.84,402.85,402.86,402.87,402.88,402.89,402.90,402.91,402.92,402.93,402.94,402.95,402.96,402.97,402.98,402.99,403.00,403.01,403.02,403.03,403.04,403.05,403.06,403.07,403.08,403.09,403.10,403.11,403.12,403.13,403.14,403.15,403.16,403.17,403.18,403.19,403.20,403.21,403.22,403.23,403.24,403.25,403.26,403.27,403.28,403.29,403.30,403.31,403.32,403.33,403.34,403.35,403.36,403.37,403.38,403.39,403.40,403.41,403.42,403.43,403.44,403.45,403.46,403.47,403.48,403.49,403.50,403.51,403.52,403.53,403.54,403.55,403.56,403.57,403.58,403.59,403.60,403.61,403.62,403.63,403.64,403.65,403.66,403.67,403.68,403.69,403.70,403.71,403.72,403.73,403.74,403.75,403.76,403.77,403.78,403.79,403.80,403.81,403.82,403.83,403.84,403.85,403.86,403.87,403.88,403.89,403.90,403.91,403.92,403.93,403.94,403.95,403.96,403.97,403.98,403.99,404.00,404.01,404.02,404.03,404.04,404.05,404.06,404.07,404.08,404.09,404.10,404.11,404.12,404.13,404.14,404.15,404.16,404.17,404.18,404.19,404.20,404.21,404.22,404.23,404.24,404.25,404.26,404.27,404.28,404.29,404.30,404.31,404.32,404.33,404.34,404.35,404.36,404.37,404.38,404.39,404.40,404.41,404.42,404.43,404.44,404.45,404.46,404.47,404.48,404.49,404.50,404.51,404.52,404.53,404.54,404.55,404.56,404.57,404.58,404.59,404.60,404.61,404.62,404.63,404.64,404.65,404.66,404.67,404.68,404.69,404.70,404.71,404.72,404.73,404.74,404.75,404.76,404.77,404.78,404.79,404.80,404.81,404.82,404.83,404.84,404.85,404.86,404.87,404.88,404.89,404.90,404.91,404.92,404.93,404.94,404.95,404.96,404.97,404.98,404.99,405.00,405.01,405.02,405.03,405.04,405.05,405.06,405.07,405.08,405.09,405.10,405.11,405.12,405.13,405.14,405.15,405.16,405.17,405.18,405.19,405.20,405.21,405.22,405.23,405.24,405.25,405.26,405.27,405.28,405.29,405.30,405.31,405.32,405.33,405.34,405.35,405.36,405.37,405.38,405.39,405.40,405.41,405.42,405.43,405.44,405.45,405.46,405.47,405.48,405.49,405.50,405.51,405.52,405.53,405.54,405.55,405.56,405.57,405.58,405.59,405.60,405.61,405.62,405.63,405.64,405.65,405.66,405.67,405.68,405.69,405.70,405.71,405.72,405.73,405.74,405.75,405.76,405.77,405.78,405.79,405.80,405.81,405.82,405.83,405.84,405.85,405.86,405.87,405.88,405.89,405.90,405.91,405.92,405.93,405.94,405.95,405.96,405.97,405.98,405.99,437.2,642.10,642.11,642.12,642.13,642.14,642.15,642.16,642.17,642.18,642.19,642.20,642.21,642.22,642.23,642.24,642.70,642.71,642.72,642.73,642.74,642.75,642.76,642.77,642.78,642.79,642.80,642.81,642.82,642.83,642.84,642.85,642.86,642.87,642.88,642.89,642.90,642.91,642.92,642.93,642.94

Paralysis	G04.1,G80.0,G80.1,G80.2,G80.8,G80.9,G81.00,G81.01,G81.02,G81.03,G81.04,G81.10,G81.11,G81.12,G81.13,G81.14,G81.90,G81.91,G81.92,G81.93,G81.94,G82.20,G82.21,G82.22,G82.50,G82.51,G82.52,G82.53,G82.54,G83.0,G83.10,G83.11,G83.12,G83.13,G83.14,G83.20,G83.21,G83.22,G83.23,G83.24,G83.30,G83.31,G83.32,G83.33,G83.34,G83.4,G83.5,G83.81,G83.82,G83.83,G83.84,G83.89,G83.9,I69.031,I69.032,I69.033,I69.034,I69.039,I69.041,I69.042,I69.043,I69.044,I69.049,I69.051,I69.052,I69.053,I69.054,I69.059,I69.061,I69.062,I69.063,I69.064,I69.065,I69.069,I69.131,I69.132,I69.133,I69.134,I69.139,I69.141,I69.142,I69.143,I69.144,I69.149,I69.151,I69.152,I69.153,I69.154,I69.159,I69.161,I69.162,I69.163,I69.164,I69.165,I69.169,I69.231,I69.232,I69.233,I69.234,I69.239,I69.241,I69.242,I69.243,I69.244,I69.249,I69.251,I69.252,I69.253,I69.254,I69.259,I69.261,I69.262,I69.263,I69.264,I69.265,I69.269,I69.331,I69.332,I69.333,I69.334,I69.339,I69.341,I69.342,I69.343,I69.344,I69.349,I69.351,I69.352,I69.353,I69.354,I69.359,I69.361,I69.362,I69.363,I69.364,I69.365,I69.369,I69.831,I69.832,I69.833,I69.834,I69.839,I69.841,I69.842,I69.843,I69.844,I69.849,I69.851,I69.852,I69.853,I69.854,I69.859,I69.861,I69.862,I69.863,I69.864,I69.865,I69.869,I69.931,I69.932,I69.933,I69.934,I69.939,I69.941,I69.942,I69.943,I69.944,I69.949,I69.951,I69.952,I69.953,I69.954,I69.959,I69.961,I69.962,I69.963,I69.964,I69.965,I69.969,R53.2,342.0,342.1,342.2,342.3,342.4,342.5,342.6,342.7,342.8,342.9,343.0,343.1,343.2,343.3,343.4,343.5,343.6,343.7,343.8,343.9,344.0,344.1,344.2,344.3,344.4,344.5,344.6,344.7,344.8,344.9,438.20,438.21,438.22,438.23,438.24,438.25,438.26,438.27,438.28,438.29,438.30,438.31,438.32,438.33,438.34,438.35,438.36,438.37,438.38,438.39,438.40,438.41,438.42,438.43,438.44,438.45,438.46,438.47,438.48,438.49,438.50,438.51,438.52,438.53,780.72
Neurological disorders affecting movement	G08.X,G10.X,G11.0,G11.1,G11.10,G11.11,G11.19,G11.2,G11.3,G11.4,G11.8,G11.9,G12.0,G12.1,G12.20,G12.21,G12.22,G12.23,G12.24,G12.25,G12.29,G12.8,G12.9,G13.0,G13.1,G13.2,G13.8,G20.X,G21.0,G21.11,G21.19,G21.2,G21.3,G21.4,G21.8,G21.9,G23.0,G23.1,G23.2,G23.8,G23.9,G24.09,G24.1,G24.2,G24.8,G25.4,G25.5,G25.70,G25.71,G25.79,G25.81,G25.82,G25.83,G25.89,G25.9,G26.X,G32.0,G32.81,G32.89,G80.3
Seizures and epilepsy	G40.001,G40.009,G40.011,G40.019,G40.101,G40.109,G40.111,G40.119,G40.201,G40.209,G40.211,G40.219,G40.301,G40.309,G40.311,G40.319,G40.401,G40.409,G40.411,G40.419,G40.42,G40.501,G40.509,G40.801,G40.802,G40.803,G40.804,G40.811,G40.812,G40.813,G40.814,G40.821,G40.822,G40.823,G40.824,G40.833,G40.834,G40.89,G40.901,G40.909,G40.911,G40.919,G40.A01,G40.A09,G40.A11,G40.A19,G40.B01,G40.B09,G40.B11,G40.B19,R56.1,R56.9
Other neurological disorders	E75.00,E75.01,E75.02,E75.09,E75.10,E75.11,E75.19,E75.23,E75.25,E75.26,E75.29,E75.4,F05.X,F84.2,G35.X,G36.0,G36.8,G36.9,G37.0,G37.1,G37.2,G37.3,G37.4,G37.5,G37.8,G37.9,G47.411,G47.419,G47.421,G47.429,G89.0,G91.0,G91.1,G91.2,G91.3,G91.4,G91.8,G91.9,G93.0,G93.40,G93.41,G93.49,G93.5,G93.6,G93.7,G93.81,G93.82,G93.89,G93.9,G94.X,O99.350,O99.351,O99.352,O99.353,O99.354,O99.355,P91.60,P91.61,P91.62,P91.63,330.1,330.2,330.3,330.4,330.5,330.6,330.7,330.8,330.9,331.0,331.1,331.2,331.3,331.4,331.5,331.6,331.7,331.8,331.9,332.0,333.4,333.5,333.71,333.72,333.79,333.85,333.94,334.0,334.1,334.2,334.3,334.4,334.5,334.6,334.7,334.8,334.9,335.0,335.1,335.2,335.3,335.4,335.5,335.6,335.7,335.8,335.9,338.0,340.X,341.1,341.2,341.3,341.4,341.5,341.6,341.7,341.8,341.9,345.00,345.01,345.02,345.03,345.04,345.05,345.06,345.07,345.08,345.09,345.10,

	345.11,345.2,345.3,345.40,345.41,345.42,345.43,345.44,345.45,345.46,345.47,345.48,345.49,345.50,345.51,345.52,345.53,345.54,345.55,345.56,345.57,345.58,345.59,345.60,345.61,345.62,345.63,345.64,345.65,345.66,345.67,345.68,345.69,345.70,345.71,345.72,345.73,345.74,345.75,345.76,345.77,345.78,345.79,345.80,345.81,345.82,345.83,345.84,345.85,345.86,345.87,345.88,345.89,345.90,345.91,347.00,347.01,347.10,347.11,649.40,649.41,649.42,649.43,649.44,768.7,768.70,768.71,768.72,780.3,780.31,780.32,780.33,780.39,780.97,784.3
Chronic pulmonary disease	J41.0,J41.1,J41.8,J42.X,J43.0,J43.1,J43.2,J43.8,J43.9,J44.0,J44.1,J44.9,J45.20,J45.21,J45.22,J45.30,J45.31,J45.32,J45.40,J45.41,J45.42,J45.50,J45.51,J45.52,J45.901,J45.902,J45.909,J45.990,J45.991,J45.998,J47.0,J47.1,J47.9,J60.X,J61.X,J62.0,J62.8,J63.0,J63.1,J63.2,J63.3,J63.4,J63.5,J63.6,J64.X,J65.X,J66.0,J66.1,J66.2,J66.8,J67.0,J67.1,J67.2,J67.3,J67.4,J67.5,J67.6,J67.7,J67.8,J67.9,J68.4,J70.1,J70.3,490.X,490.1,490.2,490.3,490.4,490.5,490.6,490.7,490.8,490.9,491.0,491.1,491.2,491.3,491.4,491.5,491.6,491.7,491.8,491.9,492.0,492.1,492.2,492.3,492.4,492.5,492.6,492.7,492.8,493.00,493.01,493.02,493.03,493.04,493.05,493.06,493.07,493.08,493.09,493.10,493.11,493.12,493.13,493.14,493.15,493.16,493.17,493.18,493.19,493.20,493.21,493.22,493.23,493.24,493.25,493.26,493.27,493.28,493.29,493.30,493.31,493.32,493.33,493.34,493.35,493.36,493.37,493.38,493.39,493.40,493.41,493.42,493.43,493.44,493.45,493.46,493.47,493.48,493.49,493.50,493.51,493.52,493.53,493.54,493.55,493.56,493.57,493.58,493.59,493.60,493.61,493.62,493.63,493.64,493.65,493.66,493.67,493.68,493.69,493.70,493.71,493.72,493.73,493.74,493.75,493.76,493.77,493.78,493.79,493.80,493.81,493.82,493.83,493.84,493.85,493.86,493.87,493.88,493.89,493.90,493.91,493.92,494.X,494.0,494.1,495.0,495.1,495.2,495.3,495.4,495.5,495.6,495.7,495.8,495.9,496.0,496.1,496.2,496.3,496.4,496.5,496.6,496.7,496.8,496.9,497.0,497.1,497.2,497.3,497.4,497.5,497.6,497.7,497.8,497.9,498.0,498.1,498.2,498.3,498.4,498.5,498.6,498.7,498.8,498.9,499.0,499.1,499.2,499.3,499.4,499.5,499.6,499.7,499.8,499.9,500.0,500.1,500.2,500.3,500.4,500.5,500.6,500.7,500.8,500.9,501.0,501.1,501.2,501.3,501.4,501.5,501.6,501.7,501.8,501.9,502.0,502.1,502.2,502.3,502.4,502.5,502.6,502.7,502.8,502.9,503.0,503.1,503.2,503.3,503.4,503.5,503.6,503.7,503.8,503.9,504.0,504.1,504.2,504.3,504.4,504.5,504.6,504.7,504.8,504.9,505.X,506.4
Diabetes (uncomplicated)	E08.21,E08.22,E08.29,E08.311,E08.319,E08.321,E08.3211,E08.3212,E08.3213,E08.3219,E08.329,E08.3291,E08.3292,E08.3293,E08.3299,E08.331,E08.3311,E08.3312,E08.3313,E08.3319,E08.339,E08.3391,E08.3392,E08.3393,E08.3399,E08.341,E08.3411,E08.3412,E08.3413,E08.3419,E08.349,E08.3491,E08.3492,E08.3493,E08.3499,E08.351,E08.3511,E08.3512,E08.3513,E08.3519,E08.3521,E08.3522,E08.3523,E08.3529,E08.3531,E08.3532,E08.3533,E08.3539,E08.3541,E08.3542,E08.3543,E08.3549,E08.3551,E08.3552,E08.3553,E08.3559,E08.359,E08.3591,E08.3592,E08.3593,E08.3599,E08.36,E08.37X1,E08.37X2,E08.37X3,E08.37X9,E08.39,E08.40,E08.41,E08.42,E08.43,E08.44,E08.49,E08.51,E08.52,E08.59,E08.610,E08.618,E08.620,E08.621,E08.622,E08.628,E08.630,E08.638,E08.641,E08.649,E08.65,E08.69,E08.8,E09.21,E09.22,E09.29,E09.311,E09.319,E09.321,E09.3211,E09.3212,E09.3213,E09.3219,E09.329,E09.3291,E09.3292,E09.3293,E09.3299,E09.331,E09.3311,E09.3312,E09.3313,E09.3319,E09.339,E09.3391,E09.3392,E09.3393,E09.3399,E09.341,E09.3411,E09.3412,E09.3413,E09.3419,E09.349,E09.3491,E09.3492,E09.3493,E09.3499,E09.351,E09.3511,E09.3512,E09.3513,E09.3519,E09.3521,E09.3522,E09.3523,E09.3529,

	E09.3531,E09.3532,E09.3533,E09.3539,E09.3541,E09.3542,E09.3543,E09.3549,E09.3551,E09.3552,E09.3553,E09.3559,E09.359,E09.3591,E09.3592,E09.3593,E09.3599,E09.36,E09.37X1,E09.37X2,E09.37X3,E09.37X9,E09.39,E09.40,E09.41,E09.42,E09.43,E09.44,E09.49,E09.51,E09.52,E09.59,E09.610,E09.618,E09.620,E09.621,E09.622,E09.628,E09.630,E09.638,E09.641,E09.649,E09.65,E09.69,E09.8,E10.21,E10.22,E10.29,E10.311,E10.319,E10.321,E10.3211,E10.3212,E10.3213,E10.3219,E10.329,E10.3291,E10.3292,E10.3293,E10.3299,E10.331,E10.3311,E10.3312,E10.3313,E10.3319,E10.339,E10.3391,E10.3392,E10.3393,E10.3399,E10.341,E10.3411,E10.3412,E10.3413,E10.3419,E10.349,E10.3491,E10.3492,E10.3493,E10.3499,E10.351,E10.3511,E10.3512,E10.3513,E10.3519,E10.3521,E10.3522,E10.3523,E10.3529,E10.3531,E10.3532,E10.3533,E10.3539,E10.3541,E10.3542,E10.3543,E10.3549,E10.3551,E10.3552,E10.3553,E10.3559,E10.359,E10.3591,E10.3592,E10.3593,E10.3599,E10.36,E10.37X1,E10.37X2,E10.37X3,E10.37X9,E10.39,E10.40,E10.41,E10.42,E10.43,E10.44,E10.49,E10.51,E10.52,E10.59,E10.610,E10.618,E10.620,E10.621,E10.622,E10.628,E10.630,E10.638,E10.641,E10.649,E10.65,E10.69,E10.8,E11.21,E11.22,E11.29,E11.311,E11.319,E11.321,E11.3211,E11.3212,E11.3213,E11.3219,E11.329,E11.3291,E11.3292,E11.3293,E11.3299,E11.331,E11.3311,E11.3312,E11.3313,E11.3319,E11.339,E11.3391,E11.3392,E11.3393,E11.3399,E11.341,E11.3411,E11.3412,E11.3413,E11.3419,E11.349,E11.3491,E11.3492,E11.3493,E11.3499,E11.351,E11.3511,E11.3512,E11.3513,E11.3519,E11.3521,E11.3522,E11.3523,E11.3529,E11.3531,E11.3532,E11.3533,E11.3539,E11.3541,E11.3542,E11.3543,E11.3549,E11.3551,E11.3552,E11.3553,E11.3559,E11.359,E11.3591,E11.3592,E11.3593,E11.3599,E11.36,E11.37X1,E11.37X2,E11.37X3,E11.37X9,E11.39,E11.40,E11.41,E11.42,E11.43,E11.44,E11.49,E11.51,E11.52,E11.59,E11.610,E11.618,E11.620,E11.621,E11.622,E11.628,E11.630,E11.638,E11.641,E11.649,E11.65,E11.69,E11.8,E13.21,E13.22,E13.29,E13.311,E13.319,E13.321,E13.3211,E13.3212,E13.3213,E13.3219,E13.329,E13.3291,E13.3292,E13.3293,E13.3299,E13.331,E13.3311,E13.3312,E13.3313,E13.3319,E13.339,E13.3391,E13.3392,E13.3393,E13.3399,E13.341,E13.3411,E13.3412,E13.3413,E13.3419,E13.349,E13.3491,E13.3492,E13.3493,E13.3499,E13.351,E13.3511,E13.3512,E13.3513,E13.3519,E13.3521,E13.3522,E13.3523,E13.3529,E13.3531,E13.3532,E13.3533,E13.3539,E13.3541,E13.3542,E13.3543,E13.3549,E13.3551,E13.3552,E13.3553,E13.3559,E13.359,E13.3591,E13.3592,E13.3593,E13.3599,E13.36,E13.37X1,E13.37X2,E13.37X3,E13.37X9,E13.39,E13.40,E13.41,E13.42,E13.43,E13.44,E13.49,E13.51,E13.52,E13.59,E13.610,E13.618,E13.620,E13.621,E13.622,E13.628,E13.630,E13.638,E13.641,E13.649,E13.65,E13.69,E13.8,249.00,249.01,249.02,249.03,249.04,249.05,249.06,249.07,249.08,249.09,249.10,249.11,249.12,249.13,249.14,249.15,249.16,249.17,249.18,249.19,249.20,249.21,249.22,249.23,249.24,249.25,249.26,249.27,249.28,249.29,249.30,249.31,250.00,250.01,250.02,250.03,250.04,250.05,250.06,250.07,250.08,250.09,250.10,250.11,250.12,250.13,250.14,250.15,250.16,250.17,250.18,250.19,250.20,250.21,250.22,250.23,250.24,250.25,250.26,250.27,250.28,250.29,250.30,250.31,250.32,250.33,648.00,648.01,648.02,648.03,648.04

Diabetes (complicated)	E08.00,E08.01,E08.10,E08.11,E08.9,E09.00,E09.01,E09.10,E09.11,E09.9,E10.10,E10.11,E10.9,E11.00,E11.01,E11.10,E11.11,E11.9,E13.00,E13.01,E13.10,E13.11,E13.9,O24.011,O24.012,O24.013,O24.019,O24.02,O24.03,O24.111,O24.112,O24.113,O24.119,O24.12,O24.13,O24.311,O24.312,O24.313,O24.319,O24.32,O24.33,O24.410,O24.414,O24.415,O24.419,O24.420,O24.424,O24.425,O24.429,O24.430,O24.434,O24.435,O24.439,O24.811,O24.812,O24.813,O24.819,O24.82,O24.83,O24.911,O24.912,O24.913,O24.919,O24.92,O24.93,249.40,249.41,249.42,249.43,249.44,249.45,249.46,249.47,249.48,249.49,249.50,249.51,249.52,249.53,249.54,249.55,249.56,249.57,249.58,249.59,249.60,249.61,249.62,249.63,249.64,249.65,249.66,249.67,249.68,249.69,249.70,249.71,249.72,249.73,249.74,249.75,249.76,249.77,249.78,249.79,249.80,249.81,249.82,249.83,249.84,249.85,249.86,249.87,249.88,249.89,249.90,249.91,250.40,250.41,250.42,250.43,250.44,250.45,250.46,250.47,250.48,250.49,250.50,250.51,250.52,250.53,250.54,250.55,250.56,250.57,250.58,250.59,250.60,250.61,250.62,250.63,250.64,250.65,250.66,250.67,250.68,250.69,250.70,250.71,250.72,250.73,250.74,250.75,250.76,250.77,250.78,250.79,250.80,250.81,250.82,250.83,250.84,250.85,250.86,250.87,250.88,250.89,250.90,250.91,250.92,250.93,775.1
Hypothyroidism	E00.0,E00.1,E00.2,E00.9,E01.0,E01.1,E01.2,E01.8,E02.X,E03.0,E03.1,E03.2,E03.3,E03.4,E03.5,E03.8,E03.9,E89.0,243.0,243.1,243.2,243.3,243.4,243.5,243.6,243.7,243.8,243.9,244.0,244.1,244.2,244.8,244.9
Renal failure (moderate)	N18.3,N18.30,N18.31,N18.32,N18.9,N19.X,403.01,403.11,403.91,402.X,404.03,404.12,404.13,404.92,404.93,585.3,585.4,585.5,585.6,585.9,586.X,V42.0,V45.1,V45.11,V45.12,V56.0,V56.00,V56.01,V56.02,V56.03,V56.04,V56.05,V56.06,V56.07,V56.08,V56.09,V56.10,V56.11,V56.12,V56.13,V56.14,V56.15,V56.16,V56.17,V56.18,V56.19,V56.20,V56.21,V56.22,V56.23,V56.24,V56.25,V56.26,V56.27,V56.28,V56.29,V56.30,V56.31,V56.32,V56.8
Renal failure (severe)	I12.0,I13.11,I13.2,N18.4,N18.5,N18.6,Z49.01,Z49.02,Z49.31,Z49.32,Z91.15,Z94.0,Z99.2
Liver disease (mild)	A51.45,A52.74,B18.0,B18.1,B18.2,B18.8,B18.9,B19.10,B19.20,B19.9,B25.1,B58.1,K70.0,K70.10,K70.11,K70.2,K70.30,K70.31,K70.9,K71.3,K71.4,K71.50,K71.51,K71.6,K71.7,K71.8,K73.0,K73.1,K73.2,K73.8,K73.9,K74.0,K74.00,K74.01,K74.02,K74.1,K74.2,K74.3,K74.4,K74.5,K74.60,K74.69,K75.1,K75.2,K75.3,K75.4,K75.81,K75.89,K75.9,K76.0,K76.1,K76.2,K76.3,K76.4,K76.81,K76.89,K76.9,K77.X,702.2,702.3,703.2,703.3,704.4,705.4,456.0,456.1,456.20,456.21,571.0,571.2,571.3,571.40,571.41,571.42,571.43,571.44,571.45,571.46,571.47,571.48,571.49,571.5,571.6,571.8,571.9,572.3,572.8,573.5,V42.7
Liver disease (moderate or severe)	B18.0,B18.1,B18.2,B18.8,B18.9,B19.0,B19.11,B19.21,B25.1,B58.1,I85.00,I85.01,I85.11,I86.4,K70.40,K70.41,K72.10,K72.11,K72.90,K76.5,K76.6,K76.7
Peptic ulcer disease (excluding bleeding)	K25.0,K25.1,K25.2,K25.3,K25.4,K25.5,K25.6,K25.7,K25.9,K26.0,K26.1,K26.2,K26.3,K26.4,K26.5,K26.6,K26.7,K26.9,K27.0,K27.1,K27.2,K27.3,K27.4,K27.5,K27.6,K27.7,K27.9,K28.0,K28.1,K28.2,K28.3,K28.4,K28.5,K28.6,K28.7,K28.9,531.41,531.51,531.61,531.70,531.71,531.91,532.41,532.51,532.61,532.70,532.71,532.91,533.41,533.51,533.61,533.70,533.71,533.91,534.41,534.51,534.61,534.70,534.71,534.91

AIDS/HIV	B20.X,O98.711,O98.712,O98.713,O98.719,O98.72,O98.73,Z21.X,042.X,042.1,042.2,042.3,042.4,042.5,042.6,042.7,042.8,042.9,043.0,043.1,043.2,043.3,043.4,043.5,043.6,043.7,043.8,043.9,044.0,044.1,044.2,044.3,044.4,044.5,044.6,044.7,044.8,044.9,043.X,044.X
Lymphoma	C81.00,C81.01,C81.02,C81.03,C81.04,C81.05,C81.06,C81.07,C81.08,C81.09,C81.10,C81.11,C81.12,C81.13,C81.14,C81.15,C81.16,C81.17,C81.18,C81.19,C81.20,C81.21,C81.22,C81.23,C81.24,C81.25,C81.26,C81.27,C81.28,C81.29,C81.30,C81.31,C81.32,C81.33,C81.34,C81.35,C81.36,C81.37,C81.38,C81.39,C81.40,C81.41,C81.42,C81.43,C81.44,C81.45,C81.46,C81.47,C81.48,C81.49,C81.70,C81.71,C81.72,C81.73,C81.74,C81.75,C81.76,C81.77,C81.78,C81.79,C81.90,C81.91,C81.92,C81.93,C81.94,C81.95,C81.96,C81.97,C81.98,C81.99,C82.00,C82.01,C82.02,C82.03,C82.04,C82.05,C82.06,C82.07,C82.08,C82.09,C82.10,C82.11,C82.12,C82.13,C82.14,C82.15,C82.16,C82.17,C82.18,C82.19,C82.20,C82.21,C82.22,C82.23,C82.24,C82.25,C82.26,C82.27,C82.28,C82.29,C82.30,C82.31,C82.32,C82.33,C82.34,C82.35,C82.36,C82.37,C82.38,C82.39,C82.40,C82.41,C82.42,C82.43,C82.44,C82.45,C82.46,C82.47,C82.48,C82.49,C82.50,C82.51,C82.52,C82.53,C82.54,C82.55,C82.56,C82.57,C82.58,C82.59,C82.60,C82.61,C82.62,C82.63,C82.64,C82.65,C82.66,C82.67,C82.68,C82.69,C82.80,C82.81,C82.82,C82.83,C82.84,C82.85,C82.86,C82.87,C82.88,C82.89,C82.90,C82.91,C82.92,C82.93,C82.94,C82.95,C82.96,C82.97,C82.98,C82.99,C83.00,C83.01,C83.02,C83.03,C83.04,C83.05,C83.06,C83.07,C83.08,C83.09,C83.10,C83.11,C83.12,C83.13,C83.14,C83.15,C83.16,C83.17,C83.18,C83.19,C83.30,C83.31,C83.32,C83.33,C83.34,C83.35,C83.36,C83.37,C83.38,C83.39,C83.50,C83.51,C83.52,C83.53,C83.54,C83.55,C83.56,C83.57,C83.58,C83.59,C83.70,C83.71,C83.72,C83.73,C83.74,C83.75,C83.76,C83.77,C83.78,C83.79,C83.80,C83.81,C83.82,C83.83,C83.84,C83.85,C83.86,C83.87,C83.88,C83.89,C83.90,C83.91,C83.92,C83.93,C83.94,C83.95,C83.96,C83.97,C83.98,C83.99,C84.00,C84.01,C84.02,C84.03,C84.04,C84.05,C84.06,C84.07,C84.08,C84.09,C84.10,C84.11,C84.12,C84.13,C84.14,C84.15,C84.16,C84.17,C84.18,C84.19,C84.40,C84.41,C84.42,C84.43,C84.44,C84.45,C84.46,C84.47,C84.48,C84.49,C84.60,C84.61,C84.62,C84.63,C84.64,C84.65,C84.66,C84.67,C84.68,C84.69,C84.70,C84.71,C84.72,C84.73,C84.74,C84.75,C84.76,C84.77,C84.78,C84.79,C84.90,C84.91,C84.92,C84.93,C84.94,C84.95,C84.96,C84.97,C84.98,C84.99,C84.A0,C84.A1,C84.A2,C84.A3,C84.A4,C84.A5,C84.A6,C84.A7,C84.A8,C84.A9,C84.Z0,C84.Z1,C84.Z2,C84.Z3,C84.Z4,C84.Z5,C84.Z6,C84.Z7,C84.Z8,C84.Z9,C85.10,C85.11,C85.12,C85.13,C85.14,C85.15,C85.16,C85.17,C85.18,C85.19,C85.20,C85.21,C85.22,C85.23,C85.24,C85.25,C85.26,C85.27,C85.28,C85.29,C85.80,C85.81,C85.82,C85.83,C85.84,C85.85,C85.86,C85.87,C85.88,C85.89,C85.90,C85.91,C85.92,C85.93,C85.94,C85.95,C85.96,C85.97,C85.98,C85.99,C86.0,C86.1,C86.2,C86.3,C86.4,C86.5,C86.6,C88.0,C88.2,C88.3,C88.4,C88.8,C88.9,C90.00,C90.01,C90.02,C90.20,C90.21,C90.22,C90.30,C90.31,C90.32,C96.0,C96.2,C96.20,C96.21,C96.22,C96.29,C96.4,C96.9,C96.A,C96.Z,D47.Z9,200.00,200.01,200.02,200.03,200.04,200.05,200.06,200.07,200.08,200.09,200.10,200.11,200.12,200.13,200.14,200.15,200.16,200.17,200.18,200.19,200.20,200.21,200.22,200.23,200.24,200.25,200.26,200.27,200.28,200.29,200.30,200.31,200.32,200.33,200.34,200.35,200.36,200.37,200.38,200.39,200.40,200.41,200.42,200.43,200.44,200.45,200.46,200.47,200.48,200.49,200.50,200.51,200.52,200.53,200.54,200.55,200.56,200.57,200.58,200.59,200.60,200.61,200.62,200.63,200.64,200.65,200.66,200.67,200.68,200.69,200.70,200.71,200.72,20

	0.73,200.74,200.75,200.76,200.77,200.78,200.79,200.80,200.81,200.82,20 0.83,200.84,200.85,200.86,200.87,200.88,200.89,200.90,200.91,200.92,20 0.93,200.94,200.95,200.96,200.97,200.98,200.99,201.00,201.01,201.02,20 1.03,201.04,201.05,201.06,201.07,201.08,201.09,201.10,201.11,201.12,20 1.13,201.14,201.15,201.16,201.17,201.18,201.19,201.20,201.21,201.22,20 1.23,201.24,201.25,201.26,201.27,201.28,201.29,201.30,201.31,201.32,20 1.33,201.34,201.35,201.36,201.37,201.38,201.39,201.40,201.41,201.42,20 1.43,201.44,201.45,201.46,201.47,201.48,201.49,201.50,201.51,201.52,20 1.53,201.54,201.55,201.56,201.57,201.58,201.59,201.60,201.61,201.62,20 1.63,201.64,201.65,201.66,201.67,201.68,201.69,201.70,201.71,201.72,20 1.73,201.74,201.75,201.76,201.77,201.78,201.79,201.80,201.81,201.82,20 1.83,201.84,201.85,201.86,201.87,201.88,201.89,201.90,201.91,201.92,20 1.93,201.94,201.95,201.96,201.97,201.98,201.99,202.00,202.01,202.02,20 2.03,202.04,202.05,202.06,202.07,202.08,202.09,202.10,202.11,202.12,20 2.13,202.14,202.15,202.16,202.17,202.18,202.19,202.20,202.21,202.22,20 2.23,202.24,202.25,202.26,202.27,202.28,202.29,202.30,202.31,202.32,20 2.33,202.34,202.35,202.36,202.37,202.38,202.50,202.51,202.52,202.53,20 2.54,202.55,202.56,202.57,202.58,202.59,202.60,202.61,202.62,202.63,20 2.64,202.65,202.66,202.67,202.68,202.69,202.70,202.71,202.72,202.73,20 2.74,202.75,202.76,202.77,202.78,202.79,202.80,202.81,202.82,202.83,20 2.84,202.85,202.86,202.87,202.88,202.89,202.90,202.91,202.92,202.93,20 2.94,202.95,202.96,202.97,202.98,202.99,203.00,203.01,203.02,203.03,20 3.04,203.05,203.06,203.07,203.08,203.09,203.10,203.11,203.12,203.13,20 3.14,203.15,203.16,203.17,203.18,203.19,203.20,203.21,203.22,203.23,20 3.24,203.25,203.26,203.27,203.28,203.29,203.30,203.31,203.32,203.33,20 3.34,203.35,203.36,203.37,203.38,203.39,203.40,203.41,203.42,203.43,20 3.44,203.45,203.46,203.47,203.48,203.49,203.50,203.51,203.52,203.53,20 3.54,203.55,203.56,203.57,203.58,203.59,203.60,203.61,203.62,203.63,20 3.64,203.65,203.66,203.67,203.68,203.69,203.70,203.71,203.72,203.73,20 3.74,203.75,203.76,203.77,203.78,203.79,203.80,203.81,238.6,273.3
Leukemia	C90.10,C90.11,C90.12,C91.00,C91.01,C91.02,C91.10,C91.11,C91.12,C91. 30,C91.31,C91.32,C91.40,C91.41,C91.42,C91.50,C91.51,C91.52,C91.60,C 91.61,C91.62,C91.90,C91.91,C91.92,C91.A0,C91.A1,C91.A2,C91.Z0,C91. Z1,C91.Z2,C92.00,C92.01,C92.02,C92.10,C92.11,C92.12,C92.20,C92.21,C 92.22,C92.30,C92.31,C92.32,C92.40,C92.41,C92.42,C92.50,C92.51,C92.5 2,C92.60,C92.61,C92.62,C92.90,C92.91,C92.92,C92.A0,C92.A1,C92.A2,C 92.Z0,C92.Z1,C92.Z2,C93.00,C93.01,C93.02,C93.10,C93.11,C93.12,C93.3 0,C93.31,C93.32,C93.90,C93.91,C93.92,C93.Z0,C93.Z1,C93.Z2,C94.00,C 94.01,C94.02,C94.20,C94.21,C94.22,C94.30,C94.31,C94.32,C94.40,C94.4 1,C94.42,C94.6,C94.80,C94.81,C94.82,C95.00,C95.01,C95.02,C95.10,C95 .11,C95.12,C95.90,C95.91,C95.92

Cancer (in situ)	D00.00,D00.01,D00.02,D00.03,D00.04,D00.05,D00.06,D00.07,D00.08,D00.1,D00.2,D01.0,D01.1,D01.2,D01.3,D01.40,D01.49,D01.5,D01.7,D01.9,D02.0,D02.1,D02.20,D02.21,D02.22,D02.3,D02.4,D03.0,D03.10,D03.11,D03.111,D03.112,D03.12,D03.121,D03.122,D03.20,D03.21,D03.22,D03.30,D03.39,D03.4,D03.51,D03.52,D03.59,D03.60,D03.61,D03.62,D03.70,D03.71,D03.72,D03.8,D03.9,D04.0,D04.10,D04.11,D04.111,D04.112,D04.12,D04.121,D04.122,D04.20,D04.21,D04.22,D04.30,D04.39,D04.4,D04.5,D04.60,D04.61,D04.62,D04.70,D04.71,D04.72,D04.8,D04.9,D05.00,D05.01,D05.02,D05.10,D05.11,D05.12,D05.80,D05.81,D05.82,D05.90,D05.91,D05.92,D06.0,D06.1,D06.7,D06.9,D07.0,D07.1,D07.2,D07.30,D07.39,D07.4,D07.5,D07.60,D07.61,D07.69,D09.0,D09.10,D09.19,D09.20,D09.21,D09.22,D09.3,D09.8,D09.9,140.0,140.1,140.2,140.3,140.4,140.5,140.6,140.7,140.8,140.9,141.0,141.1,141.2,141.3,141.4,141.5,141.6,141.7,141.8,141.9,142.0,142.1,142.2,142.3,142.4,142.5,142.6,142.7,142.8,142.9,143.0,143.1,143.2,143.3,143.4,143.5,143.6,143.7,143.8,143.9,144.0,144.1,144.2,144.3,144.4,144.5,144.6,144.7,144.8,144.9,145.0,145.1,145.2,145.3,145.4,145.5,145.6,145.7,145.8,145.9,146.0,146.1,146.2,146.3,146.4,146.5,146.6,146.7,146.8,146.9,147.0,147.1,147.2,147.3,147.4,147.5,147.6,147.7,147.8,147.9,148.0,148.1,148.2,148.3,148.4,148.5,148.6,148.7,148.8,148.9,149.0,149.1,149.2,149.3,149.4,149.5,149.6,149.7,149.8,149.9,150.0,150.1,150.2,150.3,150.4,150.5,150.6,150.7,150.8,150.9,151.0,151.1,151.2,151.3,151.4,151.5,151.6,151.7,151.8,151.9,152.0,152.1,152.2,152.3,152.4,152.5,152.6,152.7,152.8,152.9,153.0,153.1,153.2,153.3,153.4,153.5,153.6,153.7,153.8,153.9,154.0,154.1,154.2,154.3,154.4,154.5,154.6,154.7,154.8,154.9,155.0,155.1,155.2,155.3,155.4,155.5,155.6,155.7,155.8,155.9,156.0,156.1,156.2,156.3,156.4,156.5,156.6,156.7,156.8,156.9,157.0,157.1,157.2,157.3,157.4,157.5,157.6,157.7,157.8,157.9,158.0,158.1,158.2,158.3,158.4,158.5,158.6,158.7,158.8,158.9,159.0,159.1,159.2,159.3,159.4,159.5,159.6,159.7,159.8,159.9,160.0,160.1,160.2,160.3,160.4,160.5,160.6,160.7,160.8,160.9,161.0,161.1,161.2,161.3,161.4,161.5,161.6,161.7,161.8,161.9,162.0,162.1,162.2,162.3,162.4,162.5,162.6,162.7,162.8,162.9,163.0,163.1,163.2,163.3,163.4,163.5,163.6,163.7,163.8,163.9,164.0,164.1,164.2,164.3,164.4,164.5,164.6,164.7,164.8,164.9,165.0,165.1,165.2,165.3,165.4,165.5,165.6,165.7,165.8,165.9,166.0,166.1,166.2,166.3,166.4,166.5,166.6,166.7,166.8,166.9,167.0,167.1,167.2,167.3,167.4,167.5,167.6,167.7,167.8,167.9,168.0,168.1,168.2,168.3,168.4,168.5,168.6,168.7,168.8,168.9,169.0,169.1,169.2,169.3,169.4,169.5,169.6,169.7,169.8,169.9,170.0,170.1,170.2,170.3,170.4,170.5,170.6,170.7,170.8,170.9,171.0,171.1,171.2,171.3,171.4,171.5,171.6,171.7,171.8,171.9,172.0,172.1,172.2,172.3,172.4,172.5,172.6,172.7,172.8,172.9,174.0,174.1,174.2,174.3,174.4,174.5,174.6,174.7,174.8,174.9,175.0,175.1,175.2,175.3,175.4,175.5,175.6,175.7,175.8,175.9,179.0,179.1,179.2,179.3,179.4,179.5,179.6,179.7,179.8,179.9,180.0,180.1,180.2,180.3,180.4,180.5,180.6,180.7,180.8,180.9,181.0,181.1,181.2,181.3,181.4,181.5,181.6,181.7,181.8,181.9,182.0,182.1,182.2,182.3,182.4,182.5,182.6,182.7,182.8,182.9,183.0,183.1,183.2,183.3,183.4,183.5,183.6,183.7,183.8,183.9,184.0,184.1,184.2,184.3,184.4,184.5,184.6,184.7,184.8,184.9,185.0,185.1,185.2,185.3,185.4,185.5,185.6,185.7,185.8,185.9,186.0,186.1,186.2,186.3,186.4,186.5,186.6,186.7,186.8,186.9,187.0,187.1,187.2,187.3,187.4,187.5,187.6,187.7,187.8,187.9,188.0,188.1,188.2,188.3,188.4,188.5,188.6,188.7,188.8,188.9,189.0,189.1,189.2,189.3,189.4,189.5,189.6,189.7,189.8,189.9,190.0,190.1,190.2,190.3,190.4,190.5,190.6,190.7,190.8,190.9,191.0,191.1,191.2,191.3,191.4,191.5,191.6,191.7,191.8,19

	1.9,192.0,192.1,192.2,192.3,192.4,192.5,192.6,192.7,192.8,192.9,193.0,193.1,193.2,193.3,193.4,193.5,193.6,193.7,193.8,193.9,194.0,194.1,194.2,194.3,194.4,194.5,194.6,194.7,194.8,194.9,195.0,195.1,195.2,195.3,195.4,195.5,195.6,195.7,195.8,209.00,209.01,209.02,209.03,209.04,209.05,209.06,209.07,209.08,209.09,209.10,209.11,209.12,209.13,209.14,209.15,209.16,209.17,209.18,209.19,209.20,209.21,209.22,209.23,209.24,209.25,209.26,209.27,209.28,209.29,209.3,209.30,209.31,209.32,209.33,209.34,209.35,209.36,258.01,258.02,258.03
Metastatic cancer	C77.0,C77.1,C77.2,C77.3,C77.4,C77.5,C77.8,C77.9,C78.00,C78.01,C78.02,C78.1,C78.2,C78.30,C78.39,C78.4,C78.5,C78.6,C78.7,C78.80,C78.89,C79.00,C79.01,C79.02,C79.10,C79.11,C79.19,C79.2,C79.31,C79.32,C79.40,C79.49,C79.51,C79.52,C79.60,C79.61,C79.62,C79.70,C79.71,C79.72,C79.81,C79.82,C79.89,C79.9,C7B.00,C7B.01,C7B.02,C7B.03,C7B.04,C7B.09,C7B.1,C7B.8,C80.0,196.0,196.1,196.2,196.3,196.4,196.5,196.6,196.7,196.8,196.9,197.0,197.1,197.2,197.3,197.4,197.5,197.6,197.7,197.8,197.9,198.0,198.1,198.2,198.3,198.4,198.5,198.6,198.7,198.8,198.9,199.0,199.1,209.70,209.71,209.72,209.73,209.74,209.75,209.79,789.51
Solid tumor w/o metastasis (malignant)	C00.0,C00.1,C00.2,C00.3,C00.4,C00.5,C00.6,C00.8,C00.9,C01.X,C02.0,C02.1,C02.2,C02.3,C02.4,C02.8,C02.9,C03.0,C03.1,C03.9,C04.0,C04.1,C04.8,C04.9,C05.0,C05.1,C05.2,C05.8,C05.9,C06.0,C06.1,C06.2,C06.80,C06.89,C06.9,C07.X,C08.0,C08.1,C08.9,C09.0,C09.1,C09.8,C09.9,C10.0,C10.1,C10.2,C10.3,C10.4,C10.8,C10.9,C11.0,C11.1,C11.2,C11.3,C11.8,C11.9,C12.X,C13.0,C13.1,C13.2,C13.8,C13.9,C14.0,C14.2,C14.8,C15.3,C15.4,C15.5,C15.8,C15.9,C16.0,C16.1,C16.2,C16.3,C16.4,C16.5,C16.6,C16.8,C16.9,C17.0,C17.1,C17.2,C17.3,C17.8,C17.9,C18.0,C18.1,C18.2,C18.3,C18.4,C18.5,C18.6,C18.7,C18.8,C18.9,C19.X,C20.X,C21.0,C21.1,C21.2,C21.8,C22.0,C22.1,C22.2,C22.3,C22.4,C22.7,C22.8,C22.9,C23.X,C24.0,C24.1,C24.8,C24.9,C25.0,C25.1,C25.2,C25.3,C25.4,C25.7,C25.8,C25.9,C26.0,C26.1,C26.9,C30.0,C30.1,C31.0,C31.1,C31.2,C31.3,C31.8,C31.9,C32.0,C32.1,C32.2,C32.3,C32.8,C32.9,C33.X,C34.00,C34.01,C34.02,C34.10,C34.11,C34.12,C34.2,C34.30,C34.31,C34.32,C34.80,C34.81,C34.82,C34.90,C34.91,C34.92,C37.X,C38.0,C38.1,C38.2,C38.3,C38.4,C38.8,C39.0,C39.9,C40.00,C40.01,C40.02,C40.10,C40.11,C40.12,C40.20,C40.21,C40.22,C40.30,C40.31,C40.32,C40.80,C40.81,C40.82,C40.90,C40.91,C40.92,C41.0,C41.1,C41.2,C41.3,C41.4,C41.9,C43.0,C43.10,C43.11,C43.111,C43.112,C43.12,C43.121,C43.122,C43.20,C43.21,C43.22,C43.30,C43.31,C43.39,C43.4,C43.51,C43.52,C43.59,C43.60,C43.61,C43.62,C43.70,C43.71,C43.72,C43.8,C43.9,C44.00,C44.09,C44.101,C44.102,C44.1021,C44.1022,C44.109,C44.1091,C44.1092,C44.131,C44.1321,C44.1322,C44.1391,C44.1392,C44.191,C44.192,C44.1921,C44.1922,C44.199,C44.1991,C44.1992,C44.201,C44.202,C44.209,C44.291,C44.292,C44.299,C44.300,C44.301,C44.309,C44.390,C44.391,C44.399,C44.40,C44.49,C44.500,C44.501,C44.509,C44.590,C44.591,C44.599,C44.601,C44.602,C44.609,C44.691,C44.692,C44.699,C44.701,C44.702,C44.709,C44.791,C44.792,C44.799,C44.80,C44.89,C44.90,C44.99,C45.0

	,C45.1,C45.2,C45.7,C45.9,C46.0,C46.1,C46.2,C46.3,C46.4,C46.50,C46.51,C46.52,C46.7,C46.9,C47.0,C47.10,C47.11,C47.12,C47.20,C47.21,C47.22,C47.3,C47.4,C47.5,C47.6,C47.8,C47.9,C48.0,C48.1,C48.2,C48.8,C49.0,C49.10,C49.11,C49.12,C49.20,C49.21,C49.22,C49.3,C49.4,C49.5,C49.6,C49.8,C49.9,C49.A0,C49.A1,C49.A2,C49.A3,C49.A4,C49.A5,C49.A9,C4A.0,C4A.10,C4A.11,C4A.111,C4A.112,C4A.12,C4A.121,C4A.122,C4A.20,C4A.21,C4A.22,C4A.30,C4A.31,C4A.39,C4A.4,C4A.51,C4A.52,C4A.59,C4A.60,C4A.61,C4A.62,C4A.70,C4A.71,C4A.72,C4A.8,C4A.9,C50.011,C50.012,C50.019,C50.021,C50.022,C50.029,C50.111,C50.112,C50.119,C50.121,C50.122,C50.129,C50.211,C50.212,C50.219,C50.221,C50.222,C50.229,C50.311,C50.312,C50.319,C50.321,C50.322,C50.329,C50.411,C50.412,C50.419,C50.421,C50.422,C50.429,C50.511,C50.512,C50.519,C50.521,C50.522,C50.529,C50.611,C50.612,C50.619,C50.621,C50.622,C50.629,C50.811,C50.812,C50.819,C50.821,C50.822,C50.829,C50.911,C50.912,C50.919,C50.921,C50.922,C50.929,C51.0,C51.1,C51.2,C51.8,C51.9,C52.X,C53.0,C53.1,C53.8,C53.9,C54.0,C54.1,C54.2,C54.3,C54.8,C54.9,C55.X,C56.1,C56.2,C56.9,C57.00,C57.01,C57.02,C57.10,C57.11,C57.12,C57.20,C57.21,C57.22,C57.3,C57.4,C57.7,C57.8,C57.9,C58.X,C60.0,C60.1,C60.2,C60.8,C60.9,C61.X,C62.00,C62.01,C62.02,C62.10,C62.11,C62.12,C62.90,C62.91,C62.92,C63.00,C63.01,C63.02,C63.10,C63.11,C63.12,C63.2,C63.7,C63.8,C63.9,C64.1,C64.2,C64.9,C65.1,C65.2,C65.9,C66.1,C66.2,C66.9,C67.0,C67.1,C67.2,C67.3,C67.4,C67.5,C67.6,C67.7,C67.8,C67.9,C68.0,C68.1,C68.8,C68.9,C69.00,C69.01,C69.02,C69.10,C69.11,C69.12,C69.20,C69.21,C69.22,C69.30,C69.31,C69.32,C69.40,C69.41,C69.42,C69.50,C69.51,C69.52,C69.60,C69.61,C69.62,C69.80,C69.81,C69.82,C69.90,C69.91,C69.92,C70.0,C70.1,C70.9,C71.0,C71.1,C71.2,C71.3,C71.4,C71.5,C71.6,C71.7,C71.8,C71.9,C72.0,C72.1,C72.20,C72.21,C72.22,C72.30,C72.31,C72.32,C72.40,C72.41,C72.42,C72.50,C72.59,C72.9,C73.X,C74.00,C74.01,C74.02,C74.10,C74.11,C74.12,C74.90,C74.91,C74.92,C75.0,C75.1,C75.2,C75.3,C75.4,C75.5,C75.8,C75.9,C76.0,C76.1,C76.2,C76.3,C76.40,C76.41,C76.42,C76.50,C76.51,C76.52,C76.8,C7A.00,C7A.010,C7A.011,C7A.012,C7A.019,C7A.020,C7A.021,C7A.022,C7A.023,C7A.024,C7A.025,C7A.026,C7A.029,C7A.090,C7A.091,C7A.092,C7A.093,C7A.094,C7A.095,C7A.096,C7A.098,C7A.1,C7A.8,D46.9,E31.21,E31.22,E31.23
Arthropathies	L40.50,L40.51,L40.54,L40.59,L90.0,L94.0,L94.1,L94.3,M01.X0,M01.X11,M01.X12,M01.X19,M01.X21,M01.X22,M01.X29,M01.X31,M01.X32,M01.X39,M01.X41,M01.X42,M01.X49,M01.X51,M01.X52,M01.X59,M01.X61,M01.X62,M01.X69,M01.X71,M01.X72,M01.X79,M01.X8,M01.X9,M02.00,M02.011,M02.012,M02.019,M02.021,M02.022,M02.029,M02.031,M02.032,M02.039,M02.041,M02.042,M02.049,M02.051,M02.052,M02.059,M02.061,M02.062,M02.069,M02.071,M02.072,M02.079,M02.08,M02.09,M02.10,M02.111,M02.112,M02.119,M02.121,M02.122,M02.129,M02.131,M02.132,M02.139,M02.141,M02.142,M02.149,M02.151,M02.152,M02.159,M02.161,M02.162,M02.169,M02.171,M02.172,M02.179,M02.18,M02.19,M02.20,M02.211,M02.212,M02.219,M02.221,M02.222,M02.229,M02.231,M02.232,M02.239,M02.241,M02.242,M02.249,M02.251,M02.252,M02.259,M02.261,M02.262,M02.269,M02.271,M02.272,M02.279,M02.28,M02.29,M02.30,M02.311,M02.312,M02.319,M02.321,M02.322,M02.329,M02.331,M02.332,M02.339,M02.341,M02.342,M02.349,M02.351,M02.352,M02.359,M02.361,M02.362,M02.369,M02.371,M02.372,M02.379,M02.38,M02.39,M02.80,M02.811,M02.812,M02.819,M02.821,M02.822,M02.829,M02.831,M02.832,M02.839,M02.841,M02.842,

	M02.849,M02.851,M02.852,M02.859,M02.861,M02.862,M02.869,M02.871, M02.872,M02.879,M02.88,M02.89,M02.9,M05.00,M05.011,M05.012,M05.0 19,M05.021,M05.022,M05.029,M05.031,M05.032,M05.039,M05.041,M05.0 42,M05.049,M05.051,M05.052,M05.059,M05.061,M05.062,M05.069,M05.0 71,M05.072,M05.079,M05.09,M05.10,M05.111,M05.112,M05.119,M05.121, M05.122,M05.129,M05.131,M05.132,M05.139,M05.141,M05.142,M05.149, M05.151,M05.152,M05.159,M05.161,M05.162,M05.169,M05.171,M05.172, M05.179,M05.19,M05.20,M05.211,M05.212,M05.219,M05.221,M05.222,M0 5.229,M05.231,M05.232,M05.239,M05.241,M05.242,M05.249,M05.251,M0 5.252,M05.259,M05.261,M05.262,M05.269,M05.271,M05.272,M05.279,M0 5.29,M05.30,M05.311,M05.312,M05.319,M05.321,M05.322,M05.329,M05.3 31,M05.332,M05.339,M05.341,M05.342,M05.349,M05.351,M05.352,M05.3 59,M05.361,M05.362,M05.369,M05.371,M05.372,M05.379,M05.39,M05.40, M05.411,M05.412,M05.419,M05.421,M05.422,M05.429,M05.431,M05.432, M05.439,M05.441,M05.442,M05.449,M05.451,M05.452,M05.459,M05.461, M05.462,M05.469,M05.471,M05.472,M05.479,M05.49,M05.50,M05.511,M0 5.512,M05.519,M05.521,M05.522,M05.529,M05.531,M05.532,M05.539,M0 5.541,M05.542,M05.549,M05.551,M05.552,M05.559,M05.561,M05.562,M0 5.569,M05.571,M05.572,M05.579,M05.59,M05.60,M05.611,M05.612,M05.6 19,M05.621,M05.622,M05.629,M05.631,M05.632,M05.639,M05.641,M05.6 42,M05.649,M05.651,M05.652,M05.659,M05.661,M05.662,M05.669,M05.6 71,M05.672,M05.679,M05.69,M05.70,M05.711,M05.712,M05.719,M05.721, M05.722,M05.729,M05.731,M05.732,M05.739,M05.741,M05.742,M05.749, M05.751,M05.752,M05.759,M05.761,M05.762,M05.769,M05.771,M05.772, M05.779,M05.79,M05.7A,M05.80,M05.811,M05.812,M05.819,M05.821,M05 .822,M05.829,M05.831,M05.832,M05.839,M05.841,M05.842,M05.849,M05. 851,M05.852,M05.859,M05.861,M05.862,M05.869,M05.871,M05.872,M05. 879,M05.89,M05.8A,M05.9,M06.00,M06.011,M06.012,M06.019,M06.021,M 06.022,M06.029,M06.031,M06.032,M06.039,M06.041,M06.042,M06.049,M 06.051,M06.052,M06.059,M06.061,M06.062,M06.069,M06.071,M06.072,M 06.079,M06.08,M06.09,M06.0A,M06.1,M06.20,M06.211,M06.212,M06.219, M06.221,M06.222,M06.229,M06.231,M06.232,M06.239,M06.241,M06.242, M06.249,M06.251,M06.252,M06.259,M06.261,M06.262,M06.269,M06.271, M06.272,M06.279,M06.28,M06.29,M06.30,M06.311,M06.312,M06.319,M06 .321,M06.322,M06.329,M06.331,M06.332,M06.339,M06.341,M06.342,M06. 349,M06.351,M06.352,M06.359,M06.361,M06.362,M06.369,M06.371,M06. 372,M06.379,M06.38,M06.39,M06.4,M06.80,M06.811,M06.812,M06.819,M 06.821,M06.822,M06.829,M06.831,M06.832,M06.839,M06.841,M06.842,M 06.849,M06.851,M06.852,M06.859,M06.861,M06.862,M06.869,M06.871,M 06.872,M06.879,M06.88,M06.89,M06.8A,M06.9,M07.60,M07.611,M07.612, M07.619,M07.621,M07.622,M07.629,M07.631,M07.632,M07.639,M07.641, M07.642,M07.649,M07.651,M07.652,M07.659,M07.661,M07.662,M07.669, M07.671,M07.672,M07.679,M07.68,M07.69,M08.00,M08.011,M08.012,M08 .019,M08.021,M08.022,M08.029,M08.031,M08.032,M08.039,M08.041,M08. 042,M08.049,M08.051,M08.052,M08.059,M08.061,M08.062,M08.069,M08. 071,M08.072,M08.079,M08.08,M08.09,M08.0A,M08.1,M08.20,M08.211,M0 8.212,M08.219,M08.221,M08.222,M08.229,M08.231,M08.232,M08.239,M0 8.241,M08.242,M08.249,M08.251,M08.252,M08.259,M08.261,M08.262,M0 8.269,M08.271,M08.272,M08.279,M08.28,M08.29,M08.2A,M08.3,M08.40,M 08.411,M08.412,M08.419,M08.421,M08.422,M08.429,M08.431,M08.432,M 08.439,M08.441,M08.442,M08.449,M08.451,M08.452,M08.459,M08.461,M

	08.462,M08.469,M08.471,M08.472,M08.479,M08.48,M08.4A,M08.80,M08.811,M08.812,M08.819,M08.821,M08.822,M08.829,M08.831,M08.832,M08.839,M08.841,M08.842,M08.849,M08.851,M08.852,M08.859,M08.861,M08.862,M08.869,M08.871,M08.872,M08.879,M08.88,M08.89,M08.90,M08.911,M08.912,M08.919,M08.921,M08.922,M08.929,M08.931,M08.932,M08.939,M08.941,M08.942,M08.949,M08.951,M08.952,M08.959,M08.961,M08.962,M08.969,M08.971,M08.972,M08.979,M08.98,M08.99,M08.9A,M12.00,M12.011,M12.012,M12.019,M12.021,M12.022,M12.029,M12.031,M12.032,M12.039,M12.041,M12.042,M12.049,M12.051,M12.052,M12.059,M12.061,M12.062,M12.069,M12.071,M12.072,M12.079,M12.08,M12.09,M30.0,M30.1,M30.2,M30.3,M30.8,M31.0,M31.1,M31.2,M31.30,M31.31,M31.4,M31.5,M31.6,M31.7,M31.8,M31.9,M32.0,M32.10,M32.12,M32.13,M32.14,M32.15,M32.19,M32.8,M32.9,M33.00,M33.01,M33.02,M33.03,M33.09,M33.10,M33.11,M33.12,M33.13,M33.19,M33.20,M33.21,M33.22,M33.29,M33.90,M33.91,M33.92,M33.93,M33.99,M34.0,M34.1,M34.2,M34.81,M34.82,M34.83,M34.89,M34.9,M35.00,M35.01,M35.02,M35.03,M35.04,M35.09,M35.1,M35.2,M35.3,M35.5,M35.6,M35.8,M35.9,M36.0,M36.1,M36.8,M45.0,M45.1,M45.2,M45.3,M45.4,M45.5,M45.6,M45.7,M45.8,M45.9,M46.00,M46.01,M46.02,M46.03,M46.04,M46.05,M46.06,M46.07,M46.08,M46.09,M46.1,M46.50,M46.51,M46.52,M46.53,M46.54,M46.55,M46.56,M46.57,M46.58,M46.59,M46.80,M46.81,M46.82,M46.83,M46.84,M46.85,M46.86,M46.87,M46.88,M46.89,M46.90,M46.91,M46.92,M46.93,M46.94,M46.95,M46.96,M46.97,M46.98,M46.99,M49.80,M49.81,M49.82,M49.83,M49.84,M49.85,M49.86,M49.87,M49.88,M49.89,701.0,710.0,710.1,710.2,710.3,710.4,710.5,710.6,710.7,710.8,710.9,714.0,714.1,714.2,714.3,714.4,714.5,714.6,714.7,714.8,714.9,720.0,720.1,720.2,720.3,720.4,720.5,720.6,720.7,720.8,720.9,725.X
Coagulopathy	D61.09,D61.1,D61.2,D61.3,D61.810,D61.811,D61.818,D61.82,D61.89,D61.9,D65.X,D66.X,D67.X,D68.0,D68.1,D68.2,D68.311,D68.312,D68.318,D68.32,D68.4,D68.8,D68.9,D69.1,D69.3,D69.41,D69.42,D69.49,D69.51,D69.59,D69.6,D69.8,D69.9,D75.82,O99.111,O99.112,O99.113,O99.119,O99.12,O99.13,286.0,286.1,286.2,286.3,286.4,286.5,286.6,286.7,286.8,286.9,287.1,287.3,287.4,287.5,289.84,649.30,649.31,649.32,649.33,649.34

Obesity	E66.01,E66.09,E66.1,E66.2,E66.8,E66.9,O99.210,O99.211,O99.212,O99.213,O99.214,O99.215,R93.9,Z68.30,Z68.31,Z68.32,Z68.33,Z68.34,Z68.35,Z68.36,Z68.37,Z68.38,Z68.39,Z68.41,Z68.42,Z68.43,Z68.44,Z68.45,Z68.54,278.0,278.00,278.01,278.03,649.10,649.11,649.12,649.13,649.14,793.91,V85.30,V85.31,V85.32,V85.33,V85.34,V85.35,V85.36,V85.37,V85.38,V85.39,V85.41,V85.42,V85.43,V85.44,V85.45,V85.54
Weight loss	E40.X,E41.X,E42.X,E43.X,E44.0,E44.1,E45.X,E46.X,E64.0,O25.10,O25.11,O25.12,O25.13,O25.2,O25.3,R63.4,R64.X,260.X,261.X,262.X,263.X,260.1,260.2,260.3,260.4,260.5,260.6,260.7,260.8,260.9,261.0,261.1,261.2,261.3,261.4,261.5,261.6,261.7,261.8,261.9,262.0,262.1,262.2,262.3,262.4,262.5,262.6,262.7,262.8,262.9,263.0,263.1,263.2,263.3,263.4,263.5,263.6,263.7,263.8,263.9,783.21,783.22
Blood loss anemia	D50.0,O90.81,O99.02,O99.03,280.0,648.20,648.21,648.22,648.23,648.24
Deficiency anemia	D50.1,D50.8,D50.9,D51.0,D51.1,D51.2,D51.3,D51.8,D51.9,D52.0,D52.1,D52.8,D52.9,D53.0,D53.1,D53.2,D53.8,D53.9,D63.0,D63.1,D63.8,D64.9,O99.011,O99.012,O99.013,O99.019,280.1,280.2,280.3,280.4,280.5,280.6,280.7,280.8,280.9,281.0,281.1,281.2,281.3,281.4,281.5,281.6,281.7,281.8,281.9,285.21,285.22,285.23,285.24,285.25,285.26,285.27,285.28,285.29,285.9
Alcohol abuse	F10.10,F10.11,F10.120,F10.121,F10.129,F10.130,F10.131,F10.132,F10.139,F10.14,F10.150,F10.151,F10.159,F10.180,F10.181,F10.182,F10.188,F10.19,F10.20,F10.21,F10.220,F10.221,F10.229,F10.230,F10.231,F10.232,F10.239,F10.24,F10.250,F10.251,F10.259,F10.26,F10.27,F10.280,F10.281,F10.282,F10.288,F10.29,F10.94,F10.950,F10.951,F10.959,F10.96,F10.97,F10.980,G62.1,I42.6,K29.20,K29.21,K70.10,K70.11,O99.310,O99.311,O99.312,O99.313,O99.314,O99.315,291.0,291.1,291.2,291.3,291.5,291.8,291.81,291.82,291.89,291.9,303.00,303.01,303.02,303.03,303.04,303.05,303.06,303.07,303.08,303.09,303.10,303.11,303.12,303.13,303.14,303.15,303.16,303.17,303.18,303.19,303.20,303.21,303.22,303.23,303.24,303.25,303.26,303.27,303.28,303.29,303.30,303.31,303.32,303.33,303.34,303.35,303.36,303.37,303.38,303.39,303.40,303.41,303.42,303.43,303.44,303.45,303.46,303.47,303.48,303.49,303.50,303.51,303.52,303.53,303.54,303.55,303.56,303.57,303.58,303.59,303.60,303.61,303.62,303.63,303.64,303.65,303.66,303.67,303.68,303.69,303.70,303.71,303.72,303.73,303.74,303.75,303.76,303.77,303.78,303.79,303.80,303.81,303.82,303.83,303.84,303.85,303.86,303.87,303.88,303.89,303.90,303.91,303.92,303.93,305.00,305.01,305.02,305.03
Drug abuse	F11.10,F11.11,F11.120,F11.121,F11.122,F11.129,F11.13,F11.14,F11.150,F11.151,F11.159,F11.181,F11.182,F11.188,F11.19,F11.20,F11.21,F11.220,F11.221,F11.222,F11.229,F11.23,F11.24,F11.250,F11.251,F11.259,F11.281,F11.282,F11.288,F11.29,F12.10,F12.11,F12.120,F12.121,F12.122,F12.129,F12.13,F12.150,F12.151,F12.159,F12.180,F12.188,F12.19,F12.20,F12.21,F12.220,F12.221,F12.222,F12.229,F12.23,F12.250,F12.251,F12.259,F12.280,F12.288,F12.29,F13.10,F13.11,F13.120,F13.121,F13.129,F13.130,F13.131,F13.132,F13.139,F13.14,F13.150,F13.151,F13.159,F13.180,F13.181,F13.182,F13.188,F13.19,F13.20,F13.21,F13.220,F13.221,F13.229,F13.230,F13.231,F13.232,F13.239,F13.24,F13.250,F13.251,F13.259,F13.26,F13.27,F13.280,F13.281,F13.282,F13.288,F13.29,F14.10,F14.11,F14.120,F14.121,F14.122,F14.129,F14.13,F14.14,F14.150,F14.151,F14.159,F14.180,F14.181,F14.182,F14.188,F14.19,F14.20,F14.21,F14.220,F14.221,F14.222

	,F14.229,F14.23,F14.24,F14.250,F14.251,F14.259,F14.280,F14.281,F14.282,F14.288,F14.29,F15.10,F15.11,F15.120,F15.121,F15.122,F15.129,F15.13,F15.14,F15.150,F15.151,F15.159,F15.180,F15.181,F15.182,F15.188,F15.19,F15.20,F15.21,F15.220,F15.221,F15.222,F15.229,F15.23,F15.24,F15.250,F15.251,F15.259,F15.280,F15.281,F15.282,F15.288,F15.29,F16.10,F16.11,F16.120,F16.121,F16.122,F16.129,F16.14,F16.150,F16.151,F16.159,F16.180,F16.183,F16.188,F16.19,F16.20,F16.21,F16.220,F16.221,F16.229,F16.24,F16.250,F16.251,F16.259,F16.280,F16.283,F16.288,F16.29,F18.10,F18.11,F18.120,F18.121,F18.129,F18.14,F18.150,F18.151,F18.159,F18.17,F18.180,F18.188,F18.19,F18.20,F18.21,F18.220,F18.221,F18.229,F18.24,F18.250,F18.251,F18.259,F18.27,F18.280,F18.288,F18.29,F19.10,F19.11,F19.120,F19.121,F19.122,F19.129,F19.130,F19.131,F19.132,F19.139,F19.14,F19.150,F19.151,F19.159,F19.16,F19.17,F19.180,F19.181,F19.182,F19.188,F19.19,F19.20,F19.21,F19.220,F19.221,F19.222,F19.229,F19.230,F19.231,F19.232,F19.239,F19.24,F19.250,F19.251,F19.259,F19.26,F19.27,F19.280,F19.281,F19.282,F19.288,F19.29,O99.320,O99.321,O99.322,O99.323,O99.324,O99.325,292.0,292.82,292.89,292.9,304.00,304.01,304.02,304.03,304.04,304.05,304.06,304.07,304.08,304.09,304.10,304.11,304.12,304.13,304.14,304.15,304.16,304.17,304.18,304.19,304.20,304.21,304.22,304.23,304.24,304.25,304.26,304.27,304.28,304.29,304.30,304.31,304.32,304.33,304.34,304.35,304.36,304.37,304.38,304.39,304.40,304.41,304.42,304.43,304.44,304.45,304.46,304.47,304.48,304.49,304.50,304.51,304.52,304.53,304.54,304.55,304.56,304.57,304.58,304.59,304.60,304.61,304.62,304.63,304.64,304.65,304.66,304.67,304.68,304.69,304.70,304.71,304.72,304.73,304.74,304.75,304.76,304.77,304.78,304.79,304.80,304.81,304.82,304.83,304.84,304.85,304.86,304.87,304.88,304.89,304.90,304.91,304.92,304.93,305.20,305.21,305.22,305.23,305.24,305.25,305.26,305.27,305.28,305.29,305.30,305.31,305.32,305.33,305.34,305.35,305.36,305.37,305.38,305.39,305.40,305.41,305.42,305.43,305.44,305.45,305.46,305.47,305.48,305.49,305.50,305.51,305.52,305.53,305.54,305.55,305.56,305.57,305.58,305.59,305.60,305.61,305.62,305.63,305.64,305.65,305.66,305.67,305.68,305.69,305.70,305.71,305.72,305.73,305.74,305.75,305.76,305.77,305.78,305.79,305.80,305.81,305.82,305.83,305.84,305.85,305.86,305.87,305.88,305.89,305.90,305.91,305.92,305.93,648.30,648.31,648.32,648.33,648.34
Psychoses	F06.0,F06.1,F06.2,F06.30,F06.33,F11.150,F11.151,F11.159,F11.250,F11.251,F11.259,F11.950,F11.951,F11.959,F12.150,F12.151,F12.159,F12.250,F12.251,F12.259,F12.950,F12.951,F12.959,F13.150,F13.151,F13.159,F13.250,F13.251,F13.259,F13.950,F13.951,F13.959,F14.150,F14.151,F14.159,F14.250,F14.251,F14.259,F14.950,F14.951,F14.959,F15.150,F15.151,F15.159,F15.250,F15.251,F15.259,F15.950,F15.951,F15.959,F16.150,F16.151,F16.159,F16.250,F16.251,F16.259,F16.950,F16.951,F16.959,F18.150,F18.151,F18.159,F18.250,F18.251,F18.259,F18.950,F18.951,F18.959,F19.150,F19.151,F19.159,F19.250,F19.251,F19.259,F19.950,F19.951,F19.959,F20.0,F20.1,F20.2,F20.3,F20.5,F20.81,F20.89,F20.9,F21.X,F22.X,F23.X,F24.X,F25.0,F25.1,F25.8,F25.9,F28.X,F29.X,F30.10,F30.11,F30.12,F30.13,F30.2,F30.3,F30.4,F30.8,F30.9,F31.0,F31.10,F31.11,F31.12,F31.13,F31.2,F31.30,F31.31,F31.32,F31.4,F31.5,F31.60,F31.61,F31.62,F31.63,F31.64,F31.70,F31.71,F31.72,F31.73,F31.74,F31.75,F31.76,F31.77,F31.78,F31.81,F31.89,F31.9,F32.4,F32.5,F33.40,F33.41,F33.42,F34.0,F34.8,F34.81,F34.89,F34.9,F39.X,F44.89,F84.3,295.00,295.01,295.02,295.03,295.04,295.05,295.06,295.07,295.08,295.09,295.10,295.11,295.12,295.13,295.14,295.15,295.16,2

	95.17,295.18,295.19,295.20,295.21,295.22,295.23,295.24,295.25,295.26,2 95.27,295.28,295.29,295.30,295.31,295.32,295.33,295.34,295.35,295.36,2 95.37,295.38,295.39,295.40,295.41,295.42,295.43,295.44,295.45,295.46,2 95.47,295.48,295.49,295.50,295.51,295.52,295.53,295.54,295.55,295.56,2 95.57,295.58,295.59,295.60,295.61,295.62,295.63,295.64,295.65,295.66,2 95.67,295.68,295.69,295.70,295.71,295.72,295.73,295.74,295.75,295.76,2 95.77,295.78,295.79,295.80,295.81,295.82,295.83,295.84,295.85,295.86,2 95.87,295.88,295.89,295.90,295.91,295.92,295.93,295.94,295.95,295.96,2 95.97,295.98,295.99,296.00,296.01,296.02,296.03,296.04,296.05,296.06,2 96.07,296.08,296.09,296.10,296.11,296.12,296.13,296.14,296.15,296.16,2 96.17,296.18,296.19,296.20,296.21,296.22,296.23,296.24,296.25,296.26,2 96.27,296.28,296.29,296.30,296.31,296.32,296.33,296.34,296.35,296.36,2 96.37,296.38,296.39,296.40,296.41,296.42,296.43,296.44,296.45,296.46,2 96.47,296.48,296.49,296.50,296.51,296.52,296.53,296.54,296.55,296.56,2 96.57,296.58,296.59,296.60,296.61,296.62,296.63,296.64,296.65,296.66,2 96.67,296.68,296.69,296.70,296.71,296.72,296.73,296.74,296.75,296.76,2 96.77,296.78,296.79,296.80,296.81,296.82,296.83,296.84,296.85,296.86,2 96.87,296.88,296.89,296.90,296.91,296.92,296.93,296.94,296.95,296.96,2 96.97,296.98,296.99,297.00,297.01,297.02,297.03,297.04,297.05,297.06,2 97.07,297.08,297.09,297.10,297.11,297.12,297.13,297.14,297.15,297.16,2 97.17,297.18,297.19,297.20,297.21,297.22,297.23,297.24,297.25,297.26,2 97.27,297.28,297.29,297.30,297.31,297.32,297.33,297.34,297.35,297.36,2 97.37,297.38,297.39,297.40,297.41,297.42,297.43,297.44,297.45,297.46,2 97.47,297.48,297.49,297.50,297.51,297.52,297.53,297.54,297.55,297.56,2 97.57,297.58,297.59,297.60,297.61,297.62,297.63,297.64,297.65,297.66,2 97.67,297.68,297.69,297.70,297.71,297.72,297.73,297.74,297.75,297.76,2 97.77,297.78,297.79,297.80,297.81,297.82,297.83,297.84,297.85,297.86,2 97.87,297.88,297.89,297.90,297.91,297.92,297.93,297.94,297.95,297.96,2 97.97,297.98,297.99,298.00,298.01,298.02,298.03,298.04,298.05,298.06,2 98.07,298.08,298.09,298.10,298.11,298.12,298.13,298.14,298.15,298.16,2 98.17,298.18,298.19,298.20,298.21,298.22,298.23,298.24,298.25,298.26,2 98.27,298.28,298.29,298.30,298.31,298.32,298.33,298.34,298.35,298.36,2 98.37,298.38,298.39,298.40,298.41,298.42,298.43,298.44,298.45,298.46,2 98.47,298.48,298.49,298.50,298.51,298.52,298.53,298.54,298.55,298.56,2 98.57,298.58,298.59,298.60,298.61,298.62,298.63,298.64,298.65,298.66,2 98.67,298.68,298.69,298.70,298.71,298.72,298.73,298.74,298.75,298.76,2 98.77,298.78,298.79,298.80,298.81,298.82,298.83,298.84,298.85,298.86,2 98.87,298.88,298.89,298.9,298.90,299.10,299.11

Depression	F06.31,F06.32,F06.34,F32.0,F32.1,F32.2,F32.3,F32.8,F32.81,F32.89,F32.9,F33.0,F33.1,F33.2,F33.3,F33.8,F33.9,F34.1,300.4,301.12,309.0,309.1,311.X
Cerebrovascular disease	G45.0,G45.1,G45.2,G45.3,G45.4,G45.8,G45.9,G46.0,G46.1,G46.2,G46.3,G46.4,G46.5,G46.6,G46.7,G46.8,H34.00,H34.01,H34.02,H34.03,H34.10,H34.11,H34.12,H34.13,H34.211,H34.212,H34.213,H34.219,H34.231,H34.232,H34.233,H34.239,I60.00,I60.01,I60.02,I60.10,I60.11,I60.12,I60.2,I60.20,I60.21,I60.22,I60.30,I60.31,I60.32,I60.4,I60.50,I60.51,I60.52,I60.6,I60.7,I60.8,I60.9,I61.0,I61.1,I61.2,I61.3,I61.4,I61.5,I61.6,I61.8,I61.9,I62.00,I62.03,I62.1,I62.9,I63.00,I63.011,I63.012,I63.013,I63.019,I63.02,I63.031,I63.032,I63.033,I63.039,I63.09,I63.10,I63.111,I63.112,I63.113,I63.119,I63.12,I63.131,I63.132,I63.133,I63.139,I63.19,I63.20,I63.211,I63.212,I63.213,I63.219,I63.22,I63.231,I63.232,I63.233,I63.239,I63.29,I63.30,I63.311,I63.312,I63.313,I63.319,I63.321,I63.322,I63.323,I63.329,I63.331,I63.332,I63.333,I63.339,I63.341,I63.342,I63.343,I63.349,I63.39,I63.40,I63.411,I63.412,I63.413,I63.419,I63.421,I63.422,I63.423,I63.429,I63.431,I63.432,I63.433,I63.439,I63.441,I63.442,I63.443,I63.449,I63.49,I63.50,I63.511,I63.512,I63.513,I63.519,I63.521,I63.522,I63.523,I63.529,I63.531,I63.532,I63.533,I63.539,I63.541,I63.542,I63.543,I63.549,I63.59,I63.6,I63.8,I63.81,I63.89,I63.9,I65.01,I65.02,I65.03,I65.09,I65.1,I65.21,I65.22,I65.23,I65.29,I65.8,I65.9,I66.01,I66.02,I66.03,I66.09,I66.11,I66.12,I66.13,I66.19,I66.21,I66.22,I66.23,I66.29,I66.3,I66.8,I66.9
Cerebrovascular disease sequelae	I69.30,I69.31,I69.310,I69.311,I69.312,I69.313,I69.314,I69.315,I69.318,I69.319,I69.320,I69.321,I69.322,I69.323,I69.328,I69.331,I69.332,I69.333,I69.334,I69.339,I69.341,I69.342,I69.343,I69.344,I69.349,I69.351,I69.352,I69.353,I69.354,I69.359,I69.361,I69.362,I69.363,I69.364,I69.365,I69.369,I69.390,I69.391,I69.392,I69.393,I69.398,I69.80,I69.81,I69.810,I69.811,I69.812,I69.813,I69.814,I69.815,I69.818,I69.819,I69.820,I69.821,I69.822,I69.823,I69.828,I69.831,I69.832,I69.833,I69.834,I69.839,I69.841,I69.842,I69.843,I69.844,I69.849,I69.851,I69.852,I69.853,I69.854,I69.859,I69.861,I69.862,I69.863,I69.864,I69.865,I69.869,I69.890,I69.891,I69.892,I69.893,I69.898,I69.90,I69.91,I69.910,I69.911,I69.912,I69.913,I69.914,I69.915,I69.918,I69.919,I69.920,I69.921,I69.922,I69.923,I69.928,I69.931,I69.932,I69.933,I69.934,I69.939,I69.941,I69.942,I69.943,I69.944,I69.949,I69.951,I69.952,I69.953,I69.954,I69.959,I69.961,I69.962,I69.963,I69.964,I69.965,I69.969,I69.990,I69.991,I69.992,I69.993,I69.998,P91.821,P91.822,P91.823,P91.829
Other thyroid disorders	E04.0,E04.1,E04.2,E04.8,E04.9,E05.00,E05.01,E05.10,E05.11,E05.20,E05.21,E05.30,E05.31,E05.40,E05.41,E05.80,E05.81,E05.90,E05.91,E06.0,E06.1,E06.2,E06.3,E06.4,E06.5,E06.9,O90.5

Dementia	F01.50,F01.51,F02.80,F02.81,F03.90,F03.91,G30.0,G30.1,G30.8,G30.9,G31.01,G31.09,G31.1,G31.2,G31.81,G31.82,G31.83,G31.85,G31.89,G31.9
Systemic sclerosis	710.1, M34.0, M34.1, M34.8, M34.9
Amphetamine use	304.40-304.43, 305.70–305.73, F15.10, F15.20, F15.90, F15.99, F15.120, F15.29, F15.259, F15.288, F15.251, F15.19, F15.24
Chronic kidney disease	016.00, 016.01, 016.02, 016.03, 016.04, 016.05, 016.06, 095.4, 189.0, 189.9, 223.0, 236.91, 249.40, 249.41, 250.40, 250.41, 250.42, 250.43, 271.4, 274.10, 283.11, 403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, 440.1, 442.1, 572.4, 580.0, 580.4, 580.81, 580.89, 580.9, 581.0, 581.1, 581.2, 581.3, 581.81, 581.89, 581.9, 582.0, 582.1, 582.2, 582.4, 582.81, 582.89, 582.9, 583.0, 583.1, 583.2, 583.4, 583.6, 583.7, 583.81, 583.89, 583.9, 584.5, 584.6, 584.7, 584.8, 584.9, 585.1, 585.2, 585.3, 585.4, 585.5, 585.6, 585.9, 586, 587, 588.0, 588.1, 588.81, 588.89, 588.9, 591, 753.12, 753.13, 753.14, 753.15, 753.16, 753.17, 753.19, 753.20, 753.21, 753.22, 753.23, 753.29, 794.4, A18.11, A52.75, B52.0, C64.1, C64.2, C64.9, C68.9, D30.00, D30.01, D30.02, D41.00, D41.01, D41.02, D41.10, D41.11, D41.12, D41.20, D41.21, D41.22, D59.3, E08.21, E08.22, E08.29, E08.65, E09.21, E09.22, E09.29, E10.21, E10.22, E10.29, E10.65, E11.21, E11.22, E11.29, E11.65, E13.21, E13.22, E13.29, E74.8, I12.0, I12.9, I13.0, I13.10, I13.11, I13.2, I70.1, I72.2, K76.7, M10.30, M10.311, M10.312, M10.319, M10.321, M10.322, M10.329, M10.331, M10.332, M10.339, M10.341, M10.342, M10.349, M10.351, M10.352, M10.359, M10.361, M10.362, M10.369, M10.371, M10.372, M10.379, M10.38, M10.39, M32.14, M32.15, M35.04, N00.0, N00.1, N00.2, N00.3, N00.4, N00.5, N00.6, N00.7, N00.8, N00.9, N00.A, N01.0, N01.1, N01.2, N01.3, N01.4, N01.5, N01.6, N01.7, N01.8, N01.9, N01.A, N02.0, N02.1, N02.2, N02.3, N02.4, N02.5, N02.6, N02.7, N02.8, N02.9, N02.A, N03.0, N03.1, N03.2, N03.3, N03.4, N03.5, N03.6, N03.7, N03.8, N03.9, N03.A, N04.0, N04.1, N04.2, N04.3, N04.4, N04.5, N04.6, N04.7, N04.8, N04.9, N04.A, N05.0, N05.1, N05.2, N05.3, N05.4, N05.5, N05.6, N05.7, N05.8, N05.9, N05.A, N06.0, N06.1, N06.2, N06.3, N06.4, N06.5, N06.6, N06.7, N06.8, N06.9, N06.A, N07.0, N07.1, N07.2, N07.3, N07.4, N07.5, N07.6, N07.7, N07.8, N07.9, N07.A, N08, N13.1, N13.2, N13.30, N13.39, N14.0, N14.1, N14.2, N14.3, N14.4, N15.0, N15.8, N15.9, N16, N17.0, N17.1, N17.2, N17.8, N17.9, N18.1, N18.2, N18.3, N18.30, N18.31, N18.32, N18.4, N18.5, N18.6, N18.9, N19, N25.0, N25.1, N25.81, N25.89, N25.9, N26.1, N26.9, Q61.02, Q61.11, Q61.19, Q61.2, Q61.3, Q61.4, Q61.5, Q61.8, Q62.0, Q62.2, Q62.10, Q62.11, Q62.12, Q62.31, Q62.32, Q62.39, R94.4
Interstitial lung disease	515-516.9,J84-J84.9

Table S2. **Comorbidities listed by proportion of days covered and medication class.** Comorbidities by proportion of days covered (PDC) for individuals on endothelin receptor antagonists (ERA), phosphodiesterase type-5 inhibitors (PDE5), prostanoids and prostacyclin receptor agonists (prostanoids), soluble guanylate cyclase stimulators (sGCS), and combination therapy with ERA + PDE5.

	All eligible (n=4,025)	ERA (n=974)		PDE5 (n=2,123)		Prostanoids (n=652)		sGCS (n=528)		ERA + PDE5 (n=928)	
		PDC<80% n=137	**PDC≥80%** n=837	PDC<80% n=657	**PDC≥80%** n=1466	PDC<80% n=102	**PDC≥80%** n=550	PDC<80% n=89	**PDC≥80%** n=439	PDC<80% n=139	**PDC≥80%** n=789
CHF, n (%)	1658 (41.2%)	55 (40.2%)	289 (34.5%)	330 (50.2%)	714 (48.7%)	42 (41.2%)	177 (32.2%)	33 (37.1%)	160 (36.5%)	40 (28.8%)	248 (31.5%)
Valvular disease, n (%)	1274 (31.7%)	38 (27.7%)	244 (29.2%)	240 (36.5%)	550 (37.5%)	28 (27.5%)	141 (25.6%)	27 (30.3%)	136 (31%)	27 (19.4%)	180 (22.8%)
Peripheral vascular disorders, n (%)	765 (19.0%)	27 (19.7%)	148 (17.7%)	149 (22.7%)	347 (23.7%)	20 (19.6%)	79 (14.4%)	16 (18%)	76 (17.3%)	23 (16.6%)	80 (10.2%)
Hypertension (uncomplicated or complicated), n (%)	2635 (65.5%)	74 (54%)	500 (59.7%)	442 (67.3%)	1027 (70.1%)	62 (60.8%)	281 (51.1%)	49 (55.1%)	272 (62%)	68 (48.9%)	384 (48.7%)
Hypertension (complicated), n (%)	1178 (29.3%)	39 (28.5%)	204 (24.4%)	233 (35.5%)	520 (35.5%)	32 (31.4%)	122 (22.2%)	28 (31.5%)	125 (28.5%)	23 (16.6%)	150 (19%)
Paralysis, n (%)	53 (1.3%)	0 (0%)	8 (1%)	11 (1.7%)	22 (1.5%)	0 (0%)	5 (0.9%)	1 (1.1%)	6 (1.4%)	0 (0%)	8 (1%)
Neurological disorders affecting movement, n (%)	81 (2.0%)	4 (2.9%)	16 (1.9%)	13 (2%)	37 (2.5%)	2 (2%)	15 (2.7%)	1 (1.1%)	9 (2.1%)	2 (1.4%)	12 (1.5%)
Seizures and epilepsy, n (%)	55 (1.4%)	3 (2.2%)	9 (1.1%)	11 (1.7%)	18 (1.2%)	0 (0%)	9 (1.6%)	1 (1.1%)	2 (0.5%)	3 (2.2%)	10 (1.3%)
Other neurological disorders, n (%)	291 (7.2%)	11 (8%)	60 (7.2%)	62 (9.4%)	119 (8.1%)	6 (5.9%)	31 (5.6%)	8 (9%)	25 (5.7%)	2 (1.4%)	38 (4.8%)

Chronic pulmonary disease, n (%)	1721 (42.8%)	55 (40.2%)	348 (41.6%)	290 (44.1%)	706 (48.2%)	46 (45.1%)	202 (36.7%)	37 (41.6%)	184 (41.9%)	47 (33.8%)	271 (34.4%)
Diabetes (uncomplicated or complicated), n (%)	1424 (35.4%)	36 (26.3%)	224 (26.8%)	219 (33.3%)	488 (33.3%)	23 (22.6%)	118 (21.5%)	24 (27%)	128 (29.2%)	27 (19.4%)	152 (19.3%)
Diabetes (complicated), n (%)	1083 (26.9%)	33 (24.1%)	200 (23.9%)	212 (32.3%)	483 (33%)	24 (23.5%)	123 (22.4%)	20 (22.5%)	115 (26.2%)	28 (20.1%)	147 (18.7%)
Hypothyroidism, n (%)	859 (21.3%)	26 (19%)	185 (22.1%)	162 (24.7%)	342 (23.3%)	20 (19.6%)	107 (19.5%)	17 (19.1%)	98 (22.3%)	20 (14.4%)	132 (16.8%)
Renal failure (moderate or severe), n (%)	837 (20.8%)	27 (19.7%)	146 (17.4%)	165 (25.1%)	382 (26.1%)	20 (19.6%)	80 (14.6%)	17 (19.1%)	76 (17.3%)	13 (9.4%)	110 (14%)
Renal failure (severe), n (%)	188 (4.7%)	7 (5.1%)	32 (3.8%)	49 (7.5%)	73 (5%)	4 (3.9%)	14 (2.6%)	3 (3.4%)	19 (4.3%)	8 (5.8%)	19 (2.4%)
Liver disease (mild or moderate/severe), n (%)	408 (10.1%)	18 (13.1%)	71 (8.5%)	82 (12.5%)	178 (12.1%)	11 (10.8%)	62 (11.3%)	8 (9%)	43 (9.8%)	14 (10.1%)	50 (6.4%)
Liver disease (moderate or severe), n (%)	88 (2.2%)	2 (1.5%)	12 (1.4%)	19 (2.9%)	42 (2.9%)	3 (2.9%)	15 (2.7%)	1 (1.1%)	2 (0.5%)	5 (3.6%)	13 (1.7%)
Peptic ulcer disease (excluding bleeding), n (%)	54 (1.3%)	1 (0.7%)	5 (0.6%)	15 (2.3%)	23 (1.6%)	0 (0%)	5 (0.9%)	2 (2.3%)	5 (1.1%)	0 (0%)	8 (1%)
AIDS/HIV, n (%)	26 (0.7%)	0 (0%)	5 (0.6%)	4 (0.6%)	6 (0.4%)	2 (2%)	7 (1.3%)	0 (0%)	2 (0.5%)	3 (2.2%)	9 (1.1%)
Lymphoma, n (%)	64 (1.6%)	4 (2.9%)	7 (0.8%)	13 (2%)	31 (2.1%)	2 (2%)	2 (0.4%)	2 (2.3%)	9 (2.1%)	1 (0.7%)	7 (0.9%)
Leukemia, n (%)	19 (0.5%)	0 (0%)	2 (0.2%)	4 (0.6%)	9 (0.6%)	2 (2%)	3 (0.6%)	1 (1.1%)	1 (0.2%)	1 (0.7%)	2 (0.3%)

Cancer (in situ) , n (%)	222 (5.5%)	10 (7.3%)	38 (4.5%)	42 (6.4%)	109 (7.4%)	10 (9.8%)	19 (3.5%)	8 (9%)	22 (5%)	4 (2.9%)	21 (2.7%)
Metastatic cancer, n (%)	53 (1.3%)	3 (2.2%)	11 (1.3%)	7 (1.1%)	27 (1.8%)	2 (2%)	5 (0.9%)	1 (1.1%)	10 (2.3%)	1 (0.7%)	4 (0.5%)
Solid tumor w/o metastasis , n (%)	207 (5.1%)	8 (5.8%)	32 (3.8%)	43 (6.5%)	90 (6.1%)	7 (6.9%)	20 (3.6%)	5 (5.6%)	28 (6.4%)	2 (1.4%)	24 (3.1%)
Arthropathies, n (%)	754 (18.7%)	36 (26.3%)	166 (19.8%)	106 (16.1%)	255 (17.4%)	28 (27.5%)	104 (18.9%)	14 (15.7%)	72 (16.4%)	35 (25.2%)	175 (22.2%)
Coagulopathy, n (%)	388 (9.6%)	11 (8%)	66 (7.9%)	78 (11.9%)	178 (12.1%)	8 (7.8%)	37 (6.7%)	10 (11.2%)	39 (8.9%)	13 (9.4%)	38 (4.8%)
Obesity, n (%)	1092 (27.1%)	30 (21.9%)	202 (24.1%)	199 (30.3%)	452 (30.8%)	29 (28.4%)	130 (23.6%)	32 (36%)	130 (29.6%)	26 (18.7%)	164 (20.8%)
Weight loss, n (%)	290 (7.2%)	12 (8.8%)	47 (5.6%)	61 (9.3%)	136 (9.3%)	11 (10.8%)	20 (3.6%)	6 (6.7%)	23 (5.2%)	8 (5.8%)	31 (3.9%)
Blood loss anemia, n (%)	128 (3.2%)	6 (4.4%)	16 (1.9%)	23 (3.5%)	50 (3.4%)	1 (1%)	16 (2.9%)	6 (6.7%)	16 (3.6%)	5 (3.6%)	23 (2.9%)
Deficiency anemia, n (%)	1130 (28.1%)	41 (29.9%)	212 (25.3%)	213 (32.4%)	491 (33.5%)	24 (23.5%)	100 (18.2%)	29 (32.6%)	119 (27.1%)	34 (24.5%)	140 (17.8%)
Alcohol abuse, n (%)	97 (2.4%)	4 (2.9%)	13 (1.6%)	18 (2.7%)	46 (3.1%)	5 (4.9%)	13 (2.4%)	5 (5.6%)	9 (2.1%)	2 (1.4%)	10 (1.3%)
Drug abuse, n (%)	128 (3.2%)	9 (6.6%)	20 (2.4%)	27 (4.1%)	51 (3.5%)	5 (4.9%)	17 (3.1%)	7 (7.9%)	12 (2.7%)	3 (2.2%)	20 (2.5%)
Psychoses, n (%)	253 (6.3%)	12 (8.8%)	45 (5.4%)	40 (6.1%)	108 (7.4%)	12 (11.8%)	31 (5.6%)	8 (9%)	34 (7.7%)	7 (5%)	41 (5.2%)

Depression, n (%)	596 (14.8%)	23 (16.8%)	107 (12.8%)	109 (16.6%)	241 (16.4%)	19 (18.6%)	62 (11.3%)	12 (13.5%)	63 (14.4%)	20 (14.4%)	95 (12.1%)
Cerebrovascular disease, n (%)	233 (5.8%)	8 (5.8%)	49 (5.9%)	48 (7.3%)	108 (7.4%)	9 (8.8%)	29 (5.3%)	3 (3.4%)	16 (3.6%)	4 (2.9%)	28 (3.6%)
Cerebrovascular disease sequelae, n (%)	36 (0.9%)	2 (1.5%)	7 (0.8%)	4 (0.6%)	18 (1.2%)	0 (0%)	4 (0.7%)	0 (0%)	1 (0.2%)	1 (0.7%)	3 (0.4%)
Other thyroid disorders, n (%)	148 (3.7%)	4 (2.9%)	30 (3.6%)	30 (4.6%)	62 (4.2%)	2 (2%)	16 (2.9%)	1 (1.1%)	15 (3.4%)	3 (2.2%)	21 (2.7%)
Dementia, n (%)	72 (1.8%)	1 (0.7%)	11 (1.3%)	18 (2.7%)	32 (2.2%)	0 (0%)	3 (0.6%)	1 (1.1%)	10 (2.3%)	1 (0.7%)	7 (0.9%)

Table S3. **Odds ratio for adherence by copayment category and annual household income level.** Odds ratio (95% confidence interval) for adherence, defined by proportion of days covered ≥80%, by copayment category* and annual household income level. Medications include endothelin receptor antagonists (ERA), phosphodiesterase type-5 inhibitors (PDE5), prostanoids and prostacyclin receptor agonists (prostanoids), and soluble guanylate cyclase stimulators (sGCS).†

Income	Copayment	ERA (n=974)	PDE5 (n=2123)	Prostanoids (n=652)	sGC (n=528)	ERA + PDE5 (n=928)
<$40,000	Medium vs low	0.70 (0.28-1.73), p=0.44	0.62 (0.42-0.94), p=0.02	1.48 (0.35-6.26), p=0.59	0.31 (0.10-0.99), p=0.048	0.71 (0.26-1.96), p=0.51
<$40,000	High vs low	0.81 (0.39-1.67), p=0.57	1.27 (0.67-2.4), p=0.46	0.70 (0.28-1.77), p=0.45	0.64 (0.24-1.72), p=0.38	0.84 (0.35-2.02), p=0.69
$40-<$75,000	Medium vs low	1.42 (0.41-4.93), p=0.58	1.46 (0.95-2.26), p=0.09	4.27 (0.44-41.69), p=0.21	1.75 (0.28-10.84), p=0.55	1.57 (0.56-4.4), p=0.39
$40-<$75,000	High vs low	0.74 (0.28-1.99), p=0.55	2.96 (1.53-5.72), p=0.01	0.37 (0.10-1.29), p=0.12	0.48 (0.13-1.79), p=0.27	1.11 (0.47-2.58), p=0.82
≥$75,000	Medium vs low	8.02 (1.71-37.65), p=0.008	1.20 (0.76-1.89), p=0.45	1.79 (0.48-6.69), p=0.39	0.81 (0.20-3.26), p=0.77	0.46 (0.11-1.96), p=0.30
≥$75,000	High vs low	1.23 (0.51-2.98), p=0.65	1.45 (0.8-2.64), p=0.22	0.56 (0.20-1.56), p=0.27	0.33 (0.09-1.20), p=0.09	0.21 (0.06-0.75), p=0.02

*For ERA, prostanoids, sGCS, and ERA + PDE5, “low” was defined as <$30; “medium” as $30-99; and “high” as ≥$100. For PDE5, “low” was defined as <$15; “medium” as $15-49; and “high” as ≥$50.

†Adjusted for age, sex, race and ethnicity, educational attainment, Elixhauser comorbidities, systemic sclerosis, amphetamine use, chronic kidney disease, interstitial lung disease, insurance type, and presence of deductible paid toward medications.

Table S4. Odds ratio for adherence by copayment category for individuals with ≥12 months continuous enrollment after first medication claim. Odds ratio (95% confidence interval) for adherence, defined by proportion of days covered ≥80%, by copayment category* for individuals with ≥12 months continuous enrollment after first medication claim for endothelin receptor antagonists (ERA), phosphodiesterase type-5 inhibitors (PDE5), prostanoids and prostacyclin receptor agonists (prostanoids), and soluble guanylate cyclase stimulators (sGCS), and combination therapy with ERA + PDE5.†

	ERA (n=667)	PDE5 (n=1432)	Prostanoids (n=498)	sGCS (n=410)	ERA + PDE5 (n=731)
Low	Ref	Ref	Ref	Ref	Ref
Medium	1.36 (0.60-3.08), p=0.47	1.10 (0.82-1.48), p=0.51	0.86 (0.36-2.02), p=0.72	0.84 (0.35-1.99), p=0.69	0.62 (0.35-1.08), p=0.09
High	0.67 (0.33-1.35), p=0.26	1.99 (1.33-2.96), p<0.001	0.26 (0.13-0.52), p<0.001	0.47 (0.21-1.07), p=0.07	0.58 (0.35-0.97), p=0.03

*For ERA, prostanoids, sGCS, and ERA + PDE5, “low” was defined as <$30; “medium” as $30-99; and “high” as ≥$100. For PDE5, “low” was defined as <$15; “medium” as $15-49; and “high” as ≥$50.

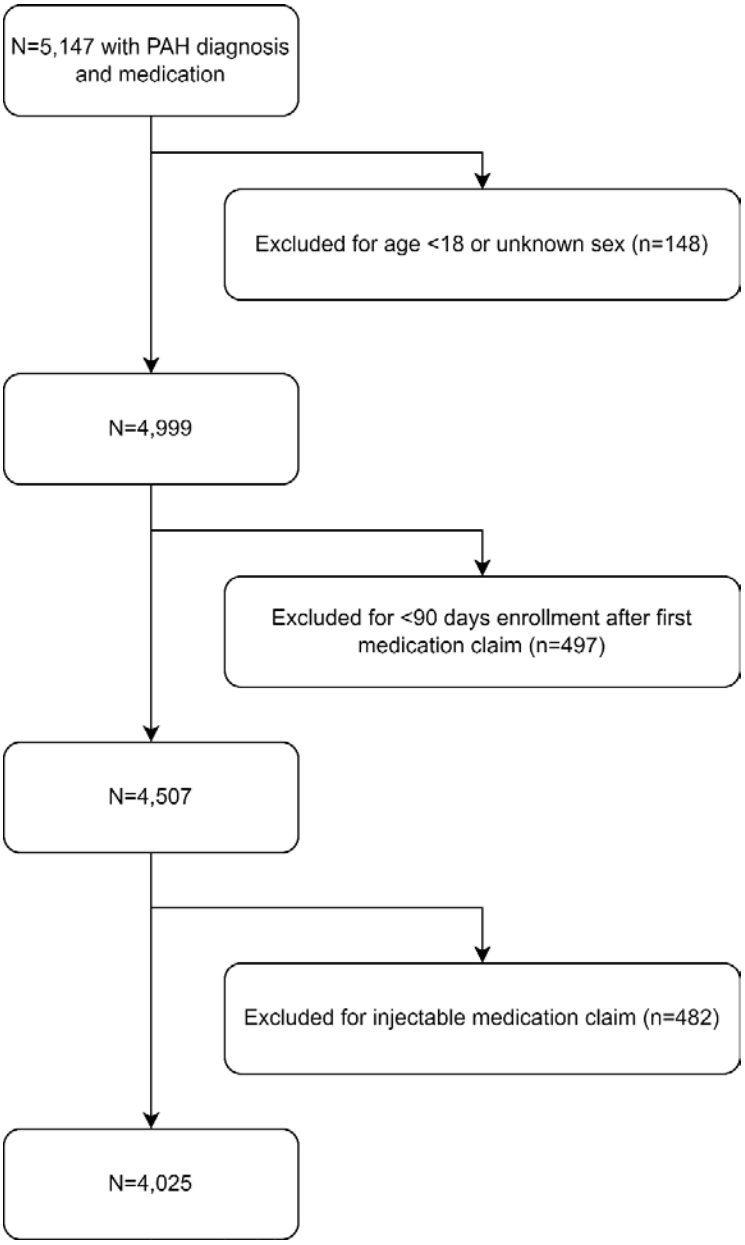
†Adjusted for age, sex, race and ethnicity, Elixhauser comorbidities, systemic sclerosis, amphetamine use, chronic kidney disease, interstitial lung disease, annual household income, educational attainment, insurance type, and presence of deductible paid toward medications.

Table S5. Odds ratio for adherence by copayment category using higher copayment cutoffs for PDE5. Odds ratio (95% confidence interval) for adherence, defined by proportion of days covered ≥80%, by copayment category* for individuals using endothelin receptor antagonists (ERA), phosphodiesterase type-5 inhibitors (PDE5), prostanoids and prostacyclin receptor agonists (prostanoids), and soluble guanylate cyclase stimulators (sGCS), and combination therapy with ERA + PDE5.†

	ERA (n=974)	PDE5 (n=2123)	Prostanoids (n=652)	sGCS (n=528)	ERA + PDE5 (n=928)
Low	Ref	Ref	Ref	Ref	Ref
Medium	1.82 (0.94-3.50), p=0.07	1.05 (0.83-1.33), p=0.68	0.96 (0.45-2.05), p=0.91	0.87 (0.41-1.84), p=0.70	0.71 (0.43-1.17), p=0.17
High	0.91 (0.51-1.62), p=0.74	1.98 (1.29-3.04), p=0.002	0.36 (0.20-0.65), p<0.001	0.63 (0.30-1.31), p=0.21	0.61 (0.38-0.97), p=0.03

*For all medication classes, “low” was defined as <$30; “medium” as $30-99; and “high” as ≥$100.
†Adjusted for age, sex, race and ethnicity, Elixhauser comorbidities, systemic sclerosis, amphetamine use, chronic kidney disease, interstitial lung disease, annual household income, educational attainment insurance type, and presence of deductible paid toward medications.

Figure S1. Ascertainment of pulmonary arterial hypertension cohort.



Ascertainment of pulmonary arterial hypertension (PAH) cohort, including individuals with a diagnosis of PAH by ICD-9 code 416.0 or ICD-10 code I27.0 plus a pharmacy claim for at least one of the following medications: endothelin receptor antagonists, phosphodiesterase type-5 inhibitors, prostanoids, and soluble guanylate cyclase stimulators.