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ORIGINAL RESEARCH

How Well Do *ICD-9-CM* Codes Predict True Congenital Heart Defects? A Centers for Disease Control and Prevention-Based Multisite Validation Project

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BACKGROUND: The Centers for Disease Control and Prevention's Surveillance of Congenital Heart Defects Across the Lifespan project uses large clinical and administrative databases at sites throughout the United States to understand population-based congenital heart defect (CHD) epidemiology and outcomes. These individual databases are also relied upon for accurate coding of CHD to estimate population prevalence.

METHODS AND RESULTS: This validation project assessed a sample of 774 cases from 4 surveillance sites to determine the positive predictive value (PPV) for identifying a true CHD case and classifying CHD anatomic group accurately based on 57 *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes. Chi-square tests assessed differences in PPV by CHD severity and age. Overall, PPV was 76.36% (591/774 [95% CI, 73.20–79.31]) for all sites and all CHD-related *ICD-9-CM* codes. Of patients with a code for complex CHD, 89.85% (177/197 [95% CI, 84.76–93.69]) had CHD; corresponding PPV estimates were 86.73% (170/196 [95% CI, 81.17–91.15]) for shunt, 82.99% (161/194 [95% CI, 76.95–87.99]) for valve, and 44.39% (83/187 [95% CI, 84.76–93.69]) for "Other" CHD anatomic group (X^2=142.16, P<0.0001). *ICD-9-CM* codes had higher PPVs for having CHD in the 3 younger age groups compared with those >64 years of age, (X^2=4.23, P<0.0001).

CONCLUSIONS: While CHD *ICD-9-CM* codes had acceptable PPV (86.54%) (508/587 [95% CI, 83.51–89.20]) for identifying whether a patient has CHD when excluding patients with *ICD-9-CM* codes for "Other" CHD and code 745.5, further evaluation and algorithm development may help inform and improve accurate identification of CHD in data sets across the CHD *ICD-9-CM* code groups.

Key Words: birth defects ■ congenital heart defects ■ epidemiology ■ surveillance ■ validation

Research and surveillance of patients with congenital heart defects (CHD) using administrative and clinical data both rely on the diagnostic accuracy of applying *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) and *International Classification of Diseases, Tenth Revision, Clinical Modification* (*ICD-10-CM*) codes to detect CHD cases. Administrative data, commonly referred to as claims data, are data created for the purpose of either the billing of health care encounters or record keeping for a health care system or an organization. *ICD* codes captured in administrative data may vary by medical practice, health care system, and region; thus, it is unknown how representative these *ICD* codes are for their intended

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CLINICAL PERSPECTIVE

What Is New?

- Four US sites associated with the Centers for Disease Control and Prevention's Surveillance of Congenital Heart Defects Across the Lifespan project validated a sample of 774 cases with *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* congenital heart disease (CHD) codes to assess true CHD cases.
- The majority of cases were associated with true CHD, though differences in positive predictive value (PPV) were noted based on anatomic complexity and ages of patients.
- Cases with complex CHD codes, multiple CHD codes, and age groups <65 years of age had greater PPV identifying true CHD.

What Are the Clinical Implications?

- *ICD-9-CM* codes can identify patients with CHD in databases with high PPV for the complex code group, but lower PPV in certain patient groups, particularly those aged >65 years, and with "Other" CHD *ICD* code group.
- When attempting to identify cases with CHD, the presence of >1 CHD code increases the PPV for a true CHD, at the expense of sensitivity.
- Development of algorithms is needed to improve the identification of CHD cases in databases across anatomic code groups and age ranges.

Nonstandard Abbreviations and Acronyms

CDC	Centers for Disease Control and Prevention
eHR	electronic health record

disease state. In a recent study conducted by Khan et al. (2018), *ICD-9-CM* administrative codes extracted from the electronic health record (eHR) of patients with various types of CHD lesions seen at a large academic health care system were <50% accurate (48.7% [95% CI, 47%–51%]) at classifying those with a true CHD.[1] However, when only patients with moderate or complex CHD anatomy were included, the positive predictive value (PPV) of having CHD increased to 77.2%, (95% CI, 74%–81%). When other factors like younger age, adult CHD, provider type, and ECG, or echocardiogram were documented at the CHD-related encounter, the C-statistic was 0.89 (95% CI, 0.88–0.90).[1] Correctly and consistently applied definitions of CHD may increase the accuracy of CHD prevalence, health care use, and health outcomes of individuals living with CHD using administrative health care data sets. However, prior studies have demonstrated that some *ICD-9-CM* codes may be associated with false positives and thus do not always reliably identify individuals who truly have CHD.[1–5]

In studies of CHD using publicly available data sets like the National Inpatient Sample and the Kids' Inpatient Database or administrative data sources, a CHD case is typically defined by *ICD-9-CM* codes 745.xx to 747.xx for classification and more recently *ICD-10-CM* codes Q20 to Q28. While the range of these codes is broad and inclusive, this code group contains conditions that are not CHD, and thus, may include individuals who do not have CHD, creating misleading conclusions and misinformation. Furthermore, some codes in the CHD group may code for CHD, but may commonly be used incorrectly, as for "rule out" or normal variants. In particular, individuals with 1 CHD-related *ICD-9-CM* code —745.5 — are often misclassified as having CHD. Frequently found in large CHD administrative data sets and commonly included in CHD literature, the *ICD-9-CM* code 745.5 (hereafter referred to as "code 745.5") is used for both secundum atrial septal defect, a true CHD, and patent foramen ovale, a normal variant and not considered a CHD, seen in about 25% of the population.[2]

The current project aims to validate the extent to which CHD-related *ICD-9-CM* codes correctly identify CHD cases in administrative and clinical records by: (1) confirming patients as having a true CHD; and (2) classifying CHD anatomic grouping among those with true CHD. We hypothesized that both individual CHD codes and CHD anatomic groupings would have a high PPV (>80%) for CHD that would vary by anatomic group, but that coding errors would likely include patients who did not truly have a CHD.

METHODS

This analysis has been replicated by 2 independent analysts. Because of the sensitive nature of the data collected for this study, requests to access the data set from qualified researchers trained in human subject confidentiality protocols may be sent to the Centers for Disease Control and Prevention (CDC) at jill.glidewell@cdc.hhs.gov.

To improve upon CHD classification and as part of the multiyear CDC-sponsored project Surveillance of Congenital Heart Defects Across the Lifespan (CDC-RFA-DD15-1506),[6] 4 sites reviewed the medical records of cases with CHD-related *ICD-9-CM* codes identified from administrative data sources to calculate the PPV of these codes (745.xx–747.xx) in correctly identifying a case with CHD. Cases were ascertained

by the presence of any CHD-related 745.xx to 747.xx *ICD-9-CM* code documented in a health care encounter between January 1, 2011 and December 31, 2013. Inclusion criteria defined a case having the presence of any included *ICD-9-CM* code at any encounter, regardless of how many encounters had CHD *ICD-9-CM* codes. The *ICD-9-CM* codes to define the *ICD* code-based anatomic groups were based on a hierarchy of codes, complex>shunt and valve>shunt or valve>"Other" CHD. The following codes were excluded as they were determined to be reflective of conditions other than true CHD: congenital heart block (746.86), absent/hypoplastic umbilical artery (747.5), pulmonary arteriovenous malformation (747.32), other anomalies of peripheral vascular system (747.6x), and other specified anomalies of circulatory system (747.8x); these codes were also excluded from the definition of CHD in the prior surveillance methods paper.[5,6] Cases with code 745.5 without another included CHD *ICD-9-CM* code were also excluded based on previous studies.[2,3] The Institutional Review Boards from Duke University in North Carolina (NC), Emory University in Georgia (GA), the New York State Department of Health (NY), and University of Utah (UT) approved an analysis of deidentified data to assess PPV of CHD-related *ICD-9-CM* codes.[6] The requirement for informed consent was waived by each site's respective Institutional Review Board. Eligible codes were classified into 1 of 5 CHD anatomic groups: complex, shunts, valves, shunts and valves, and "Other" CHD or non-specific defects[5–8] (Figure 1 and Data S1). Complex anatomy was based on native anatomy and defined as heart defects characterized by a recognized constellation of multiple specific defects which generally require intervention in the first year of life. Specific defects grouped as "complex" are defined in Data S1.[5,6] A code-based hierarchy was developed such that the presence of a complex code designates the case as complex regardless of additional codes.[6] In the absence of a complex code, the presence of both a shunt and valve code designated "shunt and valve" group inclusion. The absence of complex, shunt or valve codes and only "Other" CHD anatomic group codes designated the case as belonging to the "Other" CHD anatomic group (Figure 1).

Data and Procedures

Data from the 4 sites (GA, NC, NY, UT) over a 3-year project period, 2011 to 2013, were used for this validation. A total of 800 cases were planned for the validation study consisting of 200 cases from each of the 4 sites. Each site selected 50 cases from 4 mutually exclusive CHD anatomic groups as defined by the *ICD* code hierarchy (Figure 1) based on native anatomy: complex, shunt, valves, and "Other", with each group further stratified by age: 1 to 10 years, 11 to 19 years, 20 to 64 years, >64 years (GA, NC, NY), or ages 11 to 19 years and 20 to 64 years (UT). Anatomic groups are described in Figure 1 and Data S1. To ensure a comparable distribution of cases by age, the data set was stratified by age group and a proportion was selected, based on the age distribution of the larger cohort, into each of the 4 mutually exclusive anatomic groups (Figure 2). Only those data sources where medical charts were accessible for review were eligible for inclusion. Cases identified only in administrative data, but without clinical records to review, were excluded. Of the total cases from the larger CHD surveillance project, 69.4% of GA's cases, 36.7% of NC's cases, 32.5% of NY's cases, and 97.6% of UT's cases were eligible for medical chart review and selection for the validation project.

During medical chart review, clinical investigators at each site supervised the review of predetermined variables abstracted from eHRs and noted the presence/absence of a true CHD based on review of CHD anatomy as determined by: (1) cardiac imaging, (2) clinical diagnosis by an outpatient or inpatient encounter with a pediatric or adult CHD provider, (3) CHD surgery, and (4) autopsy report. Included in this review, clinical investigators evaluated: (1) CHD case (Yes/No), and (2) CHD anatomic group correct (Yes/No). All available information from the eHR (including any data before 2011 or after 2013) was also used to confirm or refute the presence of CHD for each selected case. During chart review, information on type of CHD recorded, number of unique CHD codes per case, diagnostic tests received (ie, echocardiograms, cardiac catheterizations, cardiac surgery), autopsy reports or clinic notes, as well as date of diagnosis and type of provider who made the CHD diagnosis was evaluated. Additionally, demographic information including age, sex, race, and ethnicity was abstracted. With respect to race, small sample size for the "Other" race category necessitated this group be combined with the "unknown" race group ("Other" race includes American Indian/Alaskan Native, Asian, native Hawaiian/Pacific Islander, and multi-racial).

The anatomic group of shunt and valve was excluded before case selection because it was assumed that if the case had codes for both of these anatomic groups, then the case was likely to be a true CHD case. Cases with code 745.5 in isolation or in combination with 746.89 or 746.9 were also excluded given the known poor PPV of these codes to represent a true CHD.[2] A total of 26 cases were excluded from analysis: 12 cases with code 745.5 in isolation or in combination with 746.89 or 746.9 among the sites that were found to be included in error after selection; 5 cases with both a shunt and valve diagnosis that were also erroneously selected for validation; 3 cases that did not have any clinical data to review; 3 cases that were inadvertently reviewed twice; and lastly, 3 cases whose only CHD code(s) were documented during

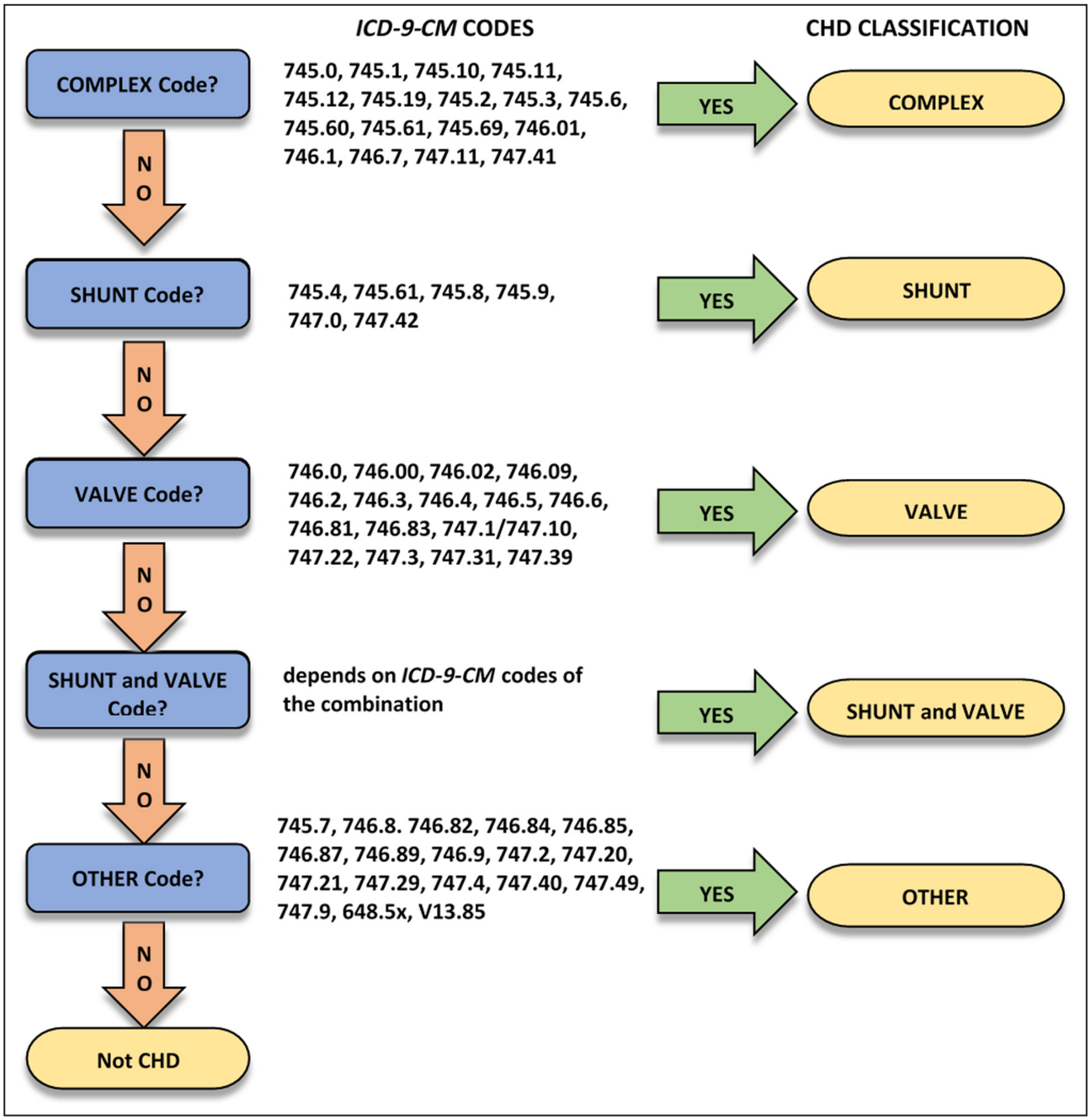

Figure 1. ***ICD-9-CM* code-based hierarchy for congenital heart defect classification by native CHD anatomy group.**
*Based on hierarchy reported in Ref. [6]. Individuals aged 1 to 64 years with documented congenital heart defects at health care encounters, 5 US surveillance sites, 2011 to 2013. CHD indicates congenital heart defect; and *ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification*.

an encounter for a fetal echocardiogram defined by the associated Current Procedural Terminology code (Figure 2). CHD codes occurring during performance of a fetal echocardiogram were excluded based on unpublished data showing that only 2.9% (4 out of 138) of women who had a CHD code solely associated with a fetal echocardiogram encounter actually had a true CHD, whereas the majority of CHD diagnosis codes documented during fetal echocardiogram encounters are intended for the fetus.

For GA, 200 cases, who resided in 1 of 5 metropolitan-Atlanta counties (Clayton, Cobb, DeKalb, Fulton, Gwinnett) and were seen at least once at 1 of 3 health care systems with records available, were randomly selected for review. For the 1- to 10- and 11- to 19-year-old groups, 13 cases for each CHD anatomic class were

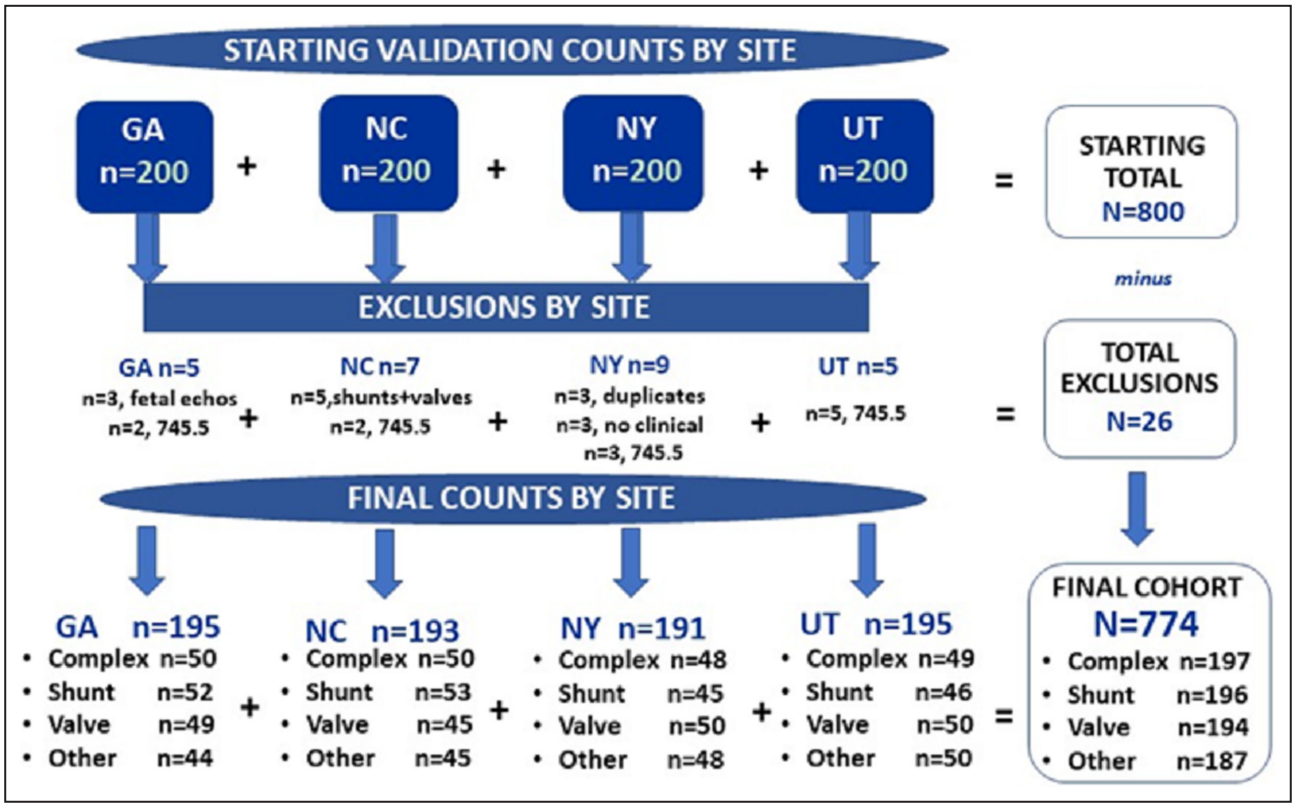

Figure 2. Cohort constructions and exclusions by site and congenital heart defect type.[‡,§]
[‡]*ICD-9-CM* code 745.5 was omitted from the shunt group as it is used to indicate secundum atrial septal defect and patent foramen ovale, a normal variant. [§]"Other" congenital heart defect anatomic group consists of unspecific defects; congenital heart defect-related *ICD-9-CM* codes and their assigned CHD anatomic grouping are displayed in Data S1. GA indicates Emory University in Georgia; *ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification*; NC, Duke University in North Carolina; NY, New York State Department of Health; and UT, Utah.

selected, and for the 20- to 64- and >64-year-old groups, 12 cases for each anatomic class were selected. A total of 195 validated GA cases were retained and contributed to the pooled analyses (Figure 2).

For NC, 200 cases, each with at least 2 encounters, were randomly selected from eHRs at one data source which captured patients with CHD statewide. Similar to GA, 13 cases each for the 1- to 10- and 11- to 19-year-old groups, and 12 cases each for the 20- to 64- and >64-year-old groups were selected for review. A total of 193 validated NC cases were included for pooled analyses with other sites' data (Figure 2).

NY's sample of 200 cases was composed of patients who resided in 1 of 11 counties (Allegany, Bronx, Cattaraugus, Chautauqua, Erie, Genesee, Monroe, Niagara, Orleans, Westchester, Wyoming) in NY and who had a health care encounter at 1 of 2 clinical data sources. NY, like GA and NC, randomly selected 13 cases for each CHD anatomic class for 1- to 10-year-olds and 11- to 19-year-olds, and 12 cases for the 20- to 64-year-olds and >64-year-old groups. A total of 191 NY cases were retained and contributed to pooled analyses (Figure 2).

In UT, data sources included eHRs from 2 health care systems. While 200 CHD cases were randomly selected and stratified by anatomic groupings with 50 in each category, these classes were further stratified by 2 age groupings, 11- to 19-year-olds and 20- to 64-year-olds, with 25 cases each. Although the UT site did not collect data on individuals aged <10 or >64 years, they contributed a total of 195 validated cases to the pooled, multisite data set (Figure 2).

Statistical Analysis

PPVs for CHD were calculated overall, and by anatomic group, site, and number of unique CHD codes associated with a case. In addition, separate PPV analyses were conducted by sex, race, ethnicity, age group, and anatomic group. For age-specific analyses, since UT did not contribute cases to the youngest age group, 1- to 10-year-olds, or the oldest age group category, >64-year-olds, UT was not included; age-specific analyses included GA, NC, and NY only. For age-specific analyses, PPV was first computed for age groups by sites, and then, also calculated omitting

the "Other" CHD anatomic group, followed by omitting the >64-year-old age group, and finally, by omitting both the "Other" CHD anatomic group and the >64-year-old age group. Analyses for CHD anatomic group proceeded similarly except all 4 sites were included. Lastly, PPVs for having CHD (Yes/No) were calculated for several individual CHD *ICD-9-CM* codes and calculated by number of unique CHD codes.

RESULTS

Table 1 shows number of cases by CHD anatomic groups, number of unique CHD-related *ICD-9-CM* codes (single/multiple) recorded in encounters, followed by demographic characteristics of the sample, overall and by site. Slightly over half (51.16%, n=396) of the 774 cases were female, and 53.49% (n=414) had a single unique CHD-related *ICD-9-CM* code recorded in the medical record. No significant differences were revealed for number of unique *ICD-9-CM* codes by site (X^2=7.14, P=0.0675) or sex by site (X^2=2.77, P=0.4278). No significant differences between age groups by site (GA, NC, and NY) in percent of individuals with one CHD-related *ICD-9-CM* code were observed (X^2=4.04, P=0.6706). Across and by site, however, White race was most prevalent accounting for 66.67% of the sample, followed by Black and other/unknown race, 16.93% and 16.41%, respectively. The contribution of Black cases varied by site, with GA providing almost 40% of the cases, while UT contributed <5% (X^2=69.97, P<0.0001). The majority of the sample were non-Hispanic (70.03%), and 18.86% of the sample's ethnicity was unknown (X^2=161.38, P<0.0001) (Table 1).

The PPVs of having a CHD overall, by site, and by anatomic group with "Other" CHD anatomic group status (included/omitted) are seen in Table 2. PPV of having a CHD increased ≈10 percentage points from 76.36% (591/774; [95% CI, 73.20–79.31]) to 86.54% (508/587 [95% CI, 83.51–89.20]) after omitting the "Other" CHD anatomic group (X^2=22.28, P<0.0001). This pattern was also observed within each site: the increase in PPV ranged from 7.4% for NC (79.79%; 154/193 [95% CI, 73.43–85.22]) to 87.16%; 129/148 [95% CI, 80.68–92.09]) (ns)] to 14.6% for NY (70.68%; 135/191 [95% CI, 63.68–77.03] to 85.31%; 122/143 [95% CI, 78.43–90.67]); site-specific Chi-squares are for when "Other" CHD anatomic group was included versus omitted (Table 2). When all anatomic groups were combined regardless of whether "Other" CHD anatomic group was included or omitted, significant differences in PPV by site were not observed (X^2=5.15, P=0.1612 and X^2=0.35, P=0.9509, respectively) (Table 2). However, there was a significant difference in PPV for having a CHD by anatomic group. Of patients with a code for complex CHD, 89.85% (177/197 [95% CI, 84.76–93.69]) had a CHD (ie, 10.15% (20/197; 95% CI, 6.31–15.24) did not have CHD); corresponding PPV estimates were 86.73% (170/196 [95% CI, 81.17–91.15]) for shunt, 82.99% (161/194 [95% CI, 76.95–87.99]) for valve, and 44.39% (83/187 [95% CI, 84.76–93.69]) for "Other" CHD anatomic group (X^2=142.16, P<0.0001) (Table 2). In Table S1, for the complex and shunt categories, all sites reported PPVs >84.00%; for the valve category, UT's PPV was 76.0% (38/50 [95% CI, 61.83–86.94]) with other sites' PPVs >80% (89.80%; 44/49 [95% CI, 77.77–96.60]) for GA, 84.44% (38/45 [95% CI, 70.54–93.51]) for NC, and 82.00% (41/50 [95% CI, 68.56–91.42] for NY. In addition, the PPV of "Other" CHD anatomic group by site ranged from 27.08% (13/48 [95% CI, 15.28–41.85]) in NY to 55.56% (25/45 [95% CI, 40.00–70.36]) in NC (Table S1), and when "Other" CHD anatomic group was omitted, PPV for having a CHD did not differ significantly by anatomic group (X^2=3.96, P=0.1383) (Table 2). Lastly, when the PPVs of *ICD-9-CM* codes for correct CHD group assignment were assessed, among patients with ≥1 complex anatomic codes, 74.62% (147/197 [95% CI, 67.94–80.54]) were confirmed to have complex CHD (ie, 25.4% had a shunt, valve, "Other" CHD anatomic grouping, or no CHD); corresponding PPV estimates for identifying a patient with CHD in the correct CHD group were 84.18% (165/196; 95% CI, 87.31–88.99) for shunt, 80.41% (156/194; 95% CI, 74.12–85.75) for valve, and 29.41% (55/187; 95% CI, 22.99–36.50) for "Other" (X^2=168.02, P<0.0001) (Table S2).

Table 3 shows PPVs of having a CHD by number of unique CHD-related *ICD-9-CM* codes overall and by anatomic group. Across all anatomic groups, when multiple unique codes were documented across 1 or multiple encounters, PPV was higher, 92.78% (334/360 [95% CI, 90.10–95.45]) compared with when a single CHD code was documented, 62.08% (257/414 [95% CI, 57.40–66.75]) (X^2=100.53, P<0.0001). This association was seen for anatomically complex CHD (X^2=29.88, P<0.0001), valve defects (X^2=13.05, P<0.0001), and the "Other" anatomic group (X^2=5.54, P=0.019). When >1 unique CHD-related *ICD-9-CM* code appeared in the patient's eHR, PPV of having a CHD ranged from a low of 73.33% (11/15 [95% CI, 44.90–92.21]) in the "Other" CHD anatomic group to a high of 95.60% (152/159 [95% CI, 91.14–98.21]) in the complex group, compared with a range of 41.86% (72/172 [95% CI, 34.40–49.61]) in "Other" CHD anatomic group to 82.95% (73/88 [95% CI, 75.10–90.13]) in the shunt group for cases with a single CHD code.

Table 4 shows PPVs of having a CHD by 4 age groups, 1- to 10-year-olds, 11- to 19-year-olds, 20- to 64-year-olds, and >64-year-olds, by 3 sites (GA, NC, and NY). Compared with age groups ≤64 years whose PPVs were observed in the mid to lower 80% range

Table 1. Cases Identified With a Congenital Heart Defect *ICD-9-CM* Code: Number of Codes and Demographics, Overall and by Sites

	Overall	Sites*			
		GA	NC	NY	UT
CHD anatomic groups					
Noncomplex					
Complex	197	50	50	48	49
Shunt	196	52	53	45	46
Valve	194	49	45	50	50
"Other"†	187	44	45	48	50
Included in analyses	774	195	193	191	195
Excluded from data set	26	5	7	9	5

No. of unique CHD-related *ICD-9-CM* codes for cases						X^2‡ *P* value
Single code	414 (53.49%)	114 (58.46%)	94 (48.70%)	111 (58.12%)	95 (48.72%)	7.14 *P*=0.0675
Multiple unique codes	360 (46.51%)	81 (41.54%)	99 (51.30%)	80 (41.88%)	100 (51.28%)	
Demographics						
Age group (in y)						
1–10	50 (8.64%)	18 (9.23%)	11 (5.70%)	21 (10.99)	…	4.04 *P*=0.6706
11–19	156 (26.94%)	52 (26.67%)	52 (26.94%)	52 (27.23%)	…	
20–64	208 (35.92%)	69 (35.38%)	75 (38.86%)	64 (33.51%)	…	
>64	165 (28.50%)	56 (28.72%)	55 (28.50%)	54 (28.27%)	…	
Sex						
Female	396 (51.16%)	105 (53.85%)	94 (48.70%)	91 (47.64%)	106 (54.36%)	2.77 *P*=0.4278
Male	378 (48.84%)	90 (46.15%)	99 (51.30%)	100 (52.36%)	89 (45.64%)	
Race						
Black	131 (16.93%)	51 (26.15%)	35 (18.13%)	43 (22.51%)	<11 (–-)	69.97 *P*<0.0001
White	516 (66.67%)	102 (52.31%)	139 (72.02%)	111 (58.12%)	164 (84.10%)	
Other§ and unknown	127 (16.41%)	42 (21.54%)	19 (9.84%)	37 (19.37%)	29 (14.87%)	
Ethnicity						
Hispanic	86 (11.11%)	18 (9.23%)	<11 (–-)	44 (23.04%)	17 (8.72%)	161.38 *P*<0.0001†
Non-Hispanic	542 (70.03%)	132 (67.69%)	173 (89.64%)	142 (74.35%)	95 (48.72%)	
Unknown	146 (18.86%)	45 (23.08%)	13 (6.74%)	<11 (–-)	83 (42.56%)	

Two numbers of unique CHD-related *ICD-9-CM* codes (single code, multiple unique codes); 4 age groups (1–10, 11–19, 20–64, >64) for GA, NC, and NY only; UT omitted as cohort does not include 1–10 or >64-year-olds; 2 sexes (male, female); 3 races (Black, White, Other/unknown); and 3 ethnicities (Hispanic, non-Hispanic, unknown). GA indicates Emory University in Georgia; *ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification*; NC, Duke University in North Carolina; NY, New York State Department of Health; and UT, University of Utah.

*Site-specific percentages are column percentages; counts <11 not displayed.

†"Other" CHD anatomic group consists of unspecific defects; CHD-related *ICD-9-CM* codes and CHD anatomic groups are identified in Data S1.

‡X^2 applies to 5 Chi-square analyses, which includes 4 sites: GA, NC, NY, UT, except the X^2 by age which omits UT: 2 number of unique CHD-related ICD-9-CM codes (single code, multiple unique codes); 4 age groups (1–10, 11–19, 20–64, >64) for GA, NC & NY only; UT omitted as cohort does not include 1 to 10 or >64-year-olds; 2 sexes (male, female); 3 races (Black, White, Other/unknown); and 3 ethnicities (Hispanic, non-Hispanic, unknown).

§"Other" race includes American Indian/Alaskan Native, Asian, native Hawaiian/Pacific Islander, and multiracial.

(86.00%; 43/50 [95% CI, 73.26–95.62]) for 1- to 10-year olds, 82.69% (129/156 [95% CI, 75.83–88.27]) for 11- to 19-year-olds, and 84.13% (175/208 [95% CI, 78.45–88.82]) for 20- to 64-year-olds), the PPV for those who were >64 years was significantly lower, 57.58% (95/165 [95% CI, 49.65–65.22]) (X^2=45.23, P<0.0001). When "Other" CHD anatomic group was omitted, the significant decreasing trend in PPV by age remained, with 95.24% (40/42 [95% CI, 83.84–99.42]) for 1- to 10-year-olds, 94.07% (111/118 [95% CI, 88.16–97.58]) for 11- to 19-year-olds, 93.90% (154/164 [95% CI, 89.07–97.04]) for 20- to 64-year olds, and 66.10% (78/118 [95% CI, 56.81–74.56]) for those >64 years (X^2=58.82, P<0.0001). Table 4 also reveals the overall PPV of having CHD increased from 76.34% (442/579 [95% CI, 72.66–79.74]) when all 4 age and CHD anatomic groups were included to 94.14% (305/324 [95% CI, 72.66–79.74]) after both "Other" CHD anatomic group and the >64-year-olds were omitted (X^2=46.04, P<0.0001). However, when the >64-year-olds were excluded regardless of whether or

Table 2. PPV* of *ICD-9-CM* CHD Codes for Having a CHD Overall, by Site and by CHD Anatomic Group, with "Other"† CHD Anatomic Group Included and Omitted

PPV* for having a CHD, overall					X^2† *P* value
"Other"‡ CHD included	76.36% 591/774 [73.20–79.31]				22.28 *P*<0.0001§
"Other"‡ CHD omitted	86.54% 508/587 [83.51–89.20]				
PPV for having a CHD by site					X^2† *P* value
	GA	**NC**	**NY**	**UT**	
"Other"‡ CHD included	78.46% 153/195 [72.02–84.01]	79.79% 154/193 [73.43–85.22]	70.68% 135/191 [63.68–77.03]	76.41% 149/195 [69.82–82.18]	5.15 *P*=0.1612
"Other"‡ CHD omitted	87.42% 132/151 [81.05–92.25]	87.16% 129/148 [80.68–92.09]	85.31% 122/143 [78.43–90.67]	86.21% 125/145 [79.50–91.37]	0.35 *P*=0.9509
PPV* for having a CHD by anatomic group				X^2† *P* value	
Complex	Noncomplex			"Other"‡ CHD included	"Other"‡ CHD omitted
	Shunt§	Valve	"Other"‡		
89.85%	86.73%	82.99%	44.39%	142.16 *P*<0.0001‖	3.96 *P*=0.1383
177/197 [84.76–93.69]	170/196 [81.17–91.15]	161/194 [76.95–87.99]	83/187 [37.14–51.81]		

ICD-9-CM indicates *International Classification of Diseases, Ninth Revision, Clinical Modification*; NC, Duke University in North Carolina; and PPV, positive predictive value.

*95% CI presented within brackets for positive predictive values.

†X^2 - 5 Chi-square analyses that include CHD overall, by site and by anatomic group: Overall CHD status (2: Yes/No) comparing when "Other" CHD anatomic group was included and omitted; by site—separate X^2s conducted when "Other" CHD anatomic group included and omitted: CHD status (2: Yes/No) by site (4: GA, NC, NY, and UT); by anatomic group - separate X^2's conducted when: "Other" CHD anatomic group included: CHD status (2: Yes/No) by anatomic group (4: complex, shunt, valve, and "Other" CHD; and 2) "Other" CHD anatomic group omitted: CHD status (2: Yes/No) by anatomic group (3: complex, shunt, valve).

‡"Other" CHD anatomic group consists of unspecific defects; CHD-related *ICD-9-CM* codes and assigned CHD anatomic group are displayed in Data S1.

§*ICD-9-CM* code 745.5 was omitted from the shunt group as it is used to indicate secundum atrial septal defect and patent foramen ovale, a normal variant.

‖X^2 analyses that revealed significance group differences at the *P*<0.05 level or better.

not the "Other" CHD anatomic group was retained in the analysis, no trend in PPV for having a CHD by age was observed (including "Other": X^2=0.34, *P*=0.8451 and excluding "Other": X^2=0.11, *P*=0.9467, respectively). In addition, PPV for having a CHD showed no significant group differences whether "Other" CHD anatomic group was included or omitted for sex (X^2=1.16, *P*=0.2809 and X^2=1.48, *P*=0.2238, respectively), for race (X^2=5.62, *P*=0.0601 and X^2=0.35, *P*=0.8382, respectively), or for ethnicity (X^2=1.24, *P*=0.5381 and X^2=2.84, *P*=0.24, respectively) (Table S3).

PPV of having a CHD for individual *ICD-9-CM* CHD codes with sufficient case numbers are presented in Table 5. In isolation, tetralogy of Fallot (745.2) had a PPV of 84.2% for having a CHD, ventricular septal defect (745.4) had a PPV of 89.1%, and patent ductus arteriosus had a PPV of 81.3%. However, unspecified anomaly of heart (746.9) had a PPV of 42.2% and other congenital anomaly of heart (746.89) had a PPV of 23.1% for having a CHD. PPV for each of these individual *ICD-9-CM* CHD-related codes were all >90.0% when multiple unique *ICD-9-CM* CHD-related codes were identified.

DISCUSSION

The primary aim of this validation project was to evaluate the PPV of *ICD-9-CM* codes and a code-based anatomic hierarchy for identifying CHD cases, and secondarily, to assess the PPV of these codes by anatomic groups. Overall, 76.36% of patients with ≥1 CHD-related *ICD-9-CM* codes had CHD. Across sites, of those with codes falling into the complex anatomic group, 86.00% to 92.00% had CHD, and only 27.08% to 55.56% of those with codes falling into the "Other" anatomic group had CHD. The PPV of *ICD-9-CM* codes for CHD was significantly higher for cases aged ≤64 years (83.82%) compared with those >64 years (57.58%). Furthermore, for cases aged ≥64 years, PPV of having CHD by anatomic group revealed a low PPV of 36.17% (17/47 [95% CI, 22.67–49.91]) for the "Other" anatomic group and a high of 73.17% (30/41 [95% CI, 59.61–85.78]) for valve lesions. This is consistent with findings from a previous study assessing the accuracy of code 745.5 to predict true atrial septal defects, in which younger patients, ages 11 to 20 years, were

Table 3. PPV* of *ICD-9-CM* CHD Codes for Having a CHD By Number of Unique CHD Codes and Anatomic Group

	Single CHD code	Multiple unique CHD codes	X^2† *P* value
CHD anatomic group			
Overall	62.08% 257/414 [57.40–66.75]	92.78% 334/360 [90.10–95.45]	100.53 *P*<0.0001
Complex	65.79% 25/38 [48.65–80.37]	95.60% 152/159 [91.14–98.21]	29.88 *P*<0.0001
Shunt†	82.95% 73/88 [75.10–90.13]	89.81% 97/108 [82.51–94.80]	1.98 *P*=0.1590
Valve	75.00% 87/116 [66.11–82.57]	94.87% 74/78 [87.39–98.59]	13.05 *P*=0.0003
"Other"‡	41.86% 72/172 [34.40–49.61]	73.33% 11/15 [44.90–92.21]	5.54 *P*=0.0186

CHD indicates congenital heart defect; *ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification*; and PPV, positive predictive value.

*95% CI presented within brackets [] for positive predictive values.

†ICD-*9-CM* code 745.5 was omitted from the shunt group as it is used to indicate secundum atrial septal defect and patent foramen ovale, a normal variant.

‡"Other" CHD anatomic group consists of unspecific defects; CHD-related *ICD-9-CM* codes and their assigned CHD anatomic grouping are displayed in Data S1.

more likely to have a true atrial septal defect (64.3%) compared with those aged 21 to 40 years (23.7%) or 41 to 64 years (19.0%) (*P*<0.001).[2] Using *ICD* codes in a "rule-out CHD" manner and incorrect coding for CHD may play a role in the low PPV for older CHD cases. Age-related changes in valve morphology and function may mistakenly be coded as CHD. The "Other" CHD category includes non-specific CHD codes such as "other congenital anomaly of the heart" that may be used inappropriately, for example, when ordering studies to investigate heart murmurs and symptoms of heart failure in older patients.

When examining the accuracy of *ICD-9-CM*-based native CHD anatomy group, about two thirds of cases across all sites were categorized into the correct anatomic group and the other one-third either did not have CHD or were categorized into the wrong group based on an incorrect code. The PPV of *ICD-9-CM* codes contained in eHR systems for identifying that a case truly has CHD of the indicated anatomic group ranged from 84.18% for shunt defect codes, excluding 745.5, to 29.41% for the "Other" CHD anatomic code group. Nonspecific codes in the "Other" CHD category may have a low PPV because they may have been used as "rule-out" codes when ordering diagnostic tests or were misused for an acquired heart condition. For example, if a patient has low blood oxygen saturations, then a "rule out CHD" code such as 746.9 (unspecified congenital anomaly of heart) may be used to assess for CHD. A comparative PPV analysis for case classification revealed a lower PPV for single versus multiple code classification, 62.08% versus 92.78%, respectively (Table 3). While requiring multiple codes for case inclusion may likely avoid "rule out" code misclassification, it often comes at the expense of losing true CHD cases. In this study, relying on multiple codes alone would have resulted in reducing sensitivity by 33.2% (257/774) because 257 single-coded true CHD cases would be excluded. Additionally, reasons for the assignment of an incorrect anatomic group may also include coding errors such as when a code in the 745.xx to 747.xx *ICD-9-CM* group has a decimal dropped, leading to conversion from 745 to 745.0, a code for truncus arteriosus (745.0), rather than an intended code, for instance 745.4, ventricular septal defect. Misuse of CHD codes may occur in other ways. For example, this study included 3 cases that were coded as "other septal defect" rather than ventricular septal defect. These coding errors highlight that nonspecific CHD *ICD-9-CM* codes may actually represent specific and true CHD that could have been better captured by a more specific CHD code.

Of the 774 total cases, 414 had a single CHD code and 360 had multiple unique CHD codes. Patients with more than one unique CHD code were more likely to have CHD, and this increase in PPV was significant for the complex and valve anatomic groups. Certain *ICD-9-CM* codes that frequently occur in combination with other CHD codes had PPVs >90%. For instance, tetralogy of Fallot (745.2) and ventricular septal defect (745.4) all had high PPVs for CHD in combination with other CHD codes.

Prior studies have also examined whether complexity of disease may play a role in the accuracy of coding in administrative data. Steiner et al. (2017) found certain complex CHD codes, such as tetralogy of Fallot and truncus arteriosus, performed well.[9] Khan et al. (2018) found that PPV of moderate or complex CHD codes for CHD was higher compared with simple shunt or valve defects or when coupled with other factors such as age, an encounter with an adult CHD provider, an echocardiogram or ECG compared with noncomplex CHD.[1] The current validation project found that the complex, shunt, and valve groups had higher PPV than the "Other" CHD group, supporting the conclusion that more specific diagnoses have a higher PPV for true CHD.

While this study did not examine sensitivity of administrative databases, other studies have demonstrated poor identification of CHD in state-specific administrative databases for pediatric patients.[3] Cronk et al. (2003) investigated the sensitivity of *ICD-9* codes for identifying individuals with CHD in 4 administrative databases in Wisconsin and found that only 57.9% of CHD cases identified at Children's Hospital

Table 4. PPV* of *ICD-9-CM* CHD Codes† for Having a CHD, Overall and by Age Group, for Three Sites with "Other"‡ CHD Anatomic Group Included and Omitted

PPV* for having a CHD, for 4 age groups		X^{2}†, § *P* value
"Other"‡ CHD included	76.34% 442/579 [72.66–79.80]	17.19 *P*<0.0001
"Other"‡ CHD omitted	86.65% 383/442 [83.12–89.68]	

PPV* for having CHD by age groups					X^{2}†, § *P* value	
	1–10 y	11–19 y	20–64 y	>64 y	All 4 age groups	Three youngest age groups
"Other"‡ CHD included	86.00% 43/50 [73.26–95.62]	82.69% 129/156 [75.83–88.27]	84.13% 175/208 [78.45–88.82]	57.58% 95/165 [49.65–65.22]	45.23 *P*<0.0001	0.34 *P*=0.8451
"Other"‡ CHD omitted	95.24% 40/42 [83.84–99.42]	94.07% 111/118 [88.16–97.58]	93.90% 154/164 [89.07–97.04]	66.10% 78/118 [56.81–74.56]	58.82 *P*<0.0001	0.11 *P*=0.9467

PPV* for having A CHD, for 3 age groups		X^{2}†, ‡ *P* value
"Other"‡ CHD included	83.82% 347/414 [79.91–87.23]	18.80 *P*<0.0001
"Other"‡ CHD omitted	94.14% 305/324 [90.99–96.43]	

X^{2} for having a CHD when all 4 age groups and CHD anatomic groups were included (PPV=76.34%) compared with when >64-year-olds and "Other" CHD anatomic group were omitted (PPV=94.14%) was X^{2}=46.04, *P*<0.0001. CHD indicates congenital heart defect; *ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification*; and PPV, positive predictive value.

*95% CI presented within brackets [] for positive predictive values.

†*ICD-9-CM* code 745.5 was omitted from the shunt group as it is used to indicate secundum atrial septal defect and patent foramen ovale, a normal variant.

‡"Other" CHD anatomic group consists of unspecific defects; CHD-related *ICD-9-CM* codes and assigned CHD anatomic group are displayed in Data S1.

§UT not included in these analyses as age groups 1–10 and >64 years were not reported.

of Wisconsin were identified by *ICD-9* codes and/or a CHD checkbox indicative of the presence of CHD in any state database; a total of 216 cases (57.9%) of the 373 total cases were identified by a CHD *ICD-9* code in at least one of the 4 state databases.[10] Almost 62% (231 of 373) had a single CHD diagnosis and 91% (339 of 373) had 1 or 2 CHD diagnoses. Lack of reporting oversight and classification problems were thought to contribute to inadequate identification of CHD from such data sets.

Ideally, constructing an algorithm that utilizes data from administrative and eHRs will help to identify true CHD cases with improved accuracy and sensitivity. Machine learning is one possibility to improve both the PPV and sensitivity of CHD codes for CHD, and specific CHD type, based on *ICD* codes and other variables from clinical and administrative data sets, using the most predictive factors, while reducing the false negative rate. Restricting analyses to certain *ICD* codes and age categories may also improve the PPV. As a result of the current findings and previous research,[2,11] researchers may consider excluding the following codes from administrative data sets to improve the PPV for analyses seeking to study CHD:

- *ICD-9-CM* and anatomically equivalent *ICD-10-CM* codes that code for conditions other than heart defects, including congenital heart block (746.86, Q24.6), pulmonary arteriovenous malformation (747.32, Q25.72), absent/hypoplastic umbilical artery (747.5, Q27.0), other anomalies of peripheral vascular system (747.6x, Q27.9), and other specified anomalies of circulatory system (747.8x, Q28.8). These codes were also excluded in the surveillance methodology.[5,6]
- The "Other" CHD anatomic group (as noted in Figure 1 and Data S1) and nonspecific *ICD-9-CM* codes and the equivalent *ICD-10-CM* codes including: other specified congenital anomalies of heart 746.8 (Q24.8), obstructive anomalies of heart, not elsewhere classified 746.84, coronary artery anomaly 746.85 (Q24.5), malposition of heart and cardiac apex 746.87 (Q24.0), other specified congenital anomalies of heart 746.89 (Q24.8), unspecified

Table 5. Positive Predictive Value of Specific CHD *ICD-9-CM* Codes for Having CHD by Number of Select Unique CHD Codes

ICD-9-CM code	Description of *ICD-9-CM* code	CHD anatomic group	Patients, n			PPV for having CHD		
			Single CHD code	Multiple unique CHD codes	Total # with code	Single CHD code	Multiple Unique CHD codes	Total % with code
745.2	Tetralogy of Fallot	Complex	19	53	72	84.2%	94.3%	91.7%
745.4	Ventricular septal defect	Shunt	64	93	157	89.1%	94.6%	92.4%
747.0	Patent ductus arteriosus	Shunt	16	36	52	81.3%	94.4%	90.4%
746.4	Bicuspid aortic valve and congenital aortic valve insufficiency	Valve	61	37	98	82.0%	97.3%	87.8%
746.02	Congenital pulmonary valve stenosis	Valve	10	37	47	100.0%	100.0%	100.0%
746.3	Congenital stenosis of aortic valve	Valve	16	24	40	87.5%	95.8%	92.5%
747.1	Coarctation of aorta	Valve	12	26	38	66.7%	100.0%	89.5%
746.9	Unspecified anomaly of heart	Other	45	89	134	42.2%	94.4%	76.9%
746.89	Other congenital anomaly of heart	Other	26	39	65	23.1%	92.3%	64.6%
V13.65	Personal history of corrected congenital Malformation of heart and circulatory system	Other	11	38	49	54.5%	92.1%	83.7%
746.85	Coronary artery anomaly	Other	26	12	38	61.5%	91.7%	71.1%
746.87	Malposition of heart and cardiac apex	Other	12	15	27	33.3%	93.3%	66.7%
747.29	Other anomaly of aorta	Other	14	12	26	35.7%	91.7%	61.5%

CHD indicates congenital heart defect; *ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification; and PPV, positive predictive value*.

congenital anomaly of heart 746.9 (Q24.9), other congenital anomalies of aorta 747.2 (Q25.49), anomaly of aorta, unspecified 747.20 (Q25.40), anomalies of aortic arch 747.21, other anomalies of aorta 747.29 (Q25.49), congenital anomalies of great veins 747.4 (Q26.1), anomaly of great veins, unspecified 747.40 (Q26.9), other anomalies of great veins 747.49 (Q26.8), unspecified anomaly of circulatory system 747.9 (Q28.9, personal history of [corrected] congenital malformations of heart and circulatory system V13.65 (Z87.74)

- Patent foramen ovale / atrial septal defect 745.5 / Q21.1 alone or in combination with the "Other" CHD category.

Codes found in combination are likely to be more accurate than an isolated CHD code, though 53% (414/774) of the cases in this validation project had a single unique CHD code. Therefore, it is suggested to avoid excluding cases with single CHD codes from algorithms and analyses; doing so could result in missed cases and lack of generalizability. Additionally, severity of CHD is not indicated by the number of unique CHD codes applied to an individual. It is notable that eliminating the *ICD-9-CM* codes above, or eliminating the >64-year-old group, will improve the PPV of CHD, but will also exclude a substantial number of true CHD cases. Certain codes are more likely to identify true CHD cases than others. Even though the vast majority of cases with complex and moderate CHD codes (80%–90%) have CHD, there remains about 1 in 4 or 5 cases who may either not have CHD or have a different severity type than what is coded. Sufficiently detailing how CHD is defined when using administrative data as well as understanding and documenting its limitations will improve the generalizability of the findings to the CHD population.

LIMITATIONS

The selected cases used in this analysis came from health care centers at locations where records could be reviewed. Thus, there was possible selection bias towards having true CHD, which might overestimate the PPV. However, using data from 2011 to 2013 may lead to an underestimation of PPV compared with more recent years as eHR use has become more standard. Coding

may vary by data source, year, and individuals who document the code (medical versus billing department staff), potentially limiting broad applicability to other data sets. Coding practices vary across both regions and medical centers, which is both a strength and limitation of our paper. Our data set used *ICD-9-CM* codes, which can be mapped to *ICD-10-CM* codes. However, differences in coding practices may vary between the *ICD-9-CM* and *ICD-10-CM* eras, thus making our results not directly applicable to *ICD-10-CM* based data sets. For the individual *ICD-9-CM* codes assessed, the reported PPV is for having CHD (Yes/No) and we were unable to examine PPV for whether the case had the specific CHD documented. We did not have access to false negatives cases in the data available and thus could not calculate sensitivities of CHD *ICD-9-CM* codes.

CONCLUSIONS

This validation study using data from 4 sites affiliated with the CDC's Surveillance of Congenital Heart Disease Across the Lifespan project revealed that *ICD-9-CM* codes accurately classify patients with true CHD in the majority of cases labeled as complex, shunt, and valve. The PPV of "Other" non-specific CHD *ICD-9-CM* codes was low and may not reflect true CHD. When >1 unique CHD code is associated with a case, the PPV for CHD increases. CHD codes had higher PPV in younger compared with older CHD cases. Further evaluation and algorithm development may help inform and improve the identification of CHD cases when administrative data sets are used.

ARTICLE INFORMATION

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Disclosures

None.

Supplemental Material

Data S1
Tables S1–S3

REFERENCES

1. Khan A, Ramsey K, Ballard C, Armstrong E, Burchill LJ, Menashe V, Pantely G, Broberg CS. Limited accuracy of administrative data for the identification and classification of adult congenital heart disease. *J Am Heart Assoc*. 2018;7:e007378. doi: 10.1161/JAHA.117.007378
2. Rodriguez FH III, Ephrem G, Gerardin JF, Raskind-Hood C, Hogue C, Book W. The 745.5 issue in code-based, adult congenital heart disease population studies: relevance to current and future ICD-9-CM and ICD-10-CM studies. *Congenital Heart Dis*. 2018;13:59–64. doi: 10.1111/chd.12563
3. Agarwal S, Sud K, Menon V. Nationwide hospitalization trends in adult congenital heart disease across 2003–2012. *J Am Heart Assoc*. 2016;5:e002330. doi: 10.1161/JAHA.115.002330
4. Broberg C, McLarry J, Mitchell J, Winter C, Doberne J, Woods P, Burchill L, Weiss J. Accuracy of administrative data for detection and categorization of adult congenital heart disease patients from an electronic medical record. *Pediatr Cardiol*. 2015;36:719–725. doi: 10.1007/s00246-014-1068-2
5. Glidewell J, Book W, Raskind-Hood C, Hogue C, Dunn JE, Gurvitz M, Ozonoff A, McGarry C, Van Zutphen A, Lui G, et al. Population-based surveillance of congenital heart defects among adolescents and adults: surveillance methodology. *Birth Defects Res*. 2018;110:1395–1403. doi: 10.1002/bdr2.1400
6. Glidewell JM, Farr SL, Book WM, Botto L, Li JS, Soim AS, Downing KF, Riehle-Colarusso T, D'Ottavio AA, Feldkamp ML, et al. Individuals aged 1–64 years with documented congenital heart defects at healthcare encounters, five U.S. surveillance sites, 2011–2013. *Am Heart J*. 2021;238:100–108. doi: 10.1016/j.ahj.2021.04.007
7. Marelli AJ, Mackie AS, Ionescu-Ittu R, Rahme E, Pilote L. Congenital heart disease in the general population: changing prevalence and age distribution. *Circulation*. 2007;115:163–172. doi: 10.1161/CIRCULATIONAHA.106.627224
8. Marelli AJ, Ionescu-Ittu R, Mackie AS, Guo L, Dendukuri N, Kaouache M. Lifetime prevalence of congenital heart disease in the general population from 2000 to 2010. *Circulation*. 2014;130:749–756. doi: 10.1161/CIRCULATIONAHA.113.008396
9. Steiner JM, Kirkpatrick JN, Heckbert SR, Habib A, Sibley J, Lober W, Randall J, Curtis JR. Identification of adults with congenital heart disease of moderate or great complexity from administrative data. *Congenital Heart Dis*. 2017;13:65–71. doi: 10.1111/chd.12524
10. Cronk CE, Malloy ME, Pelech AN, Miller RE, Meyer SA, Cowell M, McCarver DG. Completeness of state administrative databases for surveillance of congenital heart disease. *Birth Defects Res Part A: Clin Mol Teratol*. 2003;67:597–603. doi: 10.1002/bdra.10107
11. Lui GK, McGarry C, Bhatt A, Book W, Riehle-Colarusso TJ, Dunn JE, Glidewell J, Gurvitz M, Hoffman T, Hogue C, et al. Surveillance of congenital heart defects among adolescents at three U.S. sites. *Am J Cardiol*. 2019;124:137–143. doi: 10.1016/j.amjcard.2019.03.044

Supplemental Materials

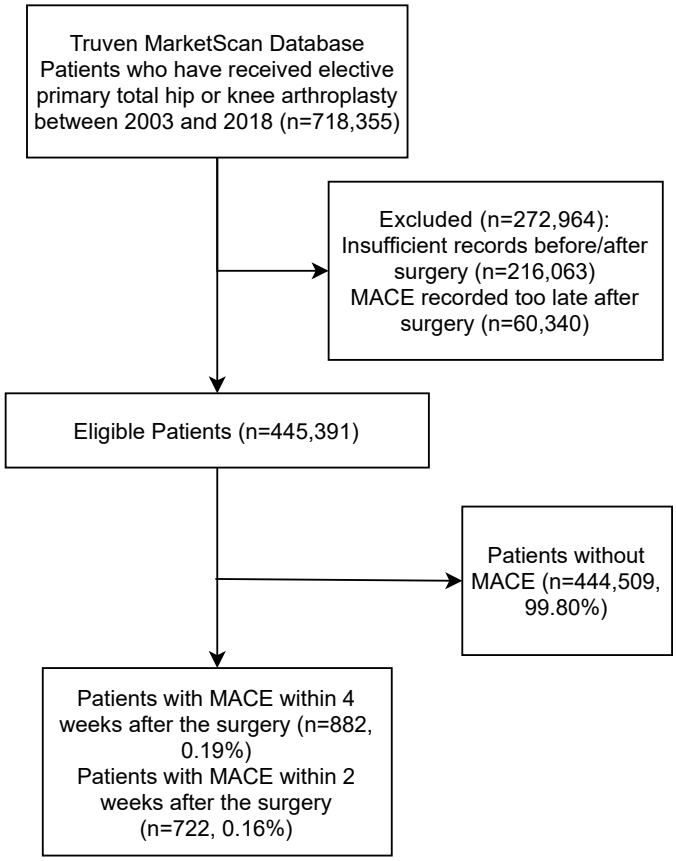

Fig. S1: CONSORT diagram conforming to the CONSORT-AI Extension guidelines stated at https://doi.org/10.1016/S2589-7500(20)30218-1

TABLE S1: Inclusion/Exclusion, Positive/Control Criteria & Cohort Definitions

	Definitions
Inclusion/Exclusion Criteria	Age 45 - 95
	Has total hip/knee CPT codes (See Table S2) in medical history and length of history available before cardiac event spans $\geqslant$ 1 year
	Has a myocardial infarction or a cardiac arrest[‡] (See Table S4 for list of target codes used to identify cardiac event in diagnostic history) 4 weeks (2 weeks considered in secondary analysis) after surgery (positive cohort)
	Has 0.5 yr of medical history available after surgery (control)
Positive & Control Cohorts	**Positive Cohort:** At least one code for cardiac event (Table S4)
	Control Cohort: No code on cardiac event within 26 weeks of surgery

TABLE S2: Current Procedural Terminology (CPT) codes for total hip/knee replacement used

CPT code	description
27130	Total Hip Replacement/Resurfacing
27132	Total Hip Replacement/Resurfacing
81.51	Total hip replacement
0SR9	Replacement: Hip Joint, Right
0SRB	Replacement: Hip Joint, Left
27442	Knee Total Replacement - (Arthroplasty)
27443	Knee Total Replacement - (Arthroplasty)
27445	Knee Total Replacement - (Arthroplasty)
27446	Knee Total Replacement - (Arthroplasty)
27447	Knee Total Replacement - (Arthroplasty)
81.54	Total knee replacement
0SRC	Replacement: Knee Joint, Right
0SRD	Replacement: Knee Joint, Left

TABLE S3: Codes used to determine RCRI

Description	Constituent Codes (*NDC: National Drug Code)
History of Heart Failure	ICD9 codes: 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9, 428.2, 428.3, 428.4; ICD10 codes: 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, I50.2, I50.3, I50.4, I50.8, I50.81
History of Cerebrovascular Disease	ICD9 codes: 430, 431, 432.0, 432.1, 432.9, 433.00, 433.01, 433.10, 433.11, 433.20, 433.21, 433.30, 433.31, 433.80, 433.81, 433.90, 433.91, 434.00, 434.01, 434.10, 434.11, 434.90, 434.91, 435.0, 435.1, 435.2, 435.3, 435.8, 435.9, 436, 437.0, 437.1, 437.2, 437.3, 437.4, 437.5, 437.6, 437.7, 437.8, 437.9, 438.0, 438.10, 438.11, 438.12, 438.13, 438.14, 438.19, 438.20, 438.21, 438.22, 438.30, 438.31, 438.32, 438.40, 438.41, 438.42, 438.50, 438.51, 438.52, 438.53, 438.6, 438.7, 438.81, 438.82, 438.83, 438.84, 438.85, 438.89, 438.9, 432, 433, 434, 435, 437, 438, 433.0, 433.1, 433.2, 433.3, 433.8, 433.9, 434.0, 434.1, 434.9, 438.1, 438.2, 438.3, 438.4, 438.5, 438.8; ICD10 codes: I60.00, I60.01, I60.02, I60.10, I60.11, I60.12, I60.2, 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, I62.01, I62.02, 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, I63.81, 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, I67.0, I67.1, I67.2, I67.3, I67.4, I67.5, I67.6, I67.7, I67.81, I67.82, I67.83, I67.841, I67.848, I67.850, I67.858, I67.89, I67.9, I68.0, I68.2, I68.8, I69.00, I69.010, I69.011, I69.012, I69.013, I69.014, I69.015, I69.018, I69.019, I69.020, I69.021, I69.022, I69.023, I69.028, 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, I69.090, I69.091, I69.092, I69.093, I69.098, I69.10, I69.110, I69.111, I69.112, I69.113, I69.114, I69.115, I69.118, I69.119, I69.120, I69.121, I69.122, I69.123, I69.128, 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, I69.190, I69.191, I69.192, I69.193, I69.198, I69.20, I69.210, I69.211, I69.212, I69.213, I69.214, I69.215, I69.218, I69.219, I69.220, I69.221, I69.222, I69.223, I69.228, 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, I69.290, I69.291, I69.292, I69.293, I69.298, I69.30, 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, I69.810, 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, I69.910, 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, I60, I61, I62, I63, I65, I66, I67, I68, I69, I60.0, I60.1, I60.3, I60.5, I62.0, I63.0, I63.1, I63.2, I63.3, I63.4, I63.5, I63.8, I65.0, I65.2, I66.0, I66.1, I66.2, I67.8, I69.0, I69.1, I69.2, I69.3, I69.8, I69.9, I63.01, I63.03, I63.11, I63.13, I63.21, I63.23, I63.31, I63.32, I63.33, I63.34, I63.41, I63.42, I63.43, I63.44, I63.51, I63.52, I63.53, I63.54, I67.84, I67.85, I69.01, I69.02, I69.03, I69.04, I69.05, I69.06, I69.09, I69.11, I69.12, I69.13, I69.14, I69.15, I69.16, I69.19, I69.21, I69.22, I69.23, I69.24, I69.25, I69.26, I69.29, I69.31, I69.32, I69.33, I69.34, I69.35, I69.36, I69.39, I69.81, I69.82, I69.83, I69.84, I69.85, I69.86, I69.89, I69.91, I69.92, I69.93, I69.94, I69.95, I69.96, I69.99
History of Ischemic Heart Disease	ICD9 codes: 410.00, 410.01, 410.02, 410.10, 410.11, 410.12, 410.20, 410.21, 410.22, 410.30, 410.31, 410.32, 410.40, 410.41, 410.42, 410.50, 410.51, 410.52, 410.60, 410.61, 410.62, 410.70, 410.71, 410.72, 410.80, 410.81, 410.82, 410.90, 410.91, 410.92, 411.0, 411.1, 411.81, 411.89, 412, 413.0, 413.1, 413.9, 414.00, 414.01, 414.02, 414.03, 414.04, 414.05, 414.06, 414.07, 414.10, 414.11, 414.12, 414.19, 414.2, 414.3, 414.4, 414.8, 414.9, 410, 411, 413, 414, 410.0, 410.1, 410.2, 410.3, 410.4, 410.5, 410.6, 410.7, 410.8, 410.9, 411.8, 414.0, 414.1; ICD10 codes: I20.0, I20.1, I20.8, I20.9, I21.01, I21.02, I21.09, I21.11, I21.19, I21.21, I21.29, I21.3, I21.4, I21.9, I21.A1, I21.A9, I22.0, I22.1, I22.2, I22.8, I22.9, I23.0, I23.1, I23.2, I23.3, I23.4, I23.5, I23.6, I23.7, I23.8, I24.0, I24.1, I24.8, I24.9, I25.10, I25.110, I25.111, I25.118, I25.119, I25.2, I25.3, I25.41, I25.42, I25.5, I25.6, I25.700, I25.701, I25.708, I25.709, I25.710, I25.711, I25.718, I25.719, I25.720, I25.721, I25.728, I25.729, I25.730, I25.731, I25.738, I25.739, I25.750, I25.751, I25.758, I25.759, I25.760, I25.761, I25.768, I25.769, I25.790, I25.791, I25.798, I25.799, I25.810, I25.811, I25.812, I25.82, I25.83, I25.84, I25.89, I25.9, I20, I21, I22, I23, I24, I25, I21.0, I21.1, I21.2, I21.A, I25.1, I25.4, I25.7, I25.8, I25.11, I25.70, I25.71, I25.72, I25.73, I25.75, I25.76, I25.79, I25.81
Pre-operative creatinine $>$ 2 mg/dL / 176.8 µmol/L - Approximated by History of Chronic Kidney Disease	ICD9 codes: 585.3, 585.5, 585.6, 585.4; ICD10 codes: N18.30, N18.31, N18.32, N18.4, N18.5, N18.6, N18.3
Pre-operative treatment with Insulin	NDC* codes: 08881242112, 08881250305, 54868582400, 08881750023, 08881242120, 08881250313, 38396043277, 08881250321, 00169369619, 08881520665, 08881242138, 36652040218, 56151171101, 08881520673, 08496275501, 08881250354, 08496275511, 08881250362, 08080810055, 36652040276, 00002831101, 08080040028, 08080040029, 08080040030, 08396800100, 38396043377, 08881750130, 36652040318, 00002831517, 56151171201, 08881750155, 08881512597, 36652400801, 36652400802, 36652400803, 36652400804, 36652400805, 36652400806, 36652400807, 36652400808, 68258889903, 08881103025, 36652040376, 96295010494, 96295010495, 96295010496, 96295010497, 96295010498, 08881512647, 08396800200, 38396043477, 57515008218, 08881750239, 56151171301, 08881750254, 55948009710, 08881250545, 57515008258, 36652400901, 36652400902, 36652400903, 36652400904, 36652400905, 08080032010, 36652400906, 36652400907, 36652400908, 59060183302, 08881512738, 08881512746, 08396800300, 54569165101, 08881701166, 54569165102, 38396076339, 08881701174, 54274048310, 08290328888, 38396043577, 08222073150, 08881750338, 08222032195, 96295010629, 36652040518, 08881676624, 96295010643, 08881906005, 96295010645, 08881676632, 08881701216, 00002821001, 08881701224, 59060183402, 08881512811, 08080032110, 08222073198, 36652040576, 89134072202, 00002831501, 08396800400, 54569165200, 54569165202, 08881512852, 54274048410, 08881512860, 38396043677, 51927368100, 36652040618, 08881512878, 08881906104, 57515082180, 08080327114, 08080032210, 36652040676, 08881750510, 52297086578, 08881512944, 08287126003, 08287126004,

Continued on next page

Pre-operative treatment with Insulin (contd.)	NDC* codes: 08287126005, 08396800500, 08881701364, 08415003129, 08415003130, 08287126014, 08287126015, 08287126016, 38396043777, 08287126021, 08287126026, 08287126027, 08287126028, 08287126029, 36652040718, 08222073358, 08881512977, 08881701406, 08080622112, 00002841501, 00888160813, 08222073396, 08290009652, 08080032310, 08881513025, 68258898501, 36652040776, 08881513033, 89134072402, 08396800600, 08326300250, 08474935900, 08881513058, 38396043877, 11845026407, 36652040818, 08080827012, 59060183702, 08474010278, 68258898601, 08881513132, 08881750700, 36652040876, 54868361900, 08396800700, 08881750718, 08881513157, 38396043977, 08222032591, 08222073556, 08881608201, 08881608202, 08881608203, 08881513207, 08222073594, 08080032510, 08881513223, 08474010378, 08881513231, 11917001487, 11917001489, 11917001492, 54569255700, 54569255701, 08396800800, 08881513249, 08881120037, 08881513256, 76300084010, 00169001771, 38396044077, 08290329403, 08290329405, 08290329406, 08290329407, 08290329408, 08290329410, 05511029572, 08290329412, 08290329416, 08290329417, 08290329418, 08881750858, 08290329420, 08290329422, 08290329424, 00169010001, 57515082580, 81306051413, 36652401502, 36652401503, 81306051423, 36652401505, 08474010478, 08881513330, 08881251188, 08290329461, 08290329464, 08290329465, 08396800900, 38396044164, 08415003529, 08415003530, 08415003531, 08290329485, 38396044177, 08080081810, 08222008218, 08080819100, 08080819101, 08080819112, 08080819113, 08080221100, 08881750957, 00002871591, 08080221112, 00002871501, 81306051513, 08222008258, 81306051523, 08881202116, 00002873001, 08474010578, 00169231321, 48135152605, 48135152606, 08396801000, 38396044264, 08415003629, 08415003630, 08080081910, 08881112059, 56151172101, 48135152650, 08881112075, 48135152660, 08290329622, 81306051613, 08021042215, 08881513512, 81306051623, 08290329650, 08290329651, 08290329652, 08290329653, 08474010678, 76300051511, 76300051512, 76300051513, 76300051514, 00169231421, 08881513538, 08881513546, 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TABLE S4: ICD codes for myocardial infarction used to identify positive cohort

ICD code	description
I46.8	Cardiac arrest due to other underlying condition
I21	ST elevation (STEMI) myocardial infarction involving left main coronary artery
410.72	Subendo infarct subseq
I21.01	ST elevation (STEMI) myocardial infarction involving left main coronary artery
410.01	AMI anterolateral init
I21.4	Non-ST elevation (NSTEMI) myocardial infarction
I21.A9	Other myocardial infarction type
I21.A1	Myocardial infarction type 2
410.61	True post infarct init
I21.3	ST elevation (STEMI) myocardial infarction of unspecified site
410.8	AMI NEC unspecified
410.42	AMI inferior wall subseq
427.5	Cardiac arrest
I46	Cardiac arrest due to underlying cardiac condition
I46.2	Cardiac arrest due to underlying cardiac condition
410	AMI anterolateral unspec
410.71	Subendo infarct initial
410.11	AMI anterior wall init
410.12	AMI anterior wall subseq
410.7	Subendo infarct unspec
I21.21	ST elevation (STEMI) myocardial infarction involving left circumflex coronary artery
410.4	AMI inferior wall unspec
410.21	AMI inferolateral init
410.82	AMI NEC subsequent
410.9	AMI NOS unspecified
410.2	AMI inferolateral unspec
I21.9	Acute myocardial infarction unspecified
I46.9	Cardiac arrest cause unspecified
410.1	AMI anterior wall unspec
410.02	AMI anterolateral subseq
410.51	AMI lateral NEC initial
410.52	AMI lateral NEC subseq
410.92	AMI NOS subsequent
I21.02	ST elevation (STEMI) myocardial infarction involving left anterior descending coronary artery
I21.19	ST elevation (STEMI) myocardial infarction involving other coronary artery of inferior wall
410.81	AMI NEC initial
410.41	AMI inferior wall init
410.31	AMI inferopost initial
410.62	True post infarct subseq
I21.09	ST elevation (STEMI) myocardial infarction involving other coronary artery of anterior wall
410.0	AMI anterolateral unspec
410.5	AMI lateral NEC unspec
410.6	True post infarct unspec
410.3	AMI inferopost unspec
410.91	AMI NOS initial
410.32	AMI inferopost subseq
I21.11	ST elevation (STEMI) myocardial infarction involving right coronary artery
410.22	AMI inferolateral subseq
I21.29	ST elevation (STEMI) myocardial infarction involving other sites

TABLE S5: Number of diagnostic codes encountered in dataset

gender	Number of codes	Number of unique codes
M	4879398	17554
F	7753318	19209
Total	12632716	36763

TABLE S6: CCoR phenotypes and maximum number of unique ICD codes defining CCoR phenotypes

CCoR phenotype	**count of ICD codes in definition (Table S7)**
Allergic	191
Cardiovascular	2017
CNS	765
Development	820
Digestive	1317
Endocrine	237
Frailty	557
Health-Services	501
Hematologic	429
Hypertension	80
Immune	1546
Infections-Bacterial	409
Infections-Fungal-and-Other	784
Infections-General	3612
Infections-Respiratory	712
Injuries	53265
Integumentary	1457
Metabolic	373
Musculoskeletal	7533
Neoplastic	3022
Ophthalmological	3401
Otic	856
PNS	394
Psychiatric	1478
Reproductive	2675
Respiratory	724

TABLE S7: Disease Categories With Detailed Set of ICD Codes Used in Definition. Not all infection and injury codes have been listed here.

	Description	Constituent ICD9 Codes
Allergic		477.2 493.81 T50.995A J67.2 495.6 T78.03x 372.14 J67 J67.0 M13.89 J30.1 995.63 995.65 558.3 T45.0X1A M13.859 716.27 D29.30 D29.1 L27.2 477.9 495.5 493.22 D69.2 T78.00x 287.33 995.60 J45.31 J45.51 D29.20 J67.7 T78.09xA D29.22 M13.80 J30.9 T78.08x 287.8 H10.45 B44.81 716.20 995.61 T78.05xA 493.92 693.1 493.90 T78.40x J45.20 493.82 J45.40 D69.42 495.7 J67.5 493.20 D69.49 J45.32 287.32 708.0 H65.119 995.64 D69.1 J45.21 D69.6 M13.819 716.23 495.4 995.67 287.1 T78.08xA T78.00xA 477.0 493.02 525.66 T78.02xA J67.1 D69.3 T78.04x T78.2xxA D29.4 716.25 T78.07xA 716.26 T78.07x M13.88 J67.3 495.9 J45.30 493.21 477 495.2 995.62 T78.40xA 995.27 287.2 495.8 495 287.5 995.0 493 T78.05x L50.0 493.11 J45.902 D29.0 J45.990 287.9 J45 D29.21 J30.0 963.0 495.1 D29.32 L25.9 J44.9 J44.0 477.1 M13.879 493.01 J45.41 T50.995 J45.998 692.9 M13.849 995.66 D69.8 995.69 T78.04xA J30 495.3 M13.869 287.30 J45.991 J44.1 995.3 287.4 J45.52 287.0 381.06 716.21 J45.901 J67.4 287.39 493.91 373.32 287.31 T78.06xA J30.89 287 K08.55 K52.2 D29.31 J45.50 495.0 J67.6 D69.9 D29.8 T78.02x 716.24 477.8 381.05 D29 493.12 T78.03xA J67.9 716.22 T78.2xx J30.5 999.4 493.00 M13.829 T78.01x T78.06x 493.10 518.6 716.28 J30.2 H01.119 995.68 M13.839 D69.0 T78.09x 381.04 D29.9 T78.01xA 716.29 J30.81 J45.22 J45.42 T45.0X1 J45.909 D69.41 J67.8
Cardiovascular		I35.0 I48.0 I25.728 444.8 P29.38 I94 I63.212 402.00 I70.669 440.30 I89.9 I60.9 I20.1 413.9 I24.1 I80.3 415.1 I77.811 785.9 I69.319 I69.339 I82.5Z9 R04.1 429.6 G43.619 I82.503 I82.611 I70.512 I75.011 I69.834 I70.628 K64.9 I89.0 I21.09 428.42 447.5 442.8 I70.792 454.0 I70.318 I50.83 I70.744 405.0 426.2 455 I70.442 455.3 I82.B29 I12 415 433.8 I69.320 I27.81 444.21 I70.735 I82.602 I67.89 441.4 425.4 I35.9 I70.693 I69.234 I65.23 427.2 I70.244 I49.02 I82.91 P29.89 I70.719 I69.131 I36.8 I60.8 I60.11 442.82 I69.852 I75.029 438.22 I69.120 I70.641 I60.2 426.51 I70.302 417.9 I63.012 R04.2 R00.2 427.31 I25.718 I05.8 I70.791 I89 426.50 I63.349 I49.49 444.89 I63.213 I83.12 I77.0 I82.433 I70.608 P29 I47.1 428 I70.348 I82.C29 I82.532 I69.322 I63.311 I65.03 I82.291 I70.498 I97.791 I69.859 I70.644 I82.441 I63.413 I70.362 405.11 I62 I87.012 I80.292 411.1 433 I70.532 I97.638 I87.091 I69.998 I07.8 I11.9 I69.390 445.01 I69.223 I37.2 I87.319 I69.932 I70.208 I82.492 I82.891 I63.233 I70.319 I70.65 I70.341 435 441.9 I40.0 I63.539 K64.4 I95.89 I69.028 I82.5Y9 I50.32 I70.731 I70.768 458.0 G43.601 I21.01 410.71 429.3 I69.398 I87.399 441.0 I70.421 I73 I70.729 E86.0 I69.231 I28.8 I13.0 I70.568 I42.2 I63.431 411.89 I70.709 438.21 438.53 I70 I50.84 I42.0 I70.212 I77.74 I08.0 P29.2 455.0 410.1 416.1 I24.8 433.10 I70.393 413.1 I70.561 I87.092 I83.218 427.60 453.82 I70.534 I97.130 I97.821 I97.711 I63.543 I02.0 405.01 I69.364 I07 I83.92 I69.928 I69.214 I70.418 346.63 I06.8 410.60 I31.2 I70.433 I75.013 I70.219 I70.431 I75.023 I82.403 I83.10 I25.730 415.13 I13.2 I69.814 I50.812 I79 429.89 I69 I69.833 I23 410.20 I77.6 I69.165 I60.52 459.81 I47 410.10 I83.201 I82.419 I69.033 I15.9 404.0 I69.213 441.7 I82.412 I69.261 I82.432 417 I24.9 I69.315 438.19 I72.8 I36.2 I97.648 I70.539 I56 I69.392 I63.512 I69.820 I77.70 I63.00 I70.439 I70.643 433.80 276.50 459.3 I70.522 I69.121 433.21 426.4 346.61 I61 I75.021 I88.8 I55 785.1 I01.9 I25.729 I63.20 454.9 I63.521 I70.769 I69.334 I72.4 I50.31 438.50 434 I70.349 I48.2 435.1 I80.219 I10 I69.115 I70.544 414.00 I69.010 I66.12 445.8 I30.9 I27.1 I80.293 432 I97.190 I69.864 I86 I34.1 410.8 438.9 I63.133 I25.89 I63.032 I34.8 I77.4 I82.4Z2 I87.391 411.0 I87.312 440.4 I63.232 I87.009 R00.8 I69.012 I70.468 Q82.5 I21.3 I87.303 I25.6 I69.842 290.41 455.8 I69.042 I82.C23 I87.099 I69.314 I74.10 I77.812 I69.393 I42.5 I69.141 I70.491 I82.210 785.50 I69.351 I82.513 785 I69.252 785.52 I77.819 415.11 I80.13 I71.5 I82.422 I42.6 P29.30 I69.031 I70.222 I31.4 I82.603 I82.729 437 I70.621 I70.509 I70.763 I95 I38 433.3 I69.133 K55.0 426.6 I80.212 I70.723 I70.229 404.10 I83.029 437.3 426.13 I65.22 I75.012 I80.202 I48.3 I27.83 I69.815 I75.022 I27.20 I70.711 453 I65.9 I80.233 410.01 I70.291 440.2 I63.29 404.11 I82.A21 R04.89 I08.3 785.0 438.10 I70.469 I91 I69.163 447.2 I50.1 414.4 I83.002 410.5 I70.243 I63.039 I70.249 I70.269 I80.211 I86.8 I70.499 I69.363 404.02 I22.0 I69.211 458.2 I83.213 I83.028 I74.2 428.0 I70.545 442 443.89 426.3 I69.362 I31 I70.398 I81 I69.810 I70.261 443.22 I70.1 I70.335 I92 I77.89 I60.00 I83.203 I72.3 I63.532 410.2 I71.02 I70.331 441.03 I69.262 410.6 I65.29 I54 453.71 I69.293 438.81 I69.110 I15 R65.21 428.31 453.89 I69.051 I67.7 I69.062 I69.111 I69.349 454.1 453.1 I63.39 I82.1 I66.03 I72 I46.8 426.12 I45.81 I73.1 I70.634 I69.918 I95.1 I87.393 410.02 410.0 I70.332 I82.549 443.29 I77.5 440 I31.8 I21 I82.B23 I11.0 433.01 455.7 403.00 I66.02 438.14 I06.0 G45.0 I97.51 I69.112 I70.369 I82.5Y2 I45.2 I74.01 415.19 I87.311 I63.22 I84 I20 I70.203 I83.009 I87 I71 433.1 I06.1 456.4 I69.822 I99 I33.0 I70.218 438.5 I60.10 I69.254 413 I51.2 I69.065 I59 410.62 I07.2 I80.8 I96 453.76 437.2 435.3 414.11 I83.019 I09.2 I83.93 426.81 I63.323 410.72 435.2 I63.441 I83.011 410.31 I82.B11 410.81 I27.23 438.41 I75.81 404.9 I13.11 I66.09 I95.0 I83.022 438.4 I82.431 I70.202 I70.342 I70.648 I23.3 I69.265 437.9 I82.812 I82.439 I63.59 I97.120 I69.249 I07.9 455.6 I82.501 I82.A23 I74.09 I63.329 I70.722 I82.423 I87.9 I82.C21 414.02 I42.9 I69.093 404 I24 455.9 I32 I70.798 I44.60 441.02 R04 I50.40 I87.302 I82.509 441 I77.3 I97.630 I69.993 I53 I83 I82.499 I69.034 I70.402 I60.01 458.1 438.82 I24.0 458 I69.144 R01.2 I70.231 I65.1 I70.429 I70.612 I50.33 I82.612 I63.422 I57 433.2 I69.221 I95.9 I78 I97.111 I04 I69.963 779.82 410.52 410.3 I70.298 438.20 I48 I50.82 I70.698 I70.533 I69.915 I69.052 425.9 I69.243 I80.229 427.32 438 410.41 I69.092 413.0 290.4 I27.22 I69.043 442.83 453.86 557 453.75 445.0 I23.2 438.1 458.21 I70.303 I70.541 I70.201 I69.154 411 429.1 I51.9 I60.7 I69.244 427.41 I72.6 I16.0 290.42 I70.793 I82.491 I69.022 443.8 I51.5 I26.09 I83.225 I37.9 I66.13 I70.329 I69.191 I70.638 444.2 I36.1 I69.91 R01.1 I08.1 I70.333 I70.462 I82.401 I82.A19 I63.519 K55.9 I82.4Y3 I82.5Z3 I33 410.7 I45.4 I69.333 I83.219 I69.198 I70.399 426.54 I25.710 442.81 557.9 I80.231 I82.443 I80.01 P29.12 447.3 I70.245 410.70 433.91 I69.812 I50.23 448.9 434.9 I26.99 427.5 I77.77 453.6 I69.118 I35 441.3 I82.C22 I08.8 414.07 I28.0 438.89 I97.42 I65.09 I37.0 I67.848 I70.449 I77.2 411.8 I70.603 G45.4 453.81 I44.5 426.0 I06.2 I74.5 427.9 427.42 I70.213 I61.2 444.9 I62.1 F01.51 I70.701 456.8 456 I87.013 I01.8 440.3 453.83 I69.242 I42.1 I83.811 I69.069 I69.313 I83.023 I45.9 I69.013 I69.813 453.77 I21.11 I25.82 I87.339 I70.749 I83.892 I23.5 I97.611 I66.3 I63.449 453.72 I88.0 405.9 I69.059 I40 I69.943 I70.748 I21.02 428.32 447.70 I78.8 403.9 I82.521 I69.321 405.09 453.40 I63.9 I69.854 453.42 I40.8 I69.162 426.1 I69.192 I83.222 I87.033 I25.83 I74.3 I82.523 458.9 K64.8 438.83 I42.7 I70.521 459 I83.221 I82.609 I82.703 I07.0 I97.110 I69.942 437.6 405.1 I60.6 I69.342 I70.728 405.99 I69.831 I69.30 I12.9 438.3 447.71 441.00 I69.828 434.91 I09.89 I23.4 I83.024 I47.0 I82.543 I50.810 I70.293 I82.211 405.19 I86.2 I69.954 I70.409 I83.812 I97.622 437.0 I25.799 403.01 I75.89 I50.20 I63.533 I78.1 428.33 I82.A22 I79.0 414 402 414.01 427.89 I69.964 I70.642 I63.542 I47.2 I87.309 I63.339 I77.72 I70.363 414.06 404.92 I71.2 441.1 I82.522 I20.8 402.11 I82.819 I65.8 I36.9 I99.9 785.3 429 I69.344 I97.811 I63.113 443.21 I69.020 I70.328 I72.9 I62.01 I70.613 447.72 I82.542 785.51 I69.132 I83.015 I82.493 I67.4 426.52 425.7 I80.00 I70.338 I63.30 I78.9 I74.19 I87.392 442.9 I82.449 I69.862 403.90 402.10 I25.758 402.1 I27.21 I83.202 I86.0 I70.401 I87.093 I49.8 I95.3 433.11 I02.9 425.2 I70.519 412 I70.739 I70.702 404.03 429.5 I88.9 410 I82.B21 410.22 I69.169 I70.368 429.82 I82.619 I82.592 I60 437.8 I80.10 414.0 433.9 I72.5 I70.591 404.12 I69.219 I73.9 I46 I63.50 434.1 I82.599 I74.9 I83.018 I82.4Z9 I70.392 I66.11 I63.531 I70.435 I22.2 I65.02 I82.541 425.0 I69.298 I63.40 I69.263 I95.81 453.8 I82.409 R03.1 I25.759 I87.1 I69.353 434.01 557.1 I25.2 I70.598 I70.601 I79.1 R57.8 I63.131 I22 414.03 I46.2 I19 I63.439 403.91 I69.064 429.8 426.9 I63.09 I80.03 I45.89 I97 I82.531 429.79 I13 I69.032 I22.8 I26.90 434.10 415.12 I70.639 I69.232 I51.0 I60.51 I63.411 I97.131 I69.891 I70.8 I44.0 I39
CNS		346.32 335.10 G40.019 G47.54 G43.609 G44.029 G16 344 349.2 G47.20 G45.0 G21.4 347.00 G81.11 346.82 G95.19 G47.27 345.70 347.11 G25.89 341.21 322 344.30 346.93 G04.2 G40.909 G40.219 G43.619 G80.0 327.15 G43.011 333.1 349.82 327.51 G83.10 G12 G47.35 327.32 G03.8 327.41 337.00 G46.2 G96.12 G05.4 G43.101 G24.2 G47.29 G12.21 345.00 G93.1 346.72 G13.1 G95.9 331.7 G31.01 343.8 G40.209 346.40 334.9 G30.1 G44.309 G83.13 321.0 344.89 G47.23 G44.009 G11.9 324.9 G43.D0 G81.90 346.20 G03.1 333.84 320.1 348.30 G30 G81.93 G95.0 G37.5 G47.12 G25.71 327.29 G40.201 346.41 G06.2 G37.9 767.0 G40.813 P91.63 G93.49 344.9 345.01 334 G47.52 322.9 G44.41 336.1 G44.82 335.11 348.39 G47.22 G37.2 G46.0 327.11 G04.89 G22 331 G41 G43.509 G83.30 327.30 G93.7 333.2 333.5 G47.419 344.41 P91.2 P91 328 349.1 G90.529 G25.79 344.5 G40.111 337.20 G83.89 G37.1 348.4 G23.2 G25.1 G44.81 G00.2 G40.804 G40.B09 336 G44.83 G47.00 G82.50 344.60 337 343 G47.63 327.44 G44.40 336.9 G13.8 P91.1 333.82 G47.59 G31.1 G82.20 334.2 333.71 G35 G21.0 G24.1 G25.3 G23 G46.5 322.0 327.8 779.2 333.85 G25.0 G81.01 344.04 G43.C1 G44.53 G40.814 G00.3 G43.111 342.02 333.89 G23.1 G90.59 G80.2 F51.05 G91.0 G40.823 343.4 344.01 335.20 G40.411 G44.221 G47.14 G12.25 G04 343.3 G43.A0 333.79 327.22 346.01 G18 G03 G83.9 G40.409 G44.001 331.82 323.42 323.72 G82.53 337.3 G93.40 G99.0 G43.719 E75.4 G40.009 G47.30 G47.10 G40.802 336.0 327.01 G40.B01 P91.60 323.63 340 G43.B1 345.91 P52.8 G12.8 G43.419 G07 G93.9 G40.001 327.40 G44.209 337.1 G25.4 G99.2 333 333.72 323.81 327.23 323.02 344.2 G12.24 333.4 327.59 G12.23 G43.601 331.2 333.3 G83.4 G44.219 G40.101 B45.1 330.0 G44 G83.23 G93.2 G43.001 G43.C0 327.49 G21.8 G46.7 G30.9 G40.419 G82.52 G40.A01 345.61 347 G44.321 G11.8 G00.9 330.1 G43.B0 G44.011 323.1 G31.81 G43.401 320.89 G83.20 346.80 G47.9 G43.911 G47.62 348.9 G13.2 346.90 G47.31 G90.09 335 342.82 327.20 342.11 G11.2 327.19 346.02 341 G40.119 G47.09 322.1 G04.02 G19 348.5 G43.829 323.82 333.99 342.12 345.3 G40.011 G20 G45.9 G40.89 P91.0 346.42 346.60 335.23 G03.9 G40.309 336.3 333.90 349 G04.01 346.00 327.14 342 G05.3 G44.059 321.2 G31.89 G43.701 G37 G43.511 G40.822 G43.919 G44.51 G47.36 345.41 G31.2 G13.0 G91.1 344.31 G00.0 320.2 G25.81 344.61 G44.329 G47.429 G40.824 G80.8 346.63 G46 G30.8 G43.831 G80.3 348.2 333.83 G45.4 G13 320.0 345.10 344.40 341.1 G37.3 G31 G14 333.94 G24.3 G36.9 G45.2 349.39 G24.8 G47 G04.31 G05 G11.4 341.20 332.1 344.1 G47.39 G83.5 G46.1 G25.70 G21.19 G00.1 343.9 G25.61 G40.311 G21 331.11 G32.89 G47.51 332.0 335.22 G44.091 345.80 331.81 G36.8 G00.8 G46.8 G47.34 P91.88 G43.D1 323.71 330.9 G04.90 331.89 G06.1 G46.4 348.1 346.30 G43.019 G82.54 337.29 335.8 G04.1 337.22 G43.839 344.02 327.43 G12.1 G43.901 G47.69 G10 G47.421 G47.50 G44.84 G31.83 346.62 G47.01 345 G47.19 G44.031 G25 320.7 323.51 G33 G06.0 G32.81 346.50 G83.11 G27 337.09 G24.09 322.2 344.00 346.61 G43.801 327.37 G31.85 327.42 G36 346.31 G46.3 G24.9 G40.211 G24.01 327.26 G44.049 341.9 G44.039 327.33 346.83 334.1 335.29 344.09 323.2 346.13 327.12 G47.37 327.36 327.02 G43.909 G25.5 G40.803 346.12 G12.20 327.31 G37.8 345.2 327.10 G44.311 G43.409 344.42 343.0 G06 323.01 333.93 346.81 G40.509 325 G44.211 G43 G81.00 G93.0 341.8 335.0 G09 G96.9 320.81 G44.229 G04.32 G24.4 346.11 G25.69 333.6 G37.4 G04.81 G44.201 345.81 332 G12.22 346.51 346.33 331.5 342.90 G44.099 G40.401 G95.89 346.10 F51.13 G43.501 G01 334.4 324 327.13 G44.051 345.71 327.53 320.3 345.60 G12.0 G04.91 G44.85 G43.821 G97.41 G11.0 346.21 P91.62 G39 345.51 321.1 G96.11 323.62 G80.1 G43.009 G31.82 344.81 327 G43.519 346.23 G43.119 336.8 345.40 345.50 333.0 G81.10 348.89 326 345.90 327.24 333.92 G29 334.0 G40.301 G47.24 G43.711 G44.021 G46.6 G40.319 333.91 G04.30 G43.A1 G31.84 G43.411 G32.0 337.01 G04.00 G21.9 P91.61 G47.26 346.43 G44.52 G83.21 G38 344.32 327.34 346.71 P91.811 G11.1 G40.A19 G40.B19 324.1 G40.109 G43.109 G90.4 G15 G47.33 342.92 G40.901 G40.811 G93.89 G93.6 E75.23 G21.3 G94 342.01 G45 G37.0 G12.29 G47.61 334.8 343.2 349.9 342.80 G93.41 G25.83 G43.709 G43.819 335.9 G43.811 346.53 347.01 G47.8 G97.82 G34 342.81 342.91 G44.319 347.10 G43.611 G03.2 G31.9 G44.1 327.21 G23.0 G47.32 341.22 323.41 320.82 G40.B11 P91.9 337.9 G00 335.24 G47.411 321.4 348.31 346.91 327.27 330.2 348 327.00 348.81 G03.0 346 G44.041 321.3 G31.09 346.03 G28 G21.11 G25.2 G02 349.0 327.52 G40.A09 G40.821 349.89 G17 346.22 327.35 330.8 331.83 G81.13 G97.1 G23.9 329 G90.01 G40.911 333.81 G21.0' P91.5 G43.809 335.19 G45.1 336.2 G24.02 335.21 346.92 G23.8 P91.4 341.0 G83.0 327.25 G47.25 346.52 G21.2 349.31 G25.9 G40.812 G24 337.21 331.4 G47.53 346.70 G91.2 345.11 330 327.09 344.03 G96.8 323.9 G44.019 G47.13 323.52 G44.301 324.0 G90.9 G42 346.73 320.9 G44.59 G25.82 G40.919 330.3 327.39 321.8 331.0 331.9 G30.0 G36.1 779.1 G81.03 334.3 G08 G47.21 331.3 G40 G11.3 G32 G04.39 342.10 G92 G36.0 323 G82.51 G45.3 G12.9 349.81 P91.819 321 G47.11 G40.A11 348.0 G93.81 G11 G40.801 G26 G80.9 342.00 G40.501 320 P91.3 G44.89 G90.519 G93.5 G81.91 G24.5 G45.8 331.19 323.61 G96.0 343.1

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Development		520.4 742.59 764.96 743.66 750.19 M26.36 756.11 749.01 748.1 524.33 740 740.1 752.35 741.0 743.53 524.79 748.5 752.42 589.0 Q18.1 Q26.2 Q93.4 764.98 743.43 744.21 Q63.8 753.23 750.4 P92 N13.70 746.82 747.40 743.57 743.41 742.5 752 743.34 749.14 524.35 744.82 Q05.2 M26.9 Q55.63 Q10.1 752.43 748.3 756.16 M26.89 743.31 593.71 M26.221 M26.72 313.23 Q31.1 743.49 F94.0 750.24 747.41 Q35.7 Q23.0 Q15.8 Q61.3 749.1 Q16.9 759.0 743.12 750.27 749.03 747.49 Q61.8 P92.4 743.65 750.21 Q20.0 Q87.81 Q62.4 758.5 764.03 524.73 Q17.1 756.13 524.31 Q34.8 Q18.4 Q27.8 520.8 743.64 Q21.2 741.9 751.61 Q76.5 524.27 Q05.7 Q61.01 746.87 Q10.0 Q25.4 Q36.9 764.06 752.36 743.11 764.91 Q28.3 747 756.14 743.39 759.89 746.6 753.12 750 750.10 Q62.31 M26.39 750.6 Q51.4 Q56.3 Q24.8 747.82 745.7 752.65 750.16 749.02 Q28.8 P05.14 743.35 Q20.9 Q64.9 P05.08 749.23 742.9 747.10 756.12 Q16.4 743.44 K00.4 P05.15 Q22.5 747.20 745.19 753.4 764.07 Q51.3 N28.83 M26.56 Q21.1 744.8 M26.220 747.8 N13.722 Q23.2 752.40 Q00.1 Q87.1 Q06.4 764.92 P05.06 524.56 743.46 Q55.22 745.11 744.0 Q51.2 K00.2 M26.52 Q76.49 752.89 Q52.12 746.0 Q99.2 E30.1 P92.2 M26.54 745.12 Q02 753.10 745.8 Q33.4 Q24.2 764.12 Q24.6 754.0 315.8 744.89 307.6 Q55.23 750.1 759.4 M26.73 Q00.2 Q40.8 752.64 M26.211 593.7 Q64.10 758.32 Q33.6 524.3 Q26.5 Q18.2 Q55.64 746.5 P05.9 764.00 744 752.34 752.9 Q43.4 524.57 Q38.2 759.1 747.2 315.9 Q13.4 759.3 524.22 Q16.2 315.4 743.63 752.51 Q27.9 745.3 524.32 743.54 Q20.1 F93.9 Q12.0 746.8 524.8 P05.18 748.61 P92.9 Q42.9 Q52.0 743.56 742.1 Q20.8 Q89.3 524.21 Q51.0 749.20 753.3 Q18.7 315 Q51.811 747.3 Q03.8 748.60 744.09 Q61.9 Q93.81 745.69 741.92 759.2 Q05.8 746.2 747.81 750.29 741.02 Q76.0 744.04 743.36 764.24 P92.8 P05.10 749.11 Q12.4 524.55 Q54.4 746.4 520.1 743.59 764.10 Q37.8 M26.33 313.2 P05.13 524.7 P92.01 745.61 752.11 P05.16 M26.34 Q24.3 751.5 524.74 Q06.2 746.00 752.10 Q50.6 Q21.9 752.49 745.4 758.31 752.33 K00.0 E30.0 753.15 307.7 758.1 746.1 Q04.8 764.13 M26.30 752.41 Q10.6 744.23 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313.89 758.81 750.0 Q64.4 Q96.9 742 746.85 743.30 313 743.06 Q14.8 R62.7 743.3 Q05.4 751.6 746.89 758.39 749.25 R62.52 752.19 N13.721 752.52 744.1 Q76.2 764.04 Q16.3 745.2 P05.04 748.9 764.14 764.94 520.7 749.21 753.19 750.7 Q25.0 764.27 F98.1 752.31 Q20.4 P05.03 Q91.7 759.83 746.81 743.48 749.0 Q50.01 524.9 Q40.1 745.10 524.76 P05.11 524.89 753.2 750.2 Q27.31 R62.59 744.41 744.46 751.1 740.0 Q67.4 749 K00.8 F82 Q64.79 Q23.4 764.93 Q27.0 753.11 Q11.0 M26.74 Q18.0 Q55.62 M26.37 Q21.3 Q22.9 Q25.1 524.4 745.60 750.12 752.32 742.53 Q37.9 Q44.2 524.71 R62.0 Q51.828 N27.9 753.6 743.8 593.72 524.54 744.00 524.25 750.9 Q61.5 Q30.8 Q23.3 751.2 524.28 746.86 756.10 524.52 M26.35 746.83 743.61 520.2 764.19 Q28.9 744.42 Q18.9 746.01 749.22 744.49 M26.81 743.37 751.7 747.29 P05.2 520.3 524.36 750.22 764.22 Q64.0 Q76.1 742.0 747.6 744.2 Q14.3 746.7 Q53.9 749.13 743.55 Q62.11 Q87.0 743.51 Q16.5 Q27.2 Q05.1 Q52.11 752.81 758.2 520.6 M26.31 524.39 Q18.3 Q93.89 M26.20 Q38.7 755.55 524.75 764.26 M26.53 744.4 758.7 756 524.23 R62 K00.7 Q40.0 Q05.6 524.2 Q13.81 K00.3 745.1 756.19 752.61 Q31.0 758 520.0 741.90 746.9 Q93.88 Q89.9 753.29 Q13.1 Q18.6 F81.9 746.02 743.00 Q44.1 743.47 747.69 Q39.1 Q38.8 753 764.23 764.18 753.20 Q27.32 764.09 Q17.9 Q23.8 Q89.1 Q13.89 M26.71 750.15 753.9 743.69 744.29 P05.00 Q40.2
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K41.10 K08.531 K03.81 K75.3 K51.411 530.11 531.01 K22.9 K72 K64 K08.423 K28.5 K29.01 K08.21 534.40 K31.89 530.2 K27.5 K51.512 K29.41 K22.4 K27.1 K02.61 R10.821 K51.518 K85.10 537.89 K73 K27.2 K38 558 536 536.8 541.0 K94.03 K86.0 K57.13 533.4 K28.9 K38.1 K93 K51.011 R10.826 K50.818 456.1 K51.912 K08.20 568.82 K61.0 579.2 K14.9 K82.1 K06.8 K08.50 R19.6 K51.218 565.0 K52.89 R13.19 K51.911 568.81 P76.1 K57.11 558.41 K08.424 K55.021 R10.812 K91.72 K50.013 K70.9 K51.219 K59.09 K94.21 K05.312 531.60 K09.1 777.6 R15.0 K29.20 562.13 K91.83 K56.691 K05.11 K31.83 K60.0 K08.412 K55.032 K13.70 536.0 K08.101 K51.812 568.9 K44.0 K34 K55.039 R16 564.9 K65.0 K12 K04.02 K08.55 P78.1 K08.192 532.30 543 K71.0 K65.3 K08.59 K66.9 K35.89 560.3 K80.70 577.2 K31.84 K08.499 K41.21 P78.83 K14.6 K08.111 K41.00 K65.1 K86.8 568.0 K26 K51.311 K38.0 K76.81 787.91 K29.51 K07 K94.11 K38.9 578.9 K03.89 K55.049 543.9 K85.31 K52.82 R19.02 K08.82 566 R10.30 565.1 K14.0 K85.22 531.90 K29.90 527.4 K94.10 K80.80 527.6 K08.409 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K95.81 K08.129 P76.2 K51.818 K11.7 K40.01 K82.4 K35 K43.5 K52.1 532.2 K71.6 K21.0 562 K71.3 K92.89 777.51 K63.0 560.81 K08.493 R19.35 K51.013 R15 787.1 777 533 537.8 533.41 K05.10 K13.3 534.6 K26.7 K25.2 534.50 531.50 K08.419 K22.710 K62.0 K65.4 R11.2 531.1 533.2 K15 K61.2 564.5 K13.24 534.11 K01.0 K55.052 K50.119 K50.018 K94.22 K11.20 K13.21 K40.91 P77.1 K27.7 K80.47 K06 530.20 569.81 K66.1 K91.32 K50.811 K62 K12.31 K20.8 K08.439 K94.09 K24 558.9 K94.00 K56.609 533.71 564.0 534.61 K51.414 K51.012 K80.46 K23 Q43.1 K00.5 K55.059 562.02 K55 K05.229 K00.6 K06.1 K45.1 K55.1 K78 251 K31.9 K40.21 K08.491 K51.014 530.3 K31.819 K08.434 K80 K56.3 K51.519 532.7 K82.9 K70.40 532.70 532.5 560.32 527.5 K17 R16.2 560.8 527.0 K27.4 K72.11 K18 K80.62 K91.870 K08.402 540.1 530.0 K03.2 K91.850 K11.8 569.43 560.9 K13.22 K31.82 K08.131 531 537.9 K80.41 534.4 K50.10 K08.139 K43.9 K91.89 K58.0 K51.212 K85.01 531.21 K70.11 564.6 K40.90 K85.9 K03.7 K97 456.20 K56.60 534.41 K51.419 K06.020 K91.873 K05.311 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Endocrine		242.11 E23.6 253 255.4 259.8 253.2 E27.0 242.90 253.0 250.62 250.72 250.02 P72 250.80 252.02 242.1 258.9 E05.40 E20.9 P72.8 250.3 242.2 P74.3 P72.2 259.2 775.6 P70.2 362.03 244.2 H05.239 250.42 250.10 E26.02 259.50 E23.0 240.9 250.30 242.8 E11.9 255.2 E11.359 250.82 250.50 250.70 255.9 259.51 255.13 242.41 250.0 246.3 E11.329 E34.52 362.05 P84 250.9 259.52 250.2 L68.0 E11.00 E26.01 E05.91 357.2 775.3 775.89 775.4 P74.5 241.0 253.4 250.52 E05.20 E11.21 P70.1 P73 E31.9 376.32 242.30 243 252.9 250.00 242 259.3 P70.4 E11.29 E34.9 362.02 250.22 775.5 E04.9 P74 242.80 E34.0 E05.30 250.7 E11.349 255.11 E00.9 E31.8 250.90 E26.9 250 E11.641 242.91 E11.65 E05.11 E22.9 E27.9 P74.1 250.60 P72.0 250.1 252.1 259.4 E21.1 250.6 242.31 240 E01.8 252.08 E04.1 241.1 259 E34.50 252.00 775.1 242.21 250.32 250.8 E07.1 255.41 255.10 362.04 255.6 E27.5 240.0 P74.6 E21.3 775.8 E23.2 E21.2 E11.40 244.9 242.20 E27.2 E23.7 E27.8 775.9 E05.41 252.8 242.4 E04.0 252.01 704.1 246.0 E07.9 775.0 E26.81 E11.51 E21.0 252 P71.8 E01.2 244 362.0 255.12 E13.42 P72.1 242.40 253.3 242.3 250.40 E03.2 E21.4 E25.8 250.5 E34.51 E11.620 775.81 255.42 E05.10 250.20 E04.2 255.5 E05.31 250.92 362.06 P74.0 252.0 246.9 253.5 242.10 E21.5 E27.49 E05.90 E03.9 244.8 250.4 P74.4 255.14 258.8 246.8 E05.21 242.81 241.9 259.9 P74.8 E11.8 362.01 P74.2 E26.1 253.6 E11.01 E11.311 E34.3 241 P74.9 E11.339 255.8 362.07 E07.0 250.12 E34.8 E11.319 E22.0 E07.89 246.1 P72.9 253.1 E22.2 246 255 242.9 E11.39 253.9 E11.69 255.3 E34.2 253.8

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Frailty		290 S88.911A F31.76 S98.919 333.82 897.3 F10.951 296.34 294.10 295.54 295.03 G24.02 295.53 295.33 298.2 295.52 296.32 S71.029A 295.70 331.7 891.2 S71.109A G24.01 296.21 295.80 F33.9 292.12 336.0 G24.3 G90.59 F19.94 S91.329 333.5 292.2 331.0 296.16 337.09 F28 296.81 295.34 F31.77 S81.829A 336.2 295.01 295.30 S98.912A 292.11 E75.23 291.3 F10.982 F44.89 S76.929A F10.159 G89.22 G32.0 292.89 296.25 331.89 F06.8 293.89 296.56 G90.09 296.22 334.2 F24 295.64 S88.912 333.81 G89.0 298.4 330.9 F31.63 G11.4 F06.4 295.91 333.3 G89.29 335.19 F23 295.24 F84.0 G31.81 F32.1 F31.30 295.84 G25.89 333.1 897.7 299.81 S98.019A 295.15 332.0 F29 F32.0 293.0 295.13 332 296.64 891.1 S98.019 335.21 F19.97 F30.3 335.23 297.3 333.6 338.28 299.10 F32.9 296.03 333.79 295 290.11 291.0 296.62 F10.239 S98.119 331 F30.2 R52 338.12 297 299.01 G12.9 S86.929A 295.23 S71.029 295.11 299.00 295.12 G10 290.13 337.9 G80.3 296.30 296.33 F33.2 F84.3 296 333.89 296.11 335.8 G25.0 F30.13 F31.73 F20.89 296.42 333 337 298 296.06 G31.09 G25.81 296.40 335.22 G90.529 F32.3 G12.8 F31.2 895 290.43 295.63 292 338.19 S71.129A 333.71 S91.129A 337.01 295.35 334.9 296.89 295.25 S88.119A S91.329A 290.9 331.5 F20.1 331.83 F20.0 293.81 G25.3 S76.929 295.94 295.85 290.41 337.29 291 G31.01 S98.912 298.1 S88.911 296.61 335.24 G32.81 G90.01 294.9 338.0 F04 G31.1 G25.82 291.4 892.0 295.73 334 895.0 F01.50 296.45 G20 290.42 891.0 G25.61 295.43 338.22 338 295.61 S81.009 338.11 S71.109 F84.9 F06.0 333.72 G25.83 F30.12 890.2 F31.32 G23.8 891 S78.119A G95.89 331.4 F31.62 296.53 F31.81 338.21 333.99 F10.27 295.02 G25.9 298.9 330 S78.119 F25.9 G21.11 S71.129 291.89 299 S91.129 294.11 296.63 296.7 296.12 295.41 F10.99 295.93 G89.4 F03.90 290.8 295.81 G90.9 295.60 295.40 F02.80 333.2 S98.119A G25.5 896.3 293.1 296.35 G89.21 F20.2 295.45 291.2 890 333.92 335.11 335.9 295.62 F31.60 F33.3 333.93 296.23 331.11 295.05 F01.51 F31.74 296.44 335.20 294 F05 897.2 337.20 296.52 296.10 296.51 333.85 295.44 G11.3 299.80 334.1 S98.911 291.81 295.75 291.1 295.71 296.04 293.84 296.13 296.41 337.00 G89.11 S71.009 S98.911A 331.2 897.0 299.91 291.5 893.1 F32.8 297.9 894.0 330.3 F32.4 G91.1 333.84 F32.5 295.82 S88.919A 296.26 330.8 F30.8 G95.0 331.81 S98.919A S91.309A 295.21 331.19 338.29 895.1 331.3 297.1 F10.929 338.3 G90.519 892 G24.1 G30.9 G95.9 G99.2 295.10 295.90 295.92 S88.919 295.83 292.83 F02.81 331.82 333.90 F31.31 292.82 G93.89 F15.920 296.15 335.10 G12.1 S88.119 F22 293.9 337.22 F06.30 336 299.90 330.1 296.43 F39 335 291.9 334.3 G11.0 892.1 897.1 897.5 893.0 295.95 297.8 F33.1 333.0 333.83 897 F84.8 G12.0 336.1 337.1 292.84 G31.89 F11.182 295.42 290.10 296.66 296.90 337.21 333.4 296.00 F19.921 G91.0 296.02 296.14 G91.2 F31.13 290.3 295.72 894.1 296.82 296.36 290.0 G31.83 897.6 F31.9 F34.8 295.14 G89.12 F30.10 F19.939 332.1 337.3 334.8 897.4 F32.2 896 G12.29 297.2 F31.78 G31.84 291.82 290.12 G12.21 295.55 296.24 293.83 334.4 G94 331.9 G24.5 F20.81 F31.61 334.0 296.20 G21.0' F19.950 S91.309 292.0 F06.1 294.8 G99.0 G89.18 F33.41 335.29 298.3 299.11 294.0 S81.009A S96.929 292.85 295.32 G31.9 890.1 298.8 338.4 S96.929A 896.2 896.1 298.0 F20.5 F33.42 296.65 S78.019A F31.75 893 297.0 S91.109 295.31 296.80 296.46 F19.951 892.2 333.91 296.05 F31.11 F31.5 F10.231 S88.912A F10.950 893.2 330.0 E75.4 296.55 F19.99 F10.96 295.20 G95.19 295.22 295.04 S71.009A 292.9 894.2 F31.64 890.0 G24.9 292.81 G93.9 295.50 S91.109A S81.829 296.60 G12.22 F19.96 S78.019 G11.1 F06.2 F30.11 896.0 296.54 296.50 335.0 295.51 290.21 290.20 G24.4 F20.9 336.3 894 338.18 F31.10 G90.4 G89.3 G89.28 293.82 293 F11.159 333.94 330.2 295.65 336.8 S86.929 290.40 F30.4 295.00 G24.8 F33.0 G93.7 F31.4 296.99 336.9 F31.12 295.74 296.01 296.31 G11.9
Health-Services		V58.49 V12.50 Z79.2 Z28.3 V04.5 V77.2 Z01.89 V06.3 V10.52 Z00.8 V12.49 V02.61 V70.8 Z93.52 V15.05 Z76.89 V03.89 V71.5 Z41.3 V03.2 V06.0 V02.60 V58.0 V15.1 Z22.31 Z11.59 V18.3 V15.02 V58.30 V72.9 Z82.49 V13.69 V53.7 V57.3 V03.6 V17.4 Z87.898 V12.01 V58.78 V77.0 Z02.1 Z71.3 Z48.01 V71.1 V06.1 Z22.51 V01.84 Z41.8 V54.19 V31.01 V64.2 Z38.1 S92.302 V64.00 Z51.11 V07.0 R13.10 V15.01 S59.101 V04.81 V59.9 Z09 V05.9 V01.79 Z02.81 V68.9 Z91.048 Z00.00 V80.2 V12.61 Z13.0 Z13.5 V67.59 V05.2 V09.0 V54.12 S92.302D V12.59 Z82.5 Z46.82 V54.89 Z91.012 Z11.8 V68.89 V17.49 V15.83 Z13.9 Z00.111 Z01.20 V02.2 Z72.820 Z22.50 V06.9 V76.3 V48.9 V72.7 V65.49 V67.4 V07.9 V74.8 V44.1 Z23 V54.09 V58.9 V55.4 Z91.011 V81.6 V77.99 V41.1 Z91.010 V61.29 Z91.038 V55.1 Z28.82 S72.471 S72.471D V29.3 Z87.19 Z48.812 V58.43 Z48.810 V70.2 V55.8 V81.5 Z76.2 Z48.813 Z47.89 V45.51 V41.0 V06.5 Z91.81 Z46.6 V13.02 Z97.3 V07.8 V71.2 V43.1 V75.7 Z13.220 Z01.110 V31.00 Z68.51 Z11.1 Z13.21 V58.74 V72.11 Z01.10 Z38.30 V82.5 V03.3 V41.6 Z45.2 Z11.6 V12.60 Z51.0 Z38.69 V13.7 V78.9 V71.7 V54.10 V54.9 Z11.2 Z55.9 Z39.1 V61.20 V44.52 V70.9 V33.01 V74.9 V05.8 V40.9 Z01.12 Z22.1 V75.9 Z53.29 V29.8 V49.75 Z43.1 S72.011 Z20.9 V54.01 S02.8xxD V20.31 Z13.4 V72.82 Z20.6 V20.32 F69 V12.09 V21.9 V05.4 Z96.1 V18.0 V30.00 Z86.79 V66.5 V04.82 V58.11 V67.9 V21.8 Z71.9 Z43.0 V62.3 V81.4 Z63.9 Z48.03 V67.2 V58.89 V15.09 V04.4 V78.3 V14.3 Z43.8 Z04.41 S42.101 V68.09 V53.6 V54.16 V20.1 Z98.89 Z16.11 V77.7 Z72.4 Z47.2 Z83.2 V03.81 V53.2 V15.86 V81.2 Z46.9 Z13.228 V85.52 V12.51 V77.6 V54.13 V03.5 V55.0 V07.1 V72.85 V54.15 V67.00 V72.1 Z00.3 Z86.718 V15.5 V61.8 Z85.830 Z86.59 V73.89 P00.2 V72.19 Z46.2 V09.1 Z20.811 Z79.01 Z04.9 Z51.89 V49.2 S52.90x V79.9 V71.81 Z85.528 V82.6 V01.7 V44.0 V19.6 V04.6 V06.2 Z38.31 V45.89 V72.84 V85.51 V77.3 V34.01 V65.43 V65.40 V69.1 Z22.330 H57.9 V04.0 Z77.9 V72.6 V07.39 V01.5 V71.9 V39.01 V12.6 V72.83 V58.82 V78.0 V78.8 V58.31 Z68.53 V44.2 V03.82 V85.54 Z76.1 V20.0 V58.69 Z13.89 Z01.810 V72.2 V70.0 Z48.00 V70.5 Z13.83 Z01.812 V45.2 Z88.3 V70.4 V06.4 V58.73 V05.1 V58.61 V72.31 Z52.9 Z00.110 Z87.01 Z03.89 Z83.3 V19.8 V15.89 Z87.440 V02.4 V49.5 Z86.69 V72.0 S59.101D V01.9 Z20.3 V10.81 Z13.29 Z01.00 V25.01 V13.9 S52.90xD V50.2 Z38.00 Z93.0 V78.1 V02.59 Z03.6 V72.69 V57.89 V02.9 V58.62 V67.51 V74.1 Z68.54 V79.3 Z79.891 V68.1 V07.2 V30.2 Z93.2 V58.32 Z08 V69.4 Z43.4 Z87.798 Z87.09 Z91.018 Z71.1 V04.8 V04.2 Z86.11 V77.1 V76.12 Z22.8 V15.88 V29.0 V61.9 Z12.31 V82.9 Z38.01 V03.1 V02.0 V54.11 Z62.1 Z01.411 Z63.8 Z48.89 S72.011D Z60.3 V16.3 V71.02 V71.89 V01.89 Z98.2 Z71.89 V14.1 V20.2 Z02.9 V58.81 V70.1 V18.19 V24.1 V65.5 V15.06 R68.89 V80.3 V79.8 Z51.81 V06.8 V72.5 Z89.519 V58.71 V30.01 V40.3 V71.4 V58.83 Z13.828 V19.1 Z12.6 V04.3 V19.2 V53.90 V29.9 V07.31 V12.00 V57.1 Z78.9 Z13.1 V77.91 Z68.52 V65.9 V72.62 V70.3 Z77.011 V14.0 V01.1 Z02.89 Z82.2 Z01.818 Z80.3 Z46.89 V05.3 V02.51 V72.63 Z04.71 V12.79 V17.5 V72.12 Z13.88 V05.0 V30.1 Z86.19 Z00.2 V15.03 V53.09 V72.60 Z76.0 Z30.011 V04.89 V03.9 Z04.3 V85.53 P00.9 V21.0 Z20.1 V58.3 Z84.89 Z93.1 V49.89 Z88.1 V40.1 V62.4 V21.2 V82.3 Z02.79 V72.81 S42.101D S02.8xx V41.2 Z48.02 V39.00 V67.09 V65.8 V65.3 Z20.89 Z22.0 Z11.9 Z04.6 Z46.1 Z00.129 Z16.10 Z83.49 V50.3 Z28.9 Z88.0 V71.09 Z13.6 P00.89 Z97.5 V02.1 V82.89 Z01.811 V57.21 V06.6 Z41.2 V64.05
Hematologic		D68.59 P59.29 D72.822 P58.42 P52.5 D50.0 P61.2 280.8 P57.0 P50.8 P52.0 282.69 286.0 774.5 D69.2 P50.0 P10.0 281.8 D57.411 D51.0 287.8 286.7 282.5 287.32 774.1 289.51 D55.9 P59 772.14 282.60 280.9 D53.8 D57.211 D59.9 284.8 D61.811 D59.2 D59.6 282.1 D73.81 P52 D61.09 287.3 281.0 282.42 773.4 P50.1 283.11 287.5 286.1 D68.318 D64 773.5 D68.8 285.21 776.4 772.3 D72.820 284.1 P51.8 D63.0 283 P61.5 D78.02 D59.1 772.9 P59.9 283.10 D50.9 D59 D68.311 D53 P10.8 D78.34 D75.81 D72.9 D57 P10 287.39 776.3 D58.9 P10.1 286.4 D74.0 287.31 D55.8 D75.0 285.29 D68.61 D78.81 D72.810 D69.9 D55.2 D60.0 D52 P55.0 D73.0 282.61 D59.5 P54.6 D53.0 285.1 285.22 289 D64.1 289.82 D59.0 D78.33 P61.0 D63 284.0 D61.1 D74.8 P54.2 289.81 281.9 D64.2 D76.3 776.7 P58.0 P58 D57.412 P58.41 773.0 772.13 D64.3 D61.9 D53.1 D68.52 D72.828 D75 P60 P52.8 D52.1 D60 P58.8 283.1 P57 D70.0 D78 D58.1 D69.49 289.59 P61.1 281.3 282.49 D68.32 283.9 D58.0 286.5 P52.4 D69.3 D73.9 D68.51 D57.80 774.31 D57.819 286.3 D78.21 284.81 D73.1 D77 282.68 P10.3 D56.4 D68.0 D73.89 D78.12 D58 284.2 D55 D76.2 P61.8 776.6 282.7 776.1 D53.9 289.52 D57.811 D56.2 D75.9 284.9 P52.6 287.30 D72.829 D68 772.6 287.0 D52.8 282.62 D68.69 776.0 774.4 D72.825 286.2 D57.812 P54.4 284.09 P61 D72.819 284.89 D73.2 282.40 D57.20 284.01 D68.2 D72.0 P58.9 D75.89 D55.3 D61.82 D56 P54.1 773 D53.2 282.9 D56.8 776.9 D69.41 772.4 P56.0 D60.9 D78.11 P59.0 286.9 D78.32 281.1 285.8 D52.9 P50.3 287.41 D57.212 289.8 287.33 D72.823 D72.824 282.64 P54.3 P55.9 D59.3 D58.2 D60.8 D70.4 D51.9 D69.42 P59.8 P61.4 D64.4 D69.1 P57.8 D75.82 D69.6 287.1 P58.2 280.0 P58.5 P56.99 P61.6 772 P50.2 D56.1 P50.4 D70.3 P52.21 284.19 D78.01 282.2 D70.8 D51.1 D50.8 D61.818 D51.8 D57.02 D57.1 D75.1 287.2 774.0 P51.9 774 D69.51 P54.8 P58.1 282.41 285.2 D56.3 P54 D72.818 287.9 P55 P61.9 P55.8 772.8 D54 D52.0 773.3 282.6 D73 D61.2 772.0 774.2 284.12 D78.22 282.8 287.4 D64.9 D55.1 P59.3 P52.22 D74 P54.0 D70 280.1 287.49 287 D76.1 D78.89 289.7 P52.1 D72 D50.1 289.89 D72.1 P56.90 281.2 772.2 286.6 772.11 289.4 D68.1 D59.4 D69.0 D73.4 D58.8 P52.9 D67 P59.1 776.8 D59.8 289.9 283.19 284.11 D61.3 D51.3 D61.89 D66 D57.40 283.0 D71 D56.0 281.4 D61.01 772.10 D69 284 P56 772.12 D51 774.6 D56.5 285 P10.4 D78.31 D63.1 D70.9 P54.5 D72.821 D57.219 P59.20 D57.3 D51.2 D64.89 P61.3 P50.9 772.5 D69.59 285.3 P54.9 D68.4 P55.1 285.9 776.2 289.50 D73.5 282.3 D62 282 776.5 D72.89 282.63 P57.9 D61 D57.00 D63.8 P51.0 D70.2 D74.9 P58.3 P52.3 D56.9 D55.0 D57.419 776 D68.62 D69.8 D68.312 D70.1 289.83 774.7 D64.81 773.2 774.39 D64.0 P50.5 P50 P53 D61.810 774.30 D76 P51 289.5 D73.3 773.1 D60.1 D68.9 P10.9 D65 P10.2 D50 D57.01
Hypertension		404.00 403.00 I15.9 403.11 404.0 402.00 404.10 I11.9 401. 403.0 I13.10 403.90 405.9 I16.1 402.10 402.1 404. 403.1 I15.2 404.11 404.03 403.9 404.1 405.09 404.91 I15.0 401.1 405.0 405.91 403.10 404.12 40311 404.9 404.13 I13.11 I12 I16.0 403 401 402.91 404.02 405.1 I10 I15.1 402.0 I15.8 405.99 405 I13.0 402. I12.9 402.01 I16 403. 404.93 401.9 I11 404 405.19 I12.0 404.01 403.01 403.91 405.01 405. 402 I15 I13 404.90 I14 402.90 404.92 402.9 402.11 I16.9 I13.2 404.04 405.11 401.0 I11.0

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Immune		H10.439 716.08 M86.642 273 003.23 M46.80 288.65 711.03 360.04 716.86 I89.9 I80.3 279.00 477.9 M02.369 K52.81 N34.0 711.11 582.81 728.82 K29.81 I89.0 715.15 597 710.0 A39.83 730.25 716.46 E10.11 M02.169 D73.81 M15.9 M81.0 J34.81 716.10 708.8 J32.9 M16.10 451.8 511.0 G37.9 M12.129 711.64 716.15 E06.0 H01.019 478.22 254.9 716.8 535.2 595.2 730.13 J45.991 692.84 J32.0 711.05 446.0 721.42 D89.0 M86.179 373.32 G35 D84.1 I05.8 555.9 571.49 716.43 250.23 D80.3 250.83 249.61 N03.5 250.21 535.10 459.10 H57.13 719.33 H16.309 733.01 476 451.84 249.20 711.90 464.2 D86.1 M12.829 M33.90 D89.49 288.0 J35.03 493.81 J35.01 250.81 715.10 713.2 475.0 711.83 721.4 K51.40 711.86 M94.0 716.35 716.02 716.88 254.0 L41.8 289.3 364.0 D72.828 M12.00 535.71 711.58 M13.80 716.01 M05.60 692.3 H57.8 M02.339 H15.129 716.20 711.84 288.6 N30.30 M02.319 363.05 711.65 376.12 M86.149 373.31 716.6 396.1 M08.3 E32.1 H30.009 696.8 D86.82 D83.2 535.21 713.6 370.60 478.24 M12.80 695.15 363.12 582.9 M02.149 373.2 373.1 245.0 474.8 715.93 H30.029 I08.0 M13.849 E10.21 530.19 D81.0 464.10 L50.8 L24.0 M02.10 376.1 716.41 249.00 478.20 E32.8 I02.0 476.0 M12.529 711.95 464.20 N30.20 279.8 729.4 L40.8 716.38 D81.819 D84.9 E31.0 M12.9 715.95 M86.9 370.61 D72.819 692.6 363.22 M02.359 M13.829 372.10 686.0 360.1 396.0 249.5 535.4 711 D83.0 M01.X49 716.29 714.81 I77.6 H01.129 716.85 D86 E08.21 535.51 693.0 H30.129 397 711.21 D80.9 595.1 D72.824 446.3 364.11 242.01 M46.90 M13.149 730.01 M12.379 474.11 373 D81.818 I01.9 716.42 478.21 279.11 J34.1 L28.2 370.55 730.28 556.5 E08.40 711.52 373.3 595.3 249.90 582.1 730.07 I80.219 711.63 289.1 D80.5 M12.519 D81.2 288.02 K51.80 556.8 394.9 446 J37.1 288.66 364.00 715.30 D80.7 J44.0 711.76 730.06 M72.2 D89.811 D89.9 696.4 I87.009 M36.2 711.09 398.99 E10.65 595.81 446.29 716.91 711.91 711.18 E10.9 M12.579 715.04 H15.019 288.01 555.1 I87.099 694.6 M34.1 711.44 519.2 K58.9 477.8 364.1 D86.2 250.71 715.24 E08.65 711.24 M05.10 715.16 714.2 714.0 715.17 394 711.50 L20.89 716.84 464.21 M31.30 M86.18 464.01 716.49 G37.0 446.7 711.53 711.47 L27.0 M06.4 461.0 M12.88 J04.10 695.4 M12.19 H01.029 J04.11 372.31 H16.249 363.04 459.19 457.8 478.11 714.31 711.9 E09.65 M02.159 D86.89 493.11 M60.20 711.73 H00.039 J35.1 J45.990 716.60 730.20 711.60 D85 H16.429 457.9 L73.2 459.13 716.12 696.3 K29.01 M02.179 474 370 555.0 M31.0 711.43 363.14 711.08 H20.9 K29.41 245.4 H05.10 M33.20 363.03 379.01 716.54 250.41 373.34 L92.3 363.20 716.50 464.11 716.63 446.4 I73.1 694.60 511.89 715.98 249.31 461.9 L51.1 715.34 I06.0 M02.349 711.35 395 711.88 474.9 716.61 I06.1 711.15 D86.0 370.9 711.82 M13.139 D89.89 716.34 372.12 H40.40x0 M13.0 I07.2 I80.8 711.12 715.9 L04.9 716.44 730.00 730.21 J01.20 711.33 H30.139 692 D86.84 M02.18 535.50 M00.09 H20.819 708.1 M19.079 M12.319 716.51 556.2 M13.159 L10.9 288.04 289.6 M35.00 279.09 730.0 E08.10 695.12 363.07 459.1 370.63 716.87 692.9 L30.4 364.04 M13.869 451.89 715.21 392.0 M12.119 720.89 249.4 686.09 711.20 H30.93 711.40 715.26 K52.2 L21.9 716.95 D89.2 D80.2 J91.8 379.93 M12.339 J30.5 693.8 715.80 M17.5 D83.1 720.0 249.71 461.2 571.40 711.5 L92.9 D81.7 358.0 H20.13 730.24 249.60 396.8 711.81 M01.X8 580.4 695.11 363.1 716.96 715.97 250.53 E08.620 475 716.53 249.70 M08.40 J35.9 D80.4 D70.0 478.29 715.27 M02.129 G70.00 H16.269 451 M00.08 373.9 L08.89 693.9 710.1 686.01 K29.90 H10.409 M30.0 451.19 396.2 363.00 530.10 M12.169 M47.10 M14.80 714.3 493.1 E10.39 716.99 M13.88 M02.00 E05.01 477 K29.00 E09.311 N03.8 E04.1 698.2 H16.449 728.71 J30.0 D80.6 464.0 711.29 461 288.3 571.41 L44.8 721.41 719.36 597.89 474.00 N00.9 711.98 I08.8 711.89 M12.50 D72.825 713.0 564.1 721.91 711.87 711.80 H20.829 N08 H44.019 716.22 341.1 I06.2 715.36 443.1 E10.29 D72.0 279.05 715.13 J01.40 457.0 373.00 711.45 579 M47.16 I01.8 H20.23 277.39 M01.X39 716.65 L93.0 289.2 461.1 535.41 279.2 M19.229 M17.10 I88.0 E10.51 H40.40x 730.26 J01.90 M00.019 M19.219 715.18 D70.4 716.11 708.0 695.89 711.28 250.43 M86.669 716.16 M12.18 K75.4 M02.379 L53.0 711.31 249.7 H30.039 H10.429 288.61 394.1 D86.9 H20.049 556.9 694.8 D70.3 D70.8 L50.3 M02.39 730.04 451.0 D87 325 288.60 473.9 M02.19 I09.89 694 E10.40 D84.0 698.4 E06.9 H05.119 250.31 L25.9 M00.049 711.69 692.8 L52 245.3 706.3 711.32 K51.50 E06.4 720 M08.00 711.94 396 K29.80 M86.659 716.06 D76.1 D82.9 711.49 279.03 580.81 715.06 397.9 535.61 535.00 715.08 L25.1 M31.4 715.90 288.51 358.00 K51.90 716.93 J45.909 D82.1 716.55 370.6 H01.9 J39.2 713.1 I80.00 M12.369 360.00 J04.0 D84 696.0 730.23 250.03 H15.059 373.12 K29.91 288.2 M86.68 D70.9 J32.1 715.35 I88.9 250.61 473.3 379.06 711.54 715 M19.249 M12.39 I80.10 692.1 730.08 394.2 716.48 M47.14 364.23 K51.00 711.48 716.17 373.11 719.30 370.62 M19.279 446.20 535.5 099.3 716.9 711.68 M30.3 372.1 711.72 716.07 379.0 J35.2 249.6 715.23 716 364.22 H01.009 719.3 716.89 716.81 711.70 730.14 720.2 708.9 582.0 N30.10 715.89 556.4 580.89 398.90 N03.3 716.21 711.14 398.9 L51.3 D89.82 H44.029 398 E05.00 716.67 719.37 451.83 711.42 710.3 D86.83 363.2 396.3 H16.339 360.01 711.7 249.9 370.54 I39 493.8 711.6 582.4 H15.009 715.31 245 714.8 249.30 E32.0 451.2 D83.8 535.70 D81.1 I87.029 E08.9 245.8 511.8 714.4 719.39 696.1 279.12 711.37 711.16 715.2 M19.039 M16.7 597.0 M46.1 L23.0 372.13 457.2 M15.0 711.06 692.4 H16.409 370.50 715.25 J45.21 I80.209 I88.1 713.7 713 708.2 555.2 M31.1 395.2 462 M12.869 242.00 J01.10 H01.8 288.64 K29.61 373.01 379.00 730.27 E08.51 M00.069 L51.9 711.2 288.5 473 379.04 493.0 715.09 714.32 E32.9 457 J94.1 721.1 249 535 493.91 L30.5 D86.85 E08.8 373.33 J05.0 373.0 716.40 D81.5 493.12 715.96 692.81 K50.80 493.00 D81.4 J30.2 H01.119 K73.8 M19.029 279.3 J02.9 595 N03.9 I08.9 L50.1 H00.019 J30.1 695.13 L50.5 716.27 M16.9 711.17 730.19 H20.019 364.10 L98.1 595.0 L44.0 L30.1 530.12 716.0 288.69 730.22 E06.1 556.0 715.22 360.03 A02.23 683 364.24 730.18 279.02 451.81 H44.009 716.09 J39.8 N30.81 D89.3 254.1 373.13 730.09 K52.1 720.81 364.02 M14.60 288.62 464 M12.149 716.30 M19.049 I80.9 391.8 715.33 L00 711.36 571.42 358.01 511.9 364.21 711.56 279.13 711.71 446.5 D83.9 711.66 M00.029 711.02 D72.829 370.52 711.78 L88 363.11 719.31 M00.079 360.02 695.1 249.21 D81.89 711.13 M12.859 715.05 D80.0 571.4 M12.179 D88 M15.1 M13.10 N00.3 M19.90 713.3 H30.119 372.14 K20.8 735.2 705.81 D81.6 H16.439 J35.8 464.00 M35.3 711.39 L27.2 N03.2 M12.30 D72.823 719.32 478 363.21 250.73 J01.30 250.01 M31.6 245.1 478.8 692.0 694.9 G70.01 693.1 493.82 D81.810 L27.9 715.91 714.9 M13.819 M12.329 J32.4 477.0 597.8 I05.1 478.19 I97.2 714.89 E08.01 363.13 711.0 493 720.8 364.05 474.01 M01.X69 691.8 288.50 493.01 289.53 459.12 H16.329 249.91 H30.23 D82.2 716.90 535.40 I89.1
Infections-Bacterial		041.4 T79.A21 T79.A29 041.86 A43.0 034.1 020.1 030.0 041.5 A27.89 038.2 023.3 T50.A25D A25 021 A24 040.89 A48.0 036.1 041.7 040.82 041.10 039.3 T50.A24S A39.83 T79.A22A 036.3 A23.9 B96.81 A44 041.04 A48.51 026.1 A37.80 032.84 041.00 A41.02 H90.A21 A22.0 A40.0 B95.0 A27 A21.2 A49.3 T50.A22 T79.A29S A48 020.3 040.3 041.84 038 A30.3 020.5 T50.A22D I82.A23 H90.A32 A39.50 T50.A21A J02.0 A22.8 A36.2 T50.A23A A41.89 038.19 041.3 A41.81 A20 A30.9 020 A22.2 A41.2 A32.89 041.03 030.8 A23.0 036.81 A28.2 A36.85 A39.9 032.2 041.6 A49.8 I82.A29 036.42 B47.9 M79.A21 T50.A25A 020.8 M79.A22 038.40 041.83 A31 038.44 T79.A22S 040.81 027.2 027 032.83 A46 038.49 039 041.85 036.40 A44.0 T50.A22A 038.42 A42.89 B95.7 A21.8 A41.01 A36.9 A39.3 A20.9 A40 H90.A22 T50.A26A A49.01 A37 023.1 041.09 A49.9 A49.1 A22 A23.1 T79.A21A A48.52 A49.2 A22.7 A42.7 A28.1 M79.A29 034 A32 031.0 038.10 A38.9 A21.9 037 A21.3 A48.3 038.0 A48.8 A39.1 022.0 A49 020.9 A28.9 A39.89 026.0 036.0 036.82 A30 T50.A26 A44.1 041 T79.A21S 036 A26.7 A28.8 039.1 A22.1 022 B95.1 A41.1 A36.0 A44.9 038.3 020.0 A27.0 038.12 A20.0 A43.8 023.9 A23.8 A39.53 027.9 B96.4 T50.A23 A41.9 A36.3 033.1 030.9 040.2 A25.0 A41.51 A32.12 A36.86 A23.2 A39 022.8 029 B96.89 A22.9 030.1 034.0 036.43 B95.8 A38.0 T50.A24 B95.4 B96.5 T50.A26D 027.8 A40.8 T79.A29D A36.1 A39.82 A43 A44.8 040 039.2 T79.A22 021.9 A43.9 L08.1 A26.0 020.2 A37.10 036.41 022.1 041.9 A42.82 038.41 A41.50 A35 B96.7 021.1 T50.A21S A49.02 T50.A21D A32.7 T50.A23S A20.1 T79.A21D A37.11 A48.4 T50.A25 A36.81 A41.53 033.8 A30.8 032.82 A21.1 A36.83 032.81 A21.0 A39.2 A32.11 023.0 A40.9 041.19 M60.009 021.2 032.1 035 A40.3 B96.1 028 A36.82 022.3 A34 A37.01 036.2 A47 023 B95.2 A38 A30.1 033.9 A42.2 041.81 032.89 A30.4 A39.4 A39.0 I82.A22 020.4 A41.4 027.0 038.8 A39.52 021.3 036.89 T79.A22D A21.7 A32.9 031.2 A37.81 041.89 A37.91 T50.A23D A30.2 A23.3 T79.A29A A42.9 030.3 A32.82 A40.1 A32.81 A26.8 T50.A26S 038.43 B96.3 H90.A31 A31.8 039.4 041.01 032.9 039.9 024 040.42 040.41 030 A39.51 041.82 041.2 A36 030.2 A41.59 A48.1 A26 T50.A25S A38.1 025 021.8 A31.1 A37.00 040.0 026.9 031.9 027.1 036.9 A42.0 032 031.1 023.8 A24.0 A28.0 A43.1 B95.61 B95.62 A20.3 041.11 A31.0 I82.A21 A25.9 022.9 A42 A41.3 B96.6 B95.3 A30.0 041.12 038.9 A45 A28 A30.5 A48.2 031.8 A20.8 A31.9 A39.81 T50.A24A 040.1 A31.2 A39.84 A25.1 A42.81 033 T50.A24D A24.1 A27.9 A26.9 A27.81 B95.5 A23 K90.81 021.0 041.05 A37.90 032.3 039.0 A36.84 A42.1 033.0 A33 032.0 026 A32.0 A29 T50.A22S 023.2 032.85 A24.9 A21 A41 T50.A21 039.8 A24.2 038.11 A20.2 A24.3 A20.7 041.02 A41.52 022.2 A36.89 A38.8 031
Infections-Fungal-and-Other		B46.4 122 B90.2 M86.642 B76.8 B58.81 M90.829 123.0 B87.2 B77 T50.B96D B69 136.4 B63 B37.1 B54 117.4 122.3 M62.3 B40.81 B67 B47.1 126.2 B60.11 B94.2 M62.89 122.4 B95 114.4 B35.0 133.8 138 123.1 115.00 B73.1 B74.8 B81.2 128.8 728.82 B57.1 728.3 B57.49 B48.8 B60.12 B35.2 139.0 116.2 B65.8 B37.81 730.91 T50.B93S 117.7 B65.3 B39.5 B94.0 B88.2 M90.869 B67.39 115.94 730.00 127.3 730.21 B75 728.85 B51.0 125.2 730.25 B37.3 B96.81 B40.89 134.9 133.9 M90.839 131.01 131 B43.1 B83.9 B57.32 B65.0 136.29 B36 B37 122.2 B87.89 B95.0 B50.0 B66.8 114.9 B66.2 730.81 B43 B44.89 M90.849 115.10 B38.89 B40.9 M62.838 B71.1 B83.2 130.1 730.94 B42.89 112 B60.0 B35.5 B74.4 B38.7 B52.9 M86.639 B98 117.8 B97.32 137.2 B42 B97.11 127.9 B50 730.27 B37.6 122.5 B58.9 B81.3 115.03 I32 B39.1 B37.41 122.6 B58.89 730.98 B56.1 115.99 B46.9 730.13 112.9 B55.9 T50.B96 730.95 B59 A07.8 T50.B91 T50.B92D B46.0 B67.4 M46.30 123.6 B76 B77.0 112.89 B37.84 M86.179 136.5 115.14 B73.00 B47.9 B36.0 B60.10 B45.2 730.77 730.36 111.0 B38.2 B80 120 730.38 B40.3 B48.3 130.9 B40.2 121.5 B37.0 730.82 730.32 B83.1 112.1 122.8 M89.659 M62.81 110.4 T50.B94 B53 B43.0 730.03 117.5 111.3 B81.1 T50.B91D B46 M86.619 728.10 127.8 128.9 B88.8 130.2 M86.19 730.29 137.3 136.3 730.24 B97.0 113 B57 136.9 B87 B95.7 728.81 B97.89 B45.8 B45.9 110.6 121.2 B76.1 M46.20 B37.9 B97.10 B74.3 B57.0 A59.00 B66.1 B77.89 112.5 730.19 115.13 B37.83 111.1 728.0 B55.1 B35.1 B78.9 117.0 730.22 B85.2 H32 M86.60 M62.00 M86.20 730.17 112.84 730.18 B38.0 B71.9 728.12 B53.8 B79 B60.2 M89.619 T50.B93 B97.35 M86.149 B45.1 B37.5 A59.9 730.09 B38.1 B67.7 126.3 M90.879 728.6 B51.9 111.8 B35.6 123.4 M61.10 B78.0 121.1 B58 B44.0 B40.0 B72 B97.4 B35.4 730.76 730.15 730.39 T50.B95A B37.7 112.83 730.75 B96.22 117.2 M89.669 B36.8 728.71 B41.7 B71.0 B71.8 A59.8 B48.0 110.9 B56.9 B65.9 M35.7 B67.99 127.7 730.96 B44.9 T50.B95D M62.82 B65.1 B88.3 L94.6 730.88 123 B68.1 B46.2 M60.10 B68.9 B95.1 B86 B43.2 T50.B96S B87.81 112.81 114.0 728.2 B60.19 131.9 B57.42 120.9 131.8 B97.39 B83 M89.679 137.4 125 130.4 730.33 B96.4 117.1 B78.1 B99 B97.5 133.0 133 130.0 121.4 B88 T50.B92S 116 B57.2 B37.2 A59.03 123.5 B85.1 B78 B41.8 M86.9 B38 112.2 139.1 B97.29 B96.89 B51 123.9 B38.4 129 B40.1 B97.12 123.2 B40.7 728.5 B99.9 B88.9 M61.40 B71 B81 114 730.31 J17 121 B36.2 B50.8 B95.8 B81.0 132.9 B57.39 M72.4 T50.B91A B55.2 B69.81 134.1 132.0 B39.2 T50.B93D 110 B42.1 134.8 B77.81 126.0 B67.5 B95.4 T50.B91S B41.9 B96.5 B48.4 B69.89 B67.61 132.2 B46.5 M24.20 B85 B35 115.04 T50.B92A 123.3 B58.00 B37.42 B47 115.05 B68.0 110.0 B36.3 B85.0 B87.9 115.01 730.26 126.8 110.5 T50.B95S 121.6 730.30 730.01 B56.0 130.8 B60 B87.82 B83.4 728.19 730 B51.8 728.11 B67.69 111 B90.9 B94.1 B96.7 M86.669 B52.8 B96.21 728.89 730.12 B38.81 B45 B73.02 B67.8 B58.2 124 730.28 B67.32 121.0 110.8 B87.3 134 D86.9 132.1 A59.09 M90.819 111.2 730.07 B66.4 115 125.7 130.3 B39.9 B85.3 B67.2 728.84 730.04 B69.1 A59.01 134.0 B38.9 B40 B94.9 115.12 B55.0 B42.7 127 B36.1 B97.33 B93 136.8 M60.009 128.1 B74.2 B96.23 121.8 B85.4 M90.80 A59.02 730.10 112.4 B39.3 117.9 B96.1 730.06 M72.2 B73 B82.9 B66.5 B69.0 139.8 B95.2 137.1 B42.0 B46.3 B48.1 115.09 B67.90 B94.8 137.0 M86.169 130.5 M86.139 131.09 115.02 T50.B93A M61.00 125.1 120.1 128.0 139 M89.69 728.87 M86.659 730.16 132 B78.7 B35.3 M86.129 116.1 120.0 B44.1 122.0 B39.0 B45.3 730.37 730.72 B57.40 730.85 B97.21 B82 B74.0 M86.119 128 M86.69 B39 B94 136.21 B58.83 728.88 B57.5 B39.4 T50.B94A T50.B92 B38.3 120.8 B99.8 M86.159 B96.82 730.78 B74 728.13 B48 730.80 B82.0 B36.9 B46.1 T50.B94D B68 B37.82 B96.3 B43.9 728 B58.3 122.9 728.79 T50.B96A 730.35 730.11 B62 B90 B97.81 115.91 M89.629 B81.8 115.19 B96.20 B42.81 B90.8 B97.6 B84 M72.0 132.3 126 B97.34 B41 B65.2 127.4 B45.7 730.02 M90.859 125.0 114.5 111.9 730.89 117.3 730.83 M86.18 B49 B70.0 730.90 M62.9 110.3 115.90 T50.B95 B66.0 110.1 B88.1 131.02 M72.6 B57.30 126.9 730.87 730.23 135 M62.50 110.2 B44.7 134.2 M61.9 117 B44.81 B95.61 B95.62 B69.9 B52 M86.68 B65 114.3 T50.B94S B97.31 125.5 B76.9 B45.0 M35.2 B70 B74.9 M61.59 B77.9 M89.60 B70.1 730.34 116.0 125.6 127.2 B67.1 728.9 B81.4 B90.0 730.08 M89.639 B50.9 119 B60.8 B43.8 B52.0 B96.6 B97.30 B66 B89 B87.4 B95.3 120.2 M62.10 B97.19 728.86 B37.89 B57.41 B58.09 136.0 122.7 130 136 127.1 B90.1 730.71 G02 B92 114.2 B87.0 M60.20 730.84 730.86 730.99 112.85 B64 114.1 730.92 B61 730.20 M89.649 125.9 115.93 B42.82 B73.01 127.0 136.1 117.6 730.05 730.73 115.11 121.3 B57.31 M86.679 B97.7 B35.8 M86.629 730.14 B76.0 B87.1 B83.0 B73.09 B96.29 M90.89 127.5 B83.8 B60.13 121.9 123.8 B95.5 B44 B53.0 126.1 B58.1 112.3 B41.0 B97 730.74 728.83 B46.8 B47.0 B37.49 125.3 B91 B96.0 130.7 131.00 B58.01 B74.1 B56 B53.1 730.70 127.6 B83.3 B66.3 B67.0 B66.9 I39 112.0 120.3 B44.2 B55 B58.82 730.79 B42.9 730.93 B48.2 728.4 115.15 131.03 122.1 730.97 112.82 137 118 115.92 125.4 B67.31 B88.0 M89.68 B35.9 B96 M90.88 115.95

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Infections-General		041.4 017.10 B02.21 055 098.14 042.9 B09 011.80 569.5 B69 136.4 A19 078.0 057.8 A50.09 017.81 590.3 083.8 016.4 013.83 003.8 B67 341.21 372.05 016.32 380.12 015.62 017.20 466.1 380.2 001.1 001 A52.10 B94.2 H70.009 B35.0 A92.8 017.44 017.82 123.1 115.00 016.71 B74.8 T79.A12S 081 016.60 011.8 B02.24 T50.A15A A05 B60.12 T50.A25D A04.9 B33.23 T50.A11A 682.6 098.41 B35.2 116.2 N37 018.92 040.89 A77.0 117.7 095.8 045.1 A07.4 A63 B08.1 018.01 070.3 B88.2 M90.869 482.42 A85.1 005.9 041.10 015.5 375.30 A39.83 016.36 013.53 B96.81 011.93 488.11 041.04 A48.51 B26.1 A73 A08.32 B43.1 A18.4 B65.0 A41.02 T80.A19D 018.85 B16.9 066 B87.89 060.1 I82.B29 324.9 P36.2 012.85 685 B50.0 A27 A66.5 070.70 A66.1 B02.9 T50.A93A P35.1 A48 100 B17.9 590.1 058.1 079.3 130.1 B06.00 B42.89 112 017.9 B60.0 T50.A22D B74.4 B52.9 046.2 077.9 381.1 086.0 483 056.01 A54.41 016.24 062.4 A83.9 K67 B97.11 449 085.0 007.8 013.62 A92.9 P36.39 T50.A94S 016.1 011.5 J05.10 466.0 A50.07 B00.82 015.61 B81.3 017.76 012.81 B08.010 015.04 771.3 A30.9 063.8 016.93 A52.05 B02.0 A22.2 059.22 041.03 008.69 011.23 381.0 A06.9 380.1 083.1 A28.2 A36.85 B46.0 013.14 070.52 B77.0 082.40 054.1 482.89 112.89 A02.0 T50.B12S 010.02 032.2 A18.54 B27.82 B73.00 008.5 047 036.42 T80.A10D M79.A21 B45.2 A08.39 681.0 111.0 T50.A25A B40.3 B48.3 375.31 094.1 017.33 014 J31.0 038.4 G00.3 B83.1 045.23 011.43 045.01 T50.B94 041.83 071 015.21 B43.0 016.53 048 094.8 472.1 016.04 010.94 073.7 A96.9 017.4 079.52 015.12 127.8 016.14 T80.A11S A00.1 097.9 A07 011.64 A66.3 038.49 039 100.81 137.3 136.3 382.2 B57 006.0 038.42 A51.45 B87 B95.7 771.1 H70.209 483.8 012.1 A36.9 010.01 063.9 J15.20 B97.89 420.91 B26.85 B45.8 081.2 074.22 A88.0 014.06 042.0 567.3 115.13 B55.1 016.54 016.35 B35.1 573.3 053.13 A37 015.75 079.2 J18.9 N11.8 008.45 056 A52.06 A54.83 A23.1 093.81 A53.0 424.90 A54.84 I40.0 H10.239 A48.52 A49.2 112.84 013.23 016.41 099.55 051.0 004.9 093.20 B14 B24 373.4 011.72 B79 098.39 M89.619 T50.B93 A80.9 091.1 A32 A17.82 031.0 M90.879 043.1 488.1 A51.9 J09.X3 A87.2 123.4 G00.9 A21.3 B40.0 B97.4 066.49 A02.24 038.0 B06.01 A48.8 017.06 730.76 421.1 098.5 094.83 020.9 001.9 115.9 015.66 A02.22 A50.03 B37.7 026.0 077.98 482.8 730.75 117.2 055.0 A93 A77.8 A04.5 A01.05 B02.32 003.21 A53.9 322.1 B48.0 B56.9 A44.1 098.50 015.70 B17.2 B67.99 H60.399 098.59 T50.A94 T50.B95D G03.9 A01.2 123 039.1 077.4 682.2 P35.2 T50.B15D B31 017.66 A80.39 A81.09 381.3 B87.81 B60.19 B32 038.12 074 321.2 131.9 012.8 A43.8 B57.42 131.8 015.92 482.2 A07.0 T50.A13D 125 011.90 072.2 060.9 014.05 027.9 101 B30.9 A06.1 320.2 B97.5 484.8 A41.9 130.0 013.90 078.19 T50.B12 084.8 040.2 102.2 A25.0 B57.2 123.5 I31.2 J15.5 B27.81 099.59 B08.72 M86.9 005.2 094.82 H59.42 112.2 T79.A11 139.1 J85.1 003.9 008.43 003.0 A82.9 480.3 A08.2 083.2 123.9 070.43 078.4 078.1 B38.4 B40.1 B00.89 034.0 A51.5 012.01 B71 006.4 513 J17 074.3 A56.4 A18.12 A77.49 B95.8 132.9 B55.2 011.15 017 008.42 T50.B93D L03.039 B77.81 126.0 A56.09 077.3 B95.4 484.5 323.71 682 074.0 008.49 B17.11 010.05 A66.8 A85.2 B48.4 B96.5 A51.31 054.42 011.41 A52.8 132.2 A50.45 A04.7 A77.9 B46.5 006.5 115.04 009 A39.82 B37.42 011.0 B08.09 054.73 A44.8 012.84 P36 B85.0 383.21 059.0 040 126.8 T50.B95S 771.0 074.23 323.51 685.0 A26.0 382.01 B01.2 B83.4 A42.82 B00.7 B67.69 015.7 038.41 B94.1 421.0 021.1 098.86 A68 T50.B15A A49.02 T50.A21D 013.22 A32.7 B58.2 124 099.49 B67.32 079.83 121.0 A54.5 A52.3 J12.0 B87.3 070.1 B08.03 132.1 016.55 111.2 T50.A25 090.7 A36.81 A41.53 018.80 A81.01 B69.1 A21.1 098.82 I30.9 002 102.9 016.94 J04.30 A19.8 050.0 017.65 A18.18 A50.43 B93 023.0 A92.5 103 B74.2 032.1 121.8 B85.4 A18.59 A59.02 015.22 A40.3 392 T50.B16D T80.A19S B82.9 A52.15 T50.A93 A30.1 B42.0 053.11 376.00 B48.1 018.04 137.0 033.9 130.5 045.9 131.09 A05.1 A19.9 A77.1 A02.9 T50.A11 125.1 590.01 011.46 A82 128.0 A39.4 139 A99 016.0 041.0 070.0 008.04 B18.1 015.73 B78.7 B34.0 P36.10 B44.1 B39.0 077 095 383.22 A93.0 381.4 062.3 036.89 326 B82 046.72 422.91 099.0 070.30 A54.85 B08.79 016.31 372.03 057.0 013.51 A37.81 T50.B94A 017.73 464.30 T79.A29A A50.9 A54.03 A52.71 730.78 A30.2 J31.2 A02.20 010.8 372.30 A26.8 012.33 008.67 B96.3 B43.9 018.84 A18.52 B58.3 I31.4 A79.89 046.8 T50.B96A B10.89 039.4 B97.81 B05.3 091.8 686.1 115.19 B81.8 B42.81 T50.A95S I38 A69.20 013.96 A06.81 015.2 B05.81 126 070.20 010.84 A93.1 041.82 A56.3 A65 085.9 054.40 093.89 015.54 016.42 084.7 464.31 B05.0 111.9 030.2 A48.1 008.64 072.1 H62.40 B10.82 A06.89 055.1 052 J12.81 466.11 T50.B95 007.2 A38.1 060 A31.1 B34.3 372.04 026.9 M72.6 016.12 027.1 590.2 P39.2 126.9 110.2 011.35 095.1 480.9 013.13 B44.81 004.8 A20.3 013.65 013.8 052.8 I82.A21 382.00 B76.9 A18.10 013.54 A68.0 M89.60 A56.19 116.0 041.43 A52.09 320.82 B25.1 J12.1 A17 036.8 091.3 M89.639 001.0 074.1 A41.3 A03.8 B02.7 B43.8 B97.30 018.96 682.5 682.0 372.20 B87.4 072.9 018.81 J16.0 G03.0 A83.0 041.12 J15.6 321.3 B37.89 012.16 391.2 018.9 B57.41 B58.09 070.5 K65.2 045.03 A98.8 070 095.4 G02 A66.9 T50.B14D 053.29 B33.0 A48.2 031.8 P39.0 099.41 A06.6 A31.9 114.2 J03.90 065.1 730.99 H05.029 A55 A50.7 H67.9 047.8 017.3 054.41 050.2 127.0 016 B34 018.94 011.34 033 056.0 115.11 121.3 A42.81 A24.1 079.50 B76.0 T50.A93D 072.71 099.51 015.95 A15.9 012.10 059.12 B07.0 T50.A13S B96.29 017.34 B00.2 B60.13 P35.9 078.2 049.8 121.9 B44 598 103.0 A05.0 H04.309 021.0 041.8 B22 B02.31 730.74 014.81 012.83 372.21 011 B91 A77.2 B58.01 J15.9 T50.B13D 015.51 054.49 B33.3 026 A54.33 A29 053.21 A51.39 682.4 488.09 321 T50.A12S T50.A22S 088.0 032.85 A00.9 008.8 073.8 730.79 A80.4 B42.9 A41 A71.9 A80.1 093.23 567 039.8 A06.0 H04.429 P37.0 015.23 078 112.82 041.02 115.92 A41.52 B88.0 B96 022.2 A36.89 A52.9 B35.9 I31.8 A38.8 013.92 I82.B23 H66.90 015.94 M35.8 G06.1 391 B46.4 017.86 A02.25 A17.83 122 B90.2 B19.11 T50.A96A T80.A11D A43.0 A74.81 016.51 056.00 A18.39 472.0 102 099.5 A67.0 H70.229 323.4 J09.X9 117.4 015.71 A80.0 B47.1 041.5 126.2 J21.8 484.7 I33.0 016.13 B95 016.95 054.71 043.2 422.93 045.10 128.8 B57.1 059.10 B57.49 091.4 038.2 016.61 021 567.31 B65.8 079.81 B37.81 730.91 018.86 B65.3 372.0 B02.23 B39.5 A48.0 B18.8 482.0 381.10 005.3 017.6 464.50 A50.6 P37.8 T50.A96 A52.11 B67.39 H04.339 T50.A14A 039.3 421 T50.A24S B16.1 B51.0 I09.2 053.19 015.56 T79.A22A T80.A19 A52 G05.4 051.2 A44 B33 079 A67.1 380.10 T79.A12D B27 053.22 103.2 771.5 A37.80 B27.19 I82.B11 018.8 A22.0 A18.83 A40.0
Infections-Respiratory		017.10 013.95 017.86 A17.83 J12.9 013.42 016.51 011.80 J15.1 017.83 017.42 A18.39 A19 010.91 J09.X9 017.81 015.71 017.30 013.83 J03.00 T50.A16D A15.8 016.32 017.20 015.62 017.31 B25.0 J20.6 482.32 J21.8 017.02 484.7 016.13 012.31 016.95 017.44 017.82 016.71 013.61 016.60 T50.A15A 011.33 011.84 018.93 016.61 011.10 485 015.50 018.92 018.86 J01.21 J12.3 017.70 482.0 018.01 464.50 011.31 J11.82 482.42 010.06 014.01 J01.20 016.36 J15.8 015.56 T80.A19 013.53 010.14 A19.0 011.93 013.44 A18.4 A17.9 017.22 T50.A15D J20.9 J03 017.80 T80.A19D 011.91 018.85 A18.83 013.06 016.03 012.85 A17.89 J18.1 012.21 015.01 482.82 011.42 462 017.32 J20.0 482.31 017.74 015.14 012.00 J01.10 487.1 012.06 483 012.86 017.93 J09.X1 011.30 016.24 J02.0 J15.212 016.73 010.11 016.66 J10.81 013.62 016.30 480.0 A18.6 013.10 016.34 017.25 017.13 A18.02 J05.10 466.0 013.01 J11.00 015.61 J06.0 010.85 017.76 012.81 015.04 480 011.70 A18.13 015.05 016.93 A19.2 013.80 012 A15 016.05 488 A18.85 015.53 011.23 012.04 J01.00 016.45 015.11 013.14 482.89 010.02 A18.54 013.93 J10.08 J01.41 011.96 J07 011.26 015.10 J11.08 018.05 466 J05.0 461.8 017.33 014 015.55 011.43 011.01 013.46 015.21 015.26 016.53 015.20 012.03 011.92 J10.00 016.04 013.60 J21 010.15 J01.01 010.94 010.04 461.2 J15.7 015.12 J02.9 464.51 016.14 017.41 018.82 013.52 011.64 011.83 J85.0 A18.09 482.1 J11.1 482.84 011.24 011.04 J15.3 483.8 010.01 010.83 J15.20 J20.1 A15.0 017.63 J22 016.90 013.26 A19.1 010.16 014.06 016.92 016.35 016.54 010.96 J00 015.75 016.91 J18.9 T50.A16 012.35 016.01 015.76 017.92 A18.31 010.93 012.13 018.95 016.21 T79.A19 013.23 016.41 012.14 482.49 014.85 011.72 017.01 A17.82 J10 488.1 011.71 487.0 J09.X3 T50.A16A 013.66 011.53 013.55 015.83 A17.81 J01.80 015.74 J12.89 B44.0 J18.8 464 482.83 017.06 A18.89 016.65 011.14 J10.01 015.66 J11.2 017.90 013.31 012.34 018.91 J08 010.80 J20.5 A16 I82.A19 011.76 017.24 011.50 013.20 016.16 016.50 015.03 015.65 012.32 015.70 016.52 A15.5 461 016.44 A18.14 015.52 A22.1 011.82 A18.53 460 J01.11 486 017.66 480.8 464.10 J02.8 012.30 J10.89 J21.9 J85.3 012.23 016.76 017.84 016.02 465 015.92 482.2 014.03 J16.8 014.05 011.90 J18.2 018.83 A17.0 017.40 484.8 013.45 464.20 013.90 014.00 J11.83 013.11 011.54 482.41 017.56 J15.5 012.22 482.30 J18.0 015.90 013.12 011.20 T79.A19S 013.81 013.33 J85.1 480.3 J01.40 015.85 012.02 013.43 016.74 017.94 010.95 017.64 461.3 011.95 012.01 016.46 A15.6 513 J18 011.65 J17 013.21 A18.12 J01.31 A17.1 011.15 015.84 017 013.00 016.63 014.04 013.40 011.94 A18 J01.91 484.5 J06.9 J20.4 464.00 461.1 010.05 012.36 010.86 A18.50 J03.80 011.41 015.15 J01.30 016.33 483.1 T79.A19D 013.32 012.84 012.05 017.52 011.06 J01.90 010.12 015 013.15 J14 011.45 J15.211 J09.X2 016.20 015.02 013.04 J01.81 014.86 011.05 013.82 487.8 015.16 011.66 A18.15 J10.82 017.53 010.90 M79.A19 017.43 013.22 012.11 J03.91 J12.0 J21.1 484.6 A18.2 017.15 J01 011.00 013.03 017.16 J12.2 016.55 J15 016.70 018.80 488.0 013.41 013.25 017.04 016.94 011.32 013.64 J04.30 J09 465.9 A19.8 017.65 A18.18 J03.01 480.2 A18.51 012.20 016.72 J15.29 016.40 010.13 016.00 A18.59 015.22 016.75 018.00 017.51 513.1 T80.A19S 013.86 015.00 A18.82 017.50 018.04 018.06 013.85 J16 011.55 A19.9 J20.2 015.06 011.22 011.46 011.73 J06 016.22 010.03 013.30 017.60 015.73 017.05 012.25 017.46 016.10 T50.A15S 012.82 J04.2 016.31 013.51 A18.81 013.36 J12 017.73 017.91 464.30 018.03 010.10 A37.91 016.43 013.16 010 481 017.35 A18.17 015.86 011.56 J20.8 T50.A16S 011.52 017.72 010.00 011.36 015.82 012.33 011.03 483.0 A15.4 018.84 013.35 A18.52 011.51 012.24 018 J11.89 J03.81 J15.0 013.96 G40.A19 010.84 017.95 010.92 015.54 464.21 016.42 464.31 016.25 A48.1 011.63 464.01 464.4 012.12 T50.A15 J04.0 513.0 015.60 J20 011.11 484 466.11 011.25 013 J12.81 017.23 015.96 016.12 013.63 484.3 461.0 017.03 011.35 480.9 J04.10 013.13 017.12 013.65 015.63 015.80 015.93 A18.10 A18.7 T79.A19A 013.54 J04.11 482 016.62 011.75 A17 J12.1 016.56 J10.83 017.36 011.13 J10.1 011.85 016.64 018.96 011.61 015.91 015.64 482.81 018.81 J16.0 013.05 J20.7 011.86 015.81 J15.6 017.71 012.16 A15.7 011.40 013.50 J02 018.90 016.26 013.91 J15.4 017.14 482.39 A18.32 482.9 A18.11 J03.90 016.11 015.24 465.8 011.60 010.82 487 017.96 013.94 012.26 013.34 016 017.55 018.94 011.34 011.21 014.82 018.02 015.95 J20.3 017.26 017.00 A15.9 012.10 017.54 J11.81 013.56 015.72 013.02 017.34 016.15 J10.2 012.15 011.74 480.1 J05.11 011.44 017.45 014.83 015.13 017.11 014.84 A18.01 010.81 466.19 J11 015.25 A18.84 016.06 016.23 017.21 014.81 A18.16 012.83 J85.2 014.80 017.75 011.16 484.1 011 017.61 J15.9 017.62 015.51 011.12 463 J05 J04.31 A18.03 J85 016.96 482.40 012.80 013.24 013.84 J04 464.11 011.62 J19 017.85 014.02 J21.0 015.23 011.81 T80.A19A J13 013.92 461.9 015.94 011.02 465.0

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Injuries		S06.9X4S T84.490D T63 S63.621D S82.232C S65.391S T85.614 S25.809D T85.398 S72.346 S83.011A S60.212A S66.526D T80.59X S52.232D S53.026A S82.115P S56.822 S86.391D T63.614D T50.992S S61.221S S19.9XXA 943.23 T23.179 S71.131 T80.410S S93.129 T40.0X2 T81.83XS S72.436R S63.433D T24.591D 832.01 S72.91XK T24.031D S36.533A S56.196S T22.232A T24.332D S92.355K S59.129 S31.112 T78.3XX S66.120A T81.516 S21.442D S82.043P 803.50 S63.232S T53.0X4A S92.123A S36.020D S72.019A T63.511S S82.864R T65.831S S63.657D S14.157 T04 T84.620 S22.040K S56.892D S72.441A T56.1X1D T83.85X T53.7X3 S68.123A T47.1X6S T26.71XA S14.4xx S89.002D T53.1X1 S62.307S T65.213S S82.242M T22.741A S62.023D T46.6X1 S32.131K S52.515C T65.0X3S S46.012A S52.265C S92.221B S65.111A S06.1X1A S60.461 S61.549D S36 814.03 S24.151A S50.811A T62.1X1S S42.446P S52.264G T24.491A S52.042A S92.599K S06.4X9A S92.416D T20.411A T81.507D S12.600B S82.492P S21.351S T45.1X4S S32.000 T75.4XX T82.391 T43.623 S36.290 T54.3X1S S42.209K T56.3X3D S59.222 S99.829S S09.19XD S34.22XD S63.652A 942.45 S32.471A T40.3X2 S60.444D S82.146S S82.822K S50.10X T83.022S S56.128S S05.91XD S82.874Q S42.111D S25.402A T82.322 S62.614S S86.929S S90.464D S74.00xA T65.4X2 T61.784D S83.30X S32.456B T53.93X T24.501A S37.69XA S37.091D S63.022D S80.849S T46.991S S61.021 T49.0X5 S90.411D S30.826 T63.834 S64.494A S42.033D S32.058D S42.191D S52.332C S31.110S S82.871M T43.4X5S S95.911S 861.20 S20.309A S01.01X S13.171D S72.366M S82.154B T79.5XXA T83.69XS S09.90x S00.252S S83.096S S01.90XA S72.031K S63.439A S06.365 T50.Z92 T25.139 S09.312A T50.Z11D S37.031 S82.426A S82.022K S95.809 S12.300K S35.338S S92.244D T23.799 T28.412 S82.254 S62.312 T22.022S S02.118B S06.6X2D S60.940S S31.20xA T17.408D S09.312D S52.399F S62.251K T63.071D S82.464Q S52.243J S82.465Q S82.401N T49.8X6A 914.3 S55.212 S59.102K T86.23 S96.899 S22.050S S41.112D S50.11XA S52.272M S72.416C S82.876G S22.039D S42.144G S63.227A S66.518A S72.416S T85.511A T48.4X4 S82.034R T20.69XD S82.62XP S42.112B S52.244 S92.031K S12.151K S42.216 S41.031A S15.202D T23.079D S39.91XS T19.4xxA S82.291A S92.491K S01.449S S52.361J T63.813S T63.713A S72.434J S82.016D S99.029B S22.002A S80.919D S83.231D S82.209H S90.933 T78.07XA T53.2X1S S20.461 T36.7X2 927.8 T82.897A S72.365F T20.72x S63.065 S72.111B 821.00 S63.432D S65.911D S96.102A 944.46 S30.857A S83.001 S22.032D S87 S93.324D S15.9XXS S41.031D T63.93XD S82.154 S60.031 T23.469A S21.429A S52.282 T71.223 S62.338G S82.443D S67.90XS S92.111P 887.7 S15.121D 917.7 S66.516S S70.12XS S23.143A 956.0 T39.8X3S S72.012D S90.01XD S61.205D S82.242S S82.843M T46.6X6D S39.002A S62.331B S09.312 T45.2X1S S82.843D S86.111S S20.02XA S42.335A S59.299A S20.112S S81.019 S32.120S S83.123A S92.331G S50.912 S50.02XA S67.194 S02.630K S82.033P S66.002A S61.234S S61.217D 901.1 810.12 S89.392P S60.342 S52.265N S60.471 S00.451D S53.091S S72.041D S59.101G 923.03 T24.031A S01.81X S89.101K S51.842A T52.2X4 S92.323D T50.4X5S S82.234J T22.351D S76.311A S52.044R S82.872M S83.262S T55.1X2 T71.234A S82.156K T38.4X2D S31.145D S62.399P S63.217A T41.0X2 S92.411D S63.121D S52.225 S56.329D T23.091A 866.10 S45.011A S36.99XA S72.361A S52.343F 949.4 S75.811S S81.822D S82.124P S72.442D S46.891 S92.326D T25.219A S72.425R S42.251B S66.120S S88.021S S27.69XD S52.513J S60.569D T63.832A S65.508S 935.1 S82.113N S62.329D T83.39XA T63.823A T61.04XA T81.532 S42.035 S02.602A S52.609A S56.418D 806.31 S82.253Q S98.912S T21.31XS T37.5X6S S09.0XX S72.364D S25.192S S25.511A S59.919S S62.637B 812.19 T33.519A S00.221 S01.401 883.1 T24.501 T18.120S T14 T48.0X5D S40.862D S30.870S S92.242G S48.021A S52.035S S52.321B S52.334R S62.620P S42.409A S43.402S S62.513D S82.126A S92.051D T43.226A S62.637A T21.33xA S62.644P T48.1X6D S45.392 S52.223A T45.1X4D S92.356K S72.052K S52.365C T65.6X1A S72.341H T82.827D 844.8 S89.312K T37.8X4 S34.101A T84.121A S10.92XD S61.344D T20.63X S92.513 T23.321A S62.226P S12.040S S93.409S S03.02XA S45.901D T39.1X1A T81.519D S62.102S S63.391S S37.022A S62.601 T43.601 S15.209S S46.109D S95.999S S52.381D S83.242A T42.6X1S T17.890D T43.605S S82.136S S72.102M T51.1X2D S04.041A S43.025A S82.102Q S65.409S S92.243G S22.49XA T22.362S T53.4X4 S61.111D S11.11X S32.402G S42.123S S62.300G S36.92XD S62.609A T53.92XD S20.169 S42.223 S82.391C S68.619 T71.21X T63.414S T52.8X3S S85.142D S81.841 T44.1X2 T82.838 S82.391M S61.253 S04.10X S93.302 S92.422 S52.202C S62.211K S98.922D S37.051A S72.302P S92.226P S92.101G S95.902S T45.2X6D S62.031D S26.92XS S72.144 945.16 S65.508A S75.911A S49.031S S09.399 S70.922 883.0 S15.199A S99.191K S82.436B S37.899 S72.302B S04.041D S21.149S S28.211D S52.379S S62.145K S32.615A S41.121A S80.822A S20.109A S92.061P T21.60XD T36.93XD T24.239A T40.1X2A T83.86XA S01.82X T65.823 T65.94X S33.101S T85.868A S92.251B S02.670S S96.029 S95.101S S29.099S S60.322D S77.10XD S92.136P 863.93 S92.334B S63.228D S82.142R S52.246K T20.619D T26.31XA T25.391D T24.512S S82.423 S90.934 S82.461K S92.224 863.54 S82.866J T53.3X1A S11.95X T51.2X4 S62.337P S70.241 T85.122S S62.92XG 915.4 S62.311A T63.634S S72.322B S60.559D S82.192P T41.205D S89.099P S07 T65.214A S52.511G S36.30XA S65.091D S66.313 S01.422D T36.6X2S T50.991 S75.999D S92.401P S26.91x S85.131 T87.0X9 S52.326N T17.910S T50.4X1 S65.999A T49.7X4S S55.811 S32.509G S62.164D S91.141A T23.479S S72.90XS S62.335S S93.333S S43.91XA S52.263F 913.1 S82.862S S56.122S S76.011 T83.25XA S31.122D S62.186B 943.31 S92.351B S10.14X 945.36 S70.369A S31.639 S89.199G T56.1X2D S75.199S T52.4X2A S31.551S S52.132B S62.308K S62.629P S61.541 S89.312P S72.451A S82.022F S93.602D S66.510 T36.4X3D T23.442A S32.442 S37.818S S66.911D S92.343S S30.842S S99.129G S63.093 S12.291K S32.601G S68.711D T45.695 S27.53XD S22.068K S92.233D T80.A9XA S90.02XD S00.04XD S62.224K S82.442K S04.032A S42.482P T49.0X1S S75.091S S56.019A S52.026N S82.846A S52.261K S68.114A S20.222A S92.513B T41.41XA S52.611H S14.107D S92.141S S52.336F S32.008B S12.112S S42.331G S63.251S S82.436Q S30.846 S52.512Q S82.453M S52.002R T23.442S S01.339 S06.9X4 T63.023S T25.412A T36.5X6 S42.265B S53.142A S92.533P T65.292A S42.296G T83.030A S15.191S S72.136F 942.50 S21.101 T67.9XXS 942.01 S96.891D 821.20 T45.515D S72.452H S86.219A S06.354D S20.349D S52.265F S11.24X S72.413A T24.632D S72.423S S66.197S T47.8X6 S12.491K S56.291D S32.030G S92.332G S20.20xA S42.036A S32.050G S75.222S S63.258 S52.099C 813.54 S95.812A S10.95XD S82.302R S86.309A T75.89X S63.619S S00.411 T54.2X3S S82.54XR T83.84X T24.601A S00.449A T37.0X2D S72.324Q T17.400 T59.813 S92.144P S72.322S S75.101 T59.7X2A S92.113S T22.159D S92.236D S72.121M S63.301A S89.399P S50.10XD S68.123 S62.650S T23.641S S31.655D S55.819D T21.00X S58.029A S68.421A 801.23 T38.891S T21.79xA T22.091S S42.362A S89.221G S62.022P T40.696D S97.119 S46.191S S53.192S S00.521 T53.0X1D T63.633S S52.611J T63.443 S36.438A T43.214A T81.512D S02.40CA S06.5X9A T82.521 S61.142A S62.111S S82.55XB S36.409D S99.131 S61.324S S61.152A S55.812S T50.6X1D S62.151 T56.891 T50.4X3 S00.212D S52.124R T22.142D S98.221S S72.411C S92.422G T71.193S S82.491G S50.861D T44.993A S82.012R S30.92X T23.312D 834.02 S72.462G S63.633S S65.502A S61.348 S72.115R T46.5X2D T26.12XD S62.610D S37.429D S82.876J T21.71XA S93.429S S76.929S T49.2X5S S62.342P S62.222B T63.793D S32.421A T24.731A S21.329A S09.0xxS S98.011A S62.515S S72.346H S63.106S T28.911A S63.636 S72.063D S04.042A S62.514B T84.112D S59.202P T56.5X1D T34.512S T36.4X4S T45.615D T24.202A S42.332K S20.479A S72.116N S82.199R T65.222D S53.106A T45.4X3A S92.062D T69.9XX T38.2X1S S72.415B S86.801S S46.121A S91.359D S89.80X S92.346G S82.426Q S82.891Q S92.054P S42.443P S42.296K S53.193S T63.114S S37.591D S92.919B S31.23XS S20.469S S92.522G S24.149 S82.424J S42.125S S99.222G T48.204D S60.473S S09.21XD S62.638A S92.812K T40.904D S82.043M T20.32X S12.391D T21.17XD T22.791D T83.420S S61.243S S62.176S T23.449 S43.121S S62.025P S83.252D S00.01X T22.052D T79.A12D S30.93XD S25.892S S82.422A S20.462D S45.019A S42.463K T63.061A S27.812S T51.3X4 S69.90XS S93.135S S32.444S T23.179A S99.142S S25.502 S56.012D S81.839D S82.092J T50.2X1D S50.322A S00.471S S32.811K T85.860 S61.353A T82.221S T34.3XXD S84.20XD S72.133M T54.2X2 S09.399A S62.251S S76.822S S82.141B S78.911 T83.23XA S93.303 S34.103D S52.599P S21.232 896.3 S06.6X3S T45.7X6 T38.4X4 S82.235D T25.321A T36.8X2S S42.115G S14.135D S72.324R S82.846D S96.999D S63.635 T83.83XD T50.993S S06.4X1D 848.40 S65.811A S66.401S S82.312G S52.311D T16.2XXA S82.102H S52.246C S56.802S S06.384S T65.291A S36.269A S02.621A S83.211A S72.326M T17.598A S36.299 T23.672S S42.156 S52.132E S63.423A S82.431K S66.501A S62.252S S20.342A S42.492K T85.613 S32.409K S01.342A S60.542 S63.312A T67.5XX S51.822A S66.902S T33.90X 805.02 S92.035D T33.02X S83.122D S65.291S S30.0xxA
Integumentary		L10.81 L89.813 709.2 L02.639 R20.8 L02.619 L97.218 L92.8 L21 690.12 L56.2 Q84.0 778.1 521.15 L64.8 L03.123 L06 R23.9 782.8 L94.9 L03.213 L16 L97.503 L89.814 L98 L97.923 L66.3 L97.812 L02.422 L89.514 L02.33 680.9 690.18 L97.529 J70.1 680.0 L97.824 L89.149 757.5 L40.4 L97.413 L51 L63.0 L92.2 L97.504 L93 L24.89 704.00 P81.0 529.2 L02.432 709.01 K08.51 P83.8 L08 L89.124 525.0 L89.129 K05.00 L10.2 L72.2 K08.403 L89.614 K13.29 L03.212 L71.1 522.7 703.8 707.02 L49.7 L02.235 690.8 695.3 705.0 737.33 L89.209 L94.1 L04.2 729 K03.9 L02.239 L89.133 L41.5 523 L29.1 707 L98.422 L89.620 778.3 782.1 L89.610 L41.8 778.0 L40.3 L35 521.09 710.9 L43.2 L03.114 L12.2 L64.0 L81.0 L49.5 L97.205 L97.306 525.64 L26 521.32 L89.103 L92 K08.530 L97.929 528.6 L89.629 L66.1 Q84.3 L89.603 L90.2 L12.0 K08.0 K05.30 695.57 L08.81 L70.3 L97.314 K08.9 L04.8 L50.8 L24.0 L89.503 L20 558.1 M35.9 692.71 L32 L89.009 L58.0 525.42 L97.118 L74.2 L89.40 L97.309 L30 L70 L40.8 L98.498 L69 525.52 L81.5 525.44 L89.501 P81.9 521.00 L63.9 L60.1 K08.52 K02.7 L97.516 528.00 L95.9 L89.020 L23.1 L11 698.9 695.53 L40.53 L03.039 M79.0 L29.2 521.49 K04.3 697.9 L97.424 L71.8 L68.1 680.2 L40.1 L89.011 L24.9 L76.21 K05.21 522.9 L40 525 K05.32 K14.1 L97.321 L89.613 L97.404 K04.90 L82.0 700 K13.23 L03.891 L89.102 L28.2 L01.1 704.2 L89.601 L14 R23.3 521.11 L74.8 L73.9 L81.3 L97.926 L49.1 L85 L91.0 521.13 707.03 L97.209 L44.2 L55.9 L89.300 L81 P83.1 692.7 697.8 L97.121 523.30 L97.106 703 L74.510 521.9 R22.9 L02.214 757.3 L02.435 L94.0 L02.532 L03.316 L41.0 M96.2 695.51 L97.512 L20.89 L89.139 K14.3 L62 525.10 508.0 L02.519 521.02 L97.221 L89.304 L98.493 L20.9 L27.0 522.6 L56.3 L89.42 523.1 L56.9 L21.8 K08.104 690.11 778.2 L98.9 523.41 L03.011 L75.1 L89.110 523.3 L89.120 709.09 L03.323 L85.8 L49.2 522.0 L97.909 525.50 707.19 525.51 698.0 697.1 L89.611 L03.312 K08.531 523.2 L81.9 Q84.8 K03.81 695.54 L73.2 L02 L89.219 L72.12 L97.914 782.61 L97 703.80 L02.221 521.40 L85.2 L89.604 527.3 680 L89.112 L60.9 L83 L89.200 L65.0 L43.0 707.25 L02.434 L36 L87.0 L03.311 695.52 L92.3 L11.1 L72.8 L97.805 K02.61 R20.2 L89.001 L97.822 L49.9 L97.815 L89.203 L97.823 R22.2 525.12 L51.1 L43.3 L92.1 L33 529.0 L85.1 L57.3 P83.0 L89.893 L97.213 L68 L38 L02.215 K14.9 P80.0 K08.50 L04.9 L65 680.1 L89.623 L97.211 L89.529 528.79 525.1 L89.134 L24.6 L02.233 L97.116 L97.402 707.15 757.2 L97.828 778.9 525.67 L02.429 L97.911 707.13 L10.9 529.9 L76.33 L56.8 L89.612 L65.1 K05.11 778.4 L89.212 L97.922 705.8 L97.829 K13.70 L89.101 L75 L81.8 L97.526 705.82 L30.4 K08.101 709.9 L02.539 L74.519 L17 521.81 P83.2 695.56 L02.521 L03.222 521.07 L98.8 K08.55 L44 L21.9 L43.1 729.9 L98.424 L72 521.7 L02.413 L74.1 680.7 L55 L02.234 L97.128 M27.62 R23 L44.9 L89.301 L97.212 K08.59 778.6 L03.319 L92.9 L01.01 L02.02 K08.499 L97.202 K14.6 L72.0 L89.121 L59.9 L02.529 P80.8 L97.323 K03.89 705.89 702.19 L12.30 L73 P81.8 759.82 L02.632 L91.9 L02.416 L97.418 709 521.35 L58.9 L97.328 L02.93 L75.2 L97.429 L89.520 L67.9 M96.5 L08.89 K14.0 521.30 525.66 L03.116 L55.2 L89.221 K08.409 L29.8 L97.219 695.50 L97.505 K12.2 L95 L66.2 L90.9 L49.8 523.21 L29.3 521.24 521.14 L02.612 L89.500 757.33 K02.63 K04.1 L97.105 L41.9 L44.8 521.3 L11.0 L89.144 521.04 L98.491 L07 L03.818 L89.313 L89.123 L40.9 L74.9 P80.9 L93.2 L89.119 706.2 707.24 K12.0 L95.0 L02.11 701.3 L97.112 L75.0 525.6 L97.902 697.0 707.21 702.1 L89.152 L97.803 L94.5 704.09 L85.3 L97.806 528.71 K04.7 L63.8 L89.159 K14.2 L89.229 K03.3 528.9 703.9 L93.0 R21 R20.3 L89.153 M27.61 523.31 K13.5 729.91 L98.412 707.01 L02.421 K13.0 P82 523.24 L97.508 L70.0 L97.819 K04.0 757.4 K02.51 L89.111 R22.40 L53.0 L98.416 L71.9 707.09 L30.3 L40.52 L50.3 707.06 521.05 L10.89 L74.512 L46 L76.31 L76.12 L59.0 L03.125 L56.1 L89.213 707.04 L97.528 L25.9 L76.82 L97.421 528.3 K05.20 N30.40 L52 655.60 523.25 L70.5 K05.5 R23.0 695.55 L97.519 706.8 528.0 K04.5 L89.002 525.53 L89.609 L56 L03.91 L49.0 L89.130 L03.022 L57.1 L89.624 525.9 K08.401 L89.41 707.10 L89.324 L05.01 L60.8 529 L89.303 L97.411 L25.1 L40.50 M27.69 L02.212 L25 L73.8 L08.82 523.9 704.9 L03.315 525.41 L89.310 L02.13 692.74 L97.406 L87.9 521.2 K02.62 L05 L02.426 L67.1 522.8 521.22 680.4 L68.0 521.25 L97.304 L47 L89.524 L97.326 M79.9 L61 A69.0 L72.3 704.3 L89.143 701.2 L97.325 L03.019 K14.5 L02.838 L97.419 K04.6 L97.109 523.23 L98.0 729.7 525.3 L41.1 L04 K52.0 L03.324 705.2 L03.012 R17 528.1 L97.101 L10.1 729.72 L02.232 L57.5 L89.140 K05.01 L13 P83.6 L48 523.5 L97.305 L97.906 L01 L89.142 707.23 L97.928 L23 L97.522 523.11 L51.3 K08.3 L90.3 694.3 L75.8 L64.9 L44.1 L03.126 L97.225 L85.0 L76.11 L97.324 706 529.4 L02.811 L23.6 L03 L03.327 L97.204 K03.5 523.42 L10 L97.813 L70.8 L03.041 L89.010 M79.89 L97.228 L94.3 695.5 655.63 L97.525 757.8 L97.403 L98.3 L89.214 L89.522 L89.201 782.5 L97.222 521.0 L98.423 L23.0 L93.1 L01.09 L97.904 529.1 705 L89.003 L02.431 L91.8 P83.5 L03.211 L84 L29.9 521.8 L29.0 L67.8 L02.225 L90.0 L89.621 525.61 782.9 K03.6 L74.511 525.7 L04.0 525.72 L02.411 782.4 R22.43 707.20 L97.114 Q82.1 L23.2 L89.311 R22.42 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C84.44 204.10 C44.310 205.32 C49.0 I82.C29 C50.629 200.55 C49.8 D41.00 D05.82 204.81 D48.4 203.1 C81.90 C38.3 C68.8 623.7 209.34 208.91 239.5 C83.86 185 164.0 164.1 C82.46 151.8 201.0 C34.82 235.8 C84.13 198.0 203 202.06 C51.2 200.48 157.1 624.3 D42.1 C34.2 D21.4 204.90 205.91 C44.721 C69.40 164 C82.28 200.5 D01.49 C90.11 C49.A4 C43.60 D02.21 C44.219 C84.08 D30.00 C72.32 D15 C74.01 206.92 C83.13 C7A.020 C81.35 D23.61 202.42 160.1 D31.50 143.1 D31.32 C62.10 200.54 202.43 C81.99 C81.21 D36.10 D35.01 C84.A3 D10.4 C82.23 209.65 C72.21 C90.20 D05.00 C22.1 213.1 Q85.00 D24 173.52 202.11 C34.31 173.6 D13.7 D03.70 190.3 201.08 D15.0 C76.50 D12.6 D41.21 D3A.098 D26.0 184.1 208.2 C84.Z4 C84.10 225.4 C83.79 D39.9 C82.34 145.4 C69.01 C79 201.75 C84.A2 C41 143.9 C84.A9 214.4 D47.02 208.8 227.4 206.1 C15.9 C91.Z1 200.37 C17.3 C83.05 207.2 600.9 C50.222 D01 623.0 C81.20 209.13 D06.7 C09 201.73 C90 C88.8 200.30 C84.90 C40.22 C92.30 201.58 202.57 155 C50.619 D47.Z9 200.72 C82.94 170.2 C34.30 215.8 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D31.41 D12.3 227.1 212.8 221.0 C44.90 C50.111 C81.48 C84.92 C53.8 209.20 174.1 C00.8 202.16 237.7 205.82 C56 Q85.03 C84.45 173.70 151.4 D23.71 C83.18 C92.Z2 'C81.78 205.30 239.2 C96.29 C10.8 200.11 C99 602.3 D16.4 C16.3 C50.829 C71.8 C92.31 200.78 C71.5 230.6 190.1 202.14 C82.16 201.00 C69.52 D12.9 173.89 D15.9 205.8 202.28 D29.21 D19 C82.57 C84.62 C43.0 C81.70 C94.01 C81.08 D02 214.8 C60.8 C83.06 C13.9 231.8 C72.59 C90.32 C50 187.8 D14.1 202.88 C51.9 202.81 C83.36 C44.509 C44.619 D04.0 D26.9 D37.8 214.3 C25.0 C46.2 182.8 C75.5 D07.30 200.38 C70.9 D15.2 188 C84.A1 C44.391 C84.02 202.26 173.81 C88.4 C91 D29.31 C94.6 C57 202.4 200.34 Q85.1 218 236.9 173.11 C18.7 C31.3 201.25 C14.8 D22.22 D35.5 C71.6 C90.21 C43.62 C49.6 236.5 188.0 C31 C22.9 C50.212 C57.7 C93.02 171.0 201.76 C00.5 C25.1 213.4 200.57 C82.64 C84.98 D35.3 D49.512 C67.1 D04.10 C83.14 C75.9 200.23 200.26 161.0 C78.1 200.7 C82.85 D31.22 C83.75 D21.11 200.83 200.43 C57.4 D10.7 146.5 D49 C44.510 C57.11 238.0 C50.021 196.3 D46.A D16.31 C78.39 569.0 D39 161.2 C25.3 C30.0 C01 D31.31 D36.14 201.46 C94.81 140.4 150.3 C91.A2 D16.02 D13.2 C47.10 C26.1 160.8 D23.10 173.8 D37.1 C44.701 C11 D25 C63.8 C94.00 D17.24 209.74 C02.9 C91.61 C28 205.02 D21.0 171.6 C17.9 210.9 174.0 D21 C67.4 C50.821 C49.5 173.7 C92.11 209.73 C84.67 C74 C7A.095 219.8 161.8 C06.9 202.75 200.80 224.9 C84.73 C88.2 D17.79 201.21 208.90 152.1 D03 147.8 186.9 C50.622 198.6 229.9 C49.A5 D22.62 203.80 C40.32 C63.9 C81.33 C96 209.6 C87 202.86 C43.30 207.01 D35.1 164.8 238.73 201.62 C96.21 D04.71 171.4 201.41 141.0 C91.60 I82.C21 206.80 189.8 208.21 C82.03 D03.52 D18.09 C25.7 162.0 C38.0 202.72 C82.41 C82.62 173.39 C72.41 202.00 C03.9 229.8 173.40 224.4 213.3 216.3 209.14 C83.83 C16.4 C75.4 202.05 C44.191 213 200.13 D41.11 C69.50 192.1 200.75 D13.1 D48.3 C00.2 C80.0 C81.09 C83.89 195.8 C93.Z0 N40.0 C30 C92.A0 C00.1 C34.10 200.1 174.2 173.71 158.0 D07.61 C84.91 156.1 C84.12 C91.42 D00.07 221 D35.6 225.9 624.6 233.31 D19.1 C91.A0 C05.0 192.3 211.4 C82.45 160.3 622.10 211.5 C7A.011 D10.0 204.0 C81.42 201.26 D23.30 C02 201.91 C40.90 C78.02 C43.21 C44.222 C91.62 239.3 237.71 239.6 230.8 202.8 232.0 C44.89 C81.12 C7A.021 C96.Z 200.01 202.51 N89.3 173.09 D27.9 156.9 C94.82 148.0 197.4 D36.7 202.02 C03.0 189.9 201.53 205.0 D00.02 273.1 199 200.85 E71.448 C50.121 202.20 D48.2 C62.02 149.1 C83.00 C50.321 173.99 D44.2 173.1 C22.7 D44.6 208 C82.56 157.0 170.7 D24.1 D14 C71.4 600.90 C85.98
Ophthalmological		H34.8332 H50.812 H10.439 H35.111 H53.043 364.5 H50.32 H44.812 H01.112 H05.243 H26.493 H10.221 377.62 362.89 H49.43 H18.811 364.71 375.13 365.59 365.89 370.3 H40.51X H44.21 370.24 375.14 H25.23 H17.00 H47.631 H05.342 H21.323 H50.811 H59.022 364.8 H21.229 H20.022 H02.134 H15.022 H46.02 H47.211 H31.111 H59.322 H35.3133 H11.032 H11.432 H16.072 H40.10x2 371.73 370.03 H11.10 362.31 H02.734 H44.753 369.3 H16.142 H40.63X3 H33.051 H18.739 369.05 360.8 H31.092 H52.532 H18.892 H17.03 H04.223 H01.133 371.20 H27.112 H44.621 H20.813 H53.033 367.20 369.08 372.9 H02.871 H40.1310 H40.51X0 H15.091 H04.302 H01.023 H31.303 H26.119 H40.1114 H54.2X1 368.31 H15.813 H35.463 H05.812 H26.103 H04.011 372.4 364.53 H10.511 H39 H40.1192 375.22 H20.012 H31.022 H35.052 H40.149 362.9 H40.241 363.70 H34.812 H53.003 H26.069 H18.833 H18.223 H16.132 H47.312 H47.333 H01.019 H21.342 H02.30 H20.821 H40.53X3 H02.104 H02.839 H05.031 H59.343 H16.061 H16.071 H34.02 377.10 371.45 371.60 H18.623 369.75 H02.209 H33.102 369.60 H50.50 371.51 H40.032 H40.2214 H33.22 H05.53 H05.813 H44.649 H54.1224 H02.439 369.66 H40.049 H40.51X1 H40.10x H02.054 H34.00 H50.15 H18.55 H15.821 H44.511 H49.813 H40.53X0 372.56 H02.136 H21.1X9 H53.023 H04.123 H02.89 H18.422 H31.123 H02.036 H20.021 374.54 368 H26.412 H40.60X3 H46.9 368.12 H57.13 H25.811 360.40 H40.62X4 371.58 369.01 H10.413 H16.309 H26.042 H44.431 H49.02 H53.031 362.6 H11.152 H35.439 362.36 H44.131 H35.3114 H26.123 H40.42X3 H53.132 H53.133 366.19 H40.1111 H08 H44.2C2 H53.433 H05.023 H50.69 H04.541 360.34 H04.212 H05.263 H11.133 H31.411 H18.232 H30.111 371.54 H04.023 H40.61X H35.172 H02.203 362.24 H33.032 H40.32X4 H44.712 377.52 H21.319 H20.22 H02.409 H10.12 H15.812 366.10 H18.9 H52.201 H50.022 H11.423 H34.813 H54.60 H57.051 H18.062 H40.63X H44.2A3 H44.539 361.10 H27.133 368.16 H40.233 H30.133 H43.813 H00.023 H02.109 H18.712 H57.8 371 H47.149 H15.129 H40.62X1 H10.239 377.32 H00.011 H44.723 H10.223 H40.139 H18.312 H35.322 H49.01 371.0 H02.735 374.87 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PNS		G56.91 G73.3 G81.92 G62.82 355 359.21 P11.5 G81.11 352.5 G57.53 352.4 G82.22 G83.14 G57.00 354.3 G80.0 354.4 355.3 354.2 353.3 G83.10 G50.0 767.6 R26.9 G56.43 G79 G71.19 G60.9 G83.13 350.2 G81.02 G71.13 G81.90 G52.9 G57.32 G56.40 767.7 G81.93 G72.1 G62.89 G65.1 R26.0 356.2 G51.8 G57.92 P14.8 G57.21 G54.4 G72.2 357 G83.30 359.22 358.2 781.94 351.8 G71.11 G54.7 G72.9 G57.22 G83.89 359.81 G56.42 G60.2 G72.41 G82.50 G80 G56.02 359.71 G82.20 359.79 G83.32 G57.10 353.0 781.1 357.7 G57.80 G81.01 359.4 G57.43 354.8 G57.40 G56.00 G59 R26.1 G80.2 G81 G57.61 G56.80 355.2 353.4 G52.2 354.5 G81.14 358.9 G55 G72.89 G83.9 350.9 G57.83 G68 G58 358.8 G82.53 G57.82 G66 781.0 G69 355.0 351.0 R27.8 G56.83 R25.8 352.6 353.1 G70.89 G56.92 G83.84 G80.4 R29.5 352.1 G70.00 353.6 G61 G56.32 R41.4 R26.2 781.3 G83.4 R29.3 G51.0 G83.23 359.89 G82.52 G54.6 G56 G56.03 G83.20 G56.90 353.5 G60.1 G73 P14.3 G50.8 G60.0 350 358.01 G51.4 G57.02 G50 G61.82 G62 357.9 R43.0 359.3 G57.71 353 352.0 R25.0 G60.8 356.8 355.1 357.89 G54.8 G80.8 G57.90 G71.9 G57.12 G80.3 357.1 781.5 G65 R29.1 R25.1 G61.81 356.4 357.0 359.29 781.2 G54.1 G70 P14.9 G53 G56.33 G65.0 356.3 G57.73 G56.23 G83.5 353.8 G57.93 781.99 R25.2 G57.13 352.9 G83.24 G54.5 G57.72 359.9 G61.89 355.71 G82.54 355.8 G56.11 G71.8 P14.0 G51.1 351.9 359.24 355.6 G56.93 355.4 G57.50 357.2 G70.01 G76 G73.1 G57.20 359.6 G83.11 351.1 781.8 G56.21 G82 G50.9 G83 R25 G57.63 G65.2 G57.62 G54.0 R25.3 G57.31 G83.82 357.3 355.79 G56.31 G81.00 352.2 G57.91 P11.4 G70.81 G78 R27.9 G62.9 G71 G56.20 358.1 G72.0 G74 P14 767.5 P14.1 G72.3 G83.31 357.81 359 E13.42 G57.70 R27 G57.33 G70.1 G80.1 359.0 356.9 G54 G81.10 P11.3 357.5 G71.12 356.1 781 G51.9 G52.0 350.1 G58.8 G77 355.5 G51 358.00 G81.94 358 G81.04 G56.22 G83.21 359.23 781.6 G83.34 G67 781.93 G57.41 R29.891 G57.11 G54.3 R29.810 R29.890 359.1 G57.42 352.3 355.9 G52.8 G57.01 353.2 767.4 G57.30 G62.1 P14.2 G54.9 G54.2 G58.7 G52.3 R26.89 G56.12 781.91 G52.7 G70.80 781.7 G70.9 G57.23 356.0 G83.33 R27.0 G52 G61.0 G50.1 G62.2 354.0 359.5 G51.2 R29.0 G60 354.1 356 G62.81 357.6 G83.22 G71.2 354 G61.1 G56.30 G82.21 G73.7 G81.13 G56.41 G56.01 G81.12 G51.3 G83.0 G83.83 R25.9 781.4 G57.51 R29.818 781.92 357.4 G71.3 G57.52 G62.0 R68.3 G57 G63 G83.81 G56.13 G52.1 G57.03 G56.81 G72.81 G81.03 352 G64 353.9 R26 G61.9 G71.0 G71.14 G72 G83.12 G82.51 G72.49 G60.3 354.9 R26.81 350.8 351 G57.60 G57.81 G80.9 G58.9 G75 357.82 G81.91 G56.82 G58.0 G70.2 G56.10
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TABLE S8: Feature Definitions (Total number of features used: 380)

Feature name	Explanation	$n_{features}$
feature scores relative to phenotype score	Mean p-score of **feature** codes within sequence divided by general p-score of **feature**	26
feature scores relative to whole score	Mean p-score of **feature** codes within sequence divided by mean p-score of all codes in the record	26
aggregation score	aggregation of the p-scores in the record	13
high scores proportion	proportion of codes with very high p-scores among all codes in the record	1
low scores proportion	proportion of codes with very low p-scores among all codes in the record	1
dynamics of mean score	mean p-score of second half of the record divided by mean p-score of first half of the record	1
dynamics of geometric mean score	geometric mean p-score of second half of the record divided by mean p-score of first half of the record	1
dynamics of st.dev score	standard deviation of p-scores of second half of the record divided by standard deviation of p-scores of first half of the record	1
dynamics of score range	range of p-scores of second half of the record divided by range of p-scores of first half of the record	1
dynamics of score skew	skew of p-scores of seconf half of the record divided by skew of p-scores of first half of the record	1
aggregation relative to phn score	aggregation of all **feature**'s mean scores divided by corresponding general p-score of **feature**	9
aggregation relative to whole score	aggregation of all **feature**'s mean scores divided by mean p-score of all codes in the record	9
predicted risk from pfsa model	predicted risk from pfsa model	1
predicted risk from seq model	predicted risk from seq model	1
predicted risk from pscore model	predicted risk from pscore model	1
predicted risk from rare model	predicted risk from rare model	1
age at screening	Patient age at the moment of the screening	1
feature proportion	Ratio of number of weeks with the codes of a given phenotype to the total number of weeks in sequence	26
feature prevalence	Ratio of number of weeks with the codes of a given phenotype to the number of weeks with any diagnosis code recorded	26
feature first incident	Time interval from observation date to the first phenotype code, normalized by record length	26
feature last incident	Time interval from observation date to the last phenotype code, normalized by record length	26
feature mean position	Mean time position of phenotype codes in the record, normalized by record length	26
feature streak	Length of the longest uninterrupted subsequence of weeks with the codes of a given phenotype recorded	26
Max/Mean/Std/Range intermission	Maximum/Mean/Standard Deviation/Range of the lengths of subsequences of consequent weeks with codes	4
Max/Mean/Std cluster	Maximum/Mean/Standard Deviation of the lengths of subsequences of consequent weeks without codes	3
Max/Std/Range prevalence	Maximum/Standard Deviation/Range of the phenotype prevalences	3
Density of DX Record	Proportion of weeks in a record observed where at least one DX code was recorded	1
feature	Sequence Likelihood Defect for a given phenotype	26
feature neg llk	Negative LogLikelihood score for a given phenotype	26
feature pos llk	Positive LogLikelihood score for a given phenotype	26
feature llk ratio	Ratio of Positive to Negative LogLikelihood score for a given phenotype	26
Mean Δ	Mean Sequence Likelihood Defect	1
Std. deviation Δ	Range of Sequence Likelihood Defects	1
Range Δ	Standard Deviation of Sequence Likelihood Defects	1
Mean neg llk	Mean Negative LogLikelihood score	1
Range neg llk	Range of Negative LogLikelihood score	1
Std. deviation neg llk	Standard Deviation of Negative LogLikelihood score	1
Mean pos llk	Mean Positive LogLikelihood score	1
Range pos llk	Range of Positive LogLikelihood score	1
Std. deviation pos llk	Standard Deviation of Positive LogLikelihood score	1
Mean llk ratio	Mean LogLikelihood score ratio	1
Range llk ratio	Range of LogLikelihood score ratio	1
Std. deviation llk ratio	Standard Deviation of LogLikelihood score ratio	1
high scores proportion	proportion of codes with very high p-scores among all codes in the record	1
low scores proportion	proportion of codes with very low p-scores among all codes in the record	1

*Δ: Sequence Likelihood Defect (See Methods)
† neg llk: loglikelihood of observed sequence being generated by the model inferred from control (See Methods)
‡pos llk: loglikelihood of observed sequence being generated by the model inferred from positive (See Methods)

TABLE S9: Proportion of 0's, 1's and 2's on average in trinary encodings with 95% CI

cohort	sex	proportion of 0	proportion of 1	proportion of 2
control	Female	0.879 ± 0.002	0.013 ± 0.001	0.106 ± 0.002
control	Male	0.891 ± 0.003	0.012 ± 0.001	0.095 ± 0.003
positive	Female	0.858 ± 0.040	0.015 ± 0.013	0.126 ± 0.038
positive	Male	0.873 ± 0.037	0.014 ± 0.012	0.111 ± 0.035
TOTAL	Female	0.879 ± 0.002	0.013 ± 0.001	0.106 ± 0.002
TOTAL	Male	0.891 ± 0.002	0.012 ± 0.001	0.095 ± 0.002

TABLE S10: Out-of-sample performance achieved (mean AUC) when training dataset is balanced (Note: performance degrades as we attempt to train with more balanced data, $e.g.$, downsampling ratio of 1 is the case where we sample the control cohort to use only as amany patients as in the positive cohort)

sex	downsampling ratio	all patients	age $65+$ years	age < 65 years	frail
Female	1	0.755	0.715	0.694	0.732
Female	2	0.756	0.723	0.700	0.736
Female	5	0.768	0.735	0.727	0.752
Female	10	0.781	0.750	0.737	0.769
Female	20	0.772	0.750	0.728	0.759
Female	40	0.790	0.760	0.743	0.772
Male	1	0.724	0.665	0.690	0.721
Male	2	0.743	0.701	0.698	0.746
Male	5	0.754	0.708	0.722	0.761
Male	10	0.751	0.711	0.718	0.757
Male	20	0.759	0.718	0.725	0.759
Male	40	0.759	0.714	0.729	0.759

TABLE S11: Cohort Sizes

sex	cardiac event within week	n_{positive}	n_{control}	$n_{\text{high risk}}$	n
M	2	385	185528	146782	185913
M	4	464	185528	146782	185992
F	2	337	258981	204170	259318
F	4	418	258981	204170	259399
	Total	882	444509	350952	445391

TABLE S12: Out-of-sample predictive performance to predict MACE 4 weeks after surgery in sub-cohorts with pre-existing conditions

Pre-existing phenotye	Female CCoR	Female RCRI	Male CCoR	Male RCRI
Allergic	0.77	0.71	0.81	0.78
CNS	0.80	0.67	0.89	0.75
Cardiovascular	0.78	0.69	0.80	0.67
Development	0.77	0.83	0.86	0.68
Digestive	0.81	0.73	0.80	0.71
Endocrine	0.80	0.69	0.80	0.67
Frailty	0.78	0.69	0.85	0.73
Health Services	0.81	0.71	0.83	0.71
Hematologic	0.80	0.72	0.85	0.74
Hypertension	0.77	0.68	0.80	0.66
Immune	0.81	0.71	0.82	0.70
Infections Fungal and Other	0.80	0.76	0.84	0.68
Infections General	0.80	0.75	0.84	0.68
Infections Respiratory	0.76	0.64	0.83	0.63
Injuries	0.79	0.73	0.84	0.69
Integumentary	0.78	0.69	0.80	0.72
Metabolic	0.80	0.70	0.82	0.70
Musculoskeletal	0.81	0.71	0.83	0.70
Neoplastic	0.87	0.75	0.78	0.68
Ophthalmological	0.79	0.69	0.76	0.65
Otic	0.79	0.75	0.84	0.62
PNS	0.80	0.70	0.84	0.73
Psychiatric	0.85	0.74	0.89	0.72
Reproductive	0.80	0.70	0.82	0.79
Respiratory	0.81	0.70	0.83	0.67

TABLE S13: Out-of-sample predictive performance in sub-cohorts stratified by age

age	gender	auc CCoR	auc RCRI	$n_{positive}$	$n_{control}$
45 - 55	F	0.59	0.58	3	9056
45 - 55	M	0.89	0.79	5	7027
55 - 65	F	0.80	0.66	31	27256
55 - 65	M	0.78	0.63	39	20244
65 - 75	F	0.81	0.73	34	14235
65 - 75	M	0.73	0.58	31	9635
75 - 85	F	0.70	0.65	25	8515
75 - 85	M	0.79	0.71	36	5164
85 - 95	F	0.80	0.67	8	1578
85 - 95	M	0.75	0.48	12	847

TABLE S14: Out-of-sample* performance for predicting MACE with 4 weeks of Hip or Knee Arthroplasty (Primary Endpoint) at 99% Specificity: CCoR vs. RCRI**

sex	cohort	model	sensitivity	PPV	acc	LR+	LR-	AUC
Female	< 65	RCRI	0.01 ± 0.02	0.008 ± 0.000	0.987 ± 0.006	0.04 ± 0.1	1.00 ± 0.02	0.639 ± 0.039
Female	< 65	CCoR	0.14 ± 0.06	0.047 ± 0.004	0.987 ± 0.006	14.12 ± 1.1	0.87 ± 0.06	0.775 ± 0.035
Male	< 65	RCRI	0.07 ± 0.03	0.025 ± 0.003	0.987 ± 0.000	7.42 ± 0.8	0.94 ± 0.03	0.682 ± 0.034
Male	< 65	CCoR	0.15 ± 0.06	0.065 ± 0.003	0.987 ± 0.006	19.94 ± 0.9	0.85 ± 0.06	0.783 ± 0.030
Female	65+	RCRI	0.03 ± 0.01	0.012 ± 0.002	0.987 ± 0.000	3.39 ± 0.5	0.97 ± 0.01	0.664 ± 0.028
Female	65+	CCoR	0.09 ± 0.06	0.036 ± 0.004	0.987 ± 0.006	10.70 ± 1.1	0.92 ± 0.06	0.771 ± 0.025
Male	65+	RCRI	0.03 ± 0.01	0.011 ± 0.001	0.987 ± 0.006	3.17 ± 0.4	0.98 ± 0.00	0.661 ± 0.026
Male	65+	CCoR	0.09 ± 0.05	0.031 ± 0.002	0.987 ± 0.006	9.09 ± 0.6	0.92 ± 0.05	0.762 ± 0.023
Female	all patients	RCRI	0.05 ± 0.01	0.016 ± 0.003	0.987 ± 0.000	4.67 ± 0.8	0.96 ± 0.01	0.688 ± 0.023
Female	all patients	CCoR	0.13 ± 0.01	0.044 ± 0.007	0.987 ± 0.006	13.19 ± 2.1	0.88 ± 0.01	0.801 ± 0.019
Male	all patients	RCRI	0.05 ± 0.01	0.019 ± 0.002	0.987 ± 0.000	5.44 ± 0.7	0.95 ± 0.01	0.705 ± 0.020
Male	all patients	CCoR	0.12 ± 0.05	0.042 ± 0.001	0.987 ± 0.006	12.44 ± 0.3	0.89 ± 0.05	0.802 ± 0.018
Female	frail***	RCRI	0.03 ± 0.00	0.009 ± 0.002	0.987 ± 0.006	2.59 ± 0.6	0.98 ± 0.00	0.670 ± 0.028
Female	frail	CCoR	0.11 ± 0.03	0.036 ± 0.002	0.987 ± 0.000	10.36 ± 0.7	0.90 ± 0.03	0.791 ± 0.025
Male	frail	RCRI	0.06 ± 0.04	0.020 ± 0.002	0.987 ± 0.006	5.91 ± 0.7	0.95 ± 0.04	0.727 ± 0.027
Male	frail	CCoR	0.15 ± 0.03	0.050 ± 0.002	0.987 ± 0.000	15.02 ± 0.7	0.86 ± 0.03	0.810 ± 0.024
Female	high risk****	RCRI	0.02 ± 0.00	0.008 ± 0.001	0.987 ± 0.006	2.19 ± 0.3	0.99 ± 0.00	0.581 ± 0.029
Female	high risk	CCoR	0.07 ± 0.03	0.026 ± 0.002	0.987 ± 0.000	7.73 ± 0.6	0.94 ± 0.03	0.737 ± 0.026
Male	high risk	RCRI	0.03 ± 0.01	0.010 ± 0.001	0.987 ± 0.006	2.91 ± 0.3	0.98 ± 0.00	0.617 ± 0.026
Male	high risk	CCoR	0.09 ± 0.05	0.033 ± 0.002	0.987 ± 0.006	9.61 ± 0.7	0.92 ± 0.05	0.729 ± 0.024
Female	low risk†	CCoR	0.22 ± 0.04	0.071 ± 0.004	0.987 ± 0.000	21.81 ± 1.3	0.79 ± 0.04	0.765 ± 0.036
Male	low risk	CCoR	0.11 ± 0.04	0.042 ± 0.003	0.987 ± 0.000	5.96 ± 0.9	0.90 ± 0.04	0.766 ± 0.032

Abbreviations, AUC, area under the receiver operating characteristic curve; CCoR, Cardiac Co-Morbidity Risk Score; LR+, positive likelihood ratio; LR-, negative likelihood ratio; NPV, negative predictive value; PPV, positive predictive value; acc, accuracy; RCRI, Revised Cardiac Risk Index

*50% (n=445391) of cohort used for validation

**Because of insufficient availability of relevant laboratory data in the Truven dataset, presence of at least one diagnostic code for chronic kidney disease stage III or higher in the medical record in the year before the date of arthroplasty was used as a surrogate for the RCRI condition, serum creatinine concentration $>$ 2.0mg/dL (to convert to micromoles per liter, multiply by 88.4).

***Frail subcategory was defined by codes specified in Table S7

****Low risk subcohort comprises patients with RCRI score 0. High risk patients have RCRI score $>$ 0.

†No RCRI performance logged for low-risk patients, since their RCRI score is zero.

TABLE S15: Out-of-sample* performance for predicting MACE with 2 weeks of Hip or Knee Arthroplasty (Secondary Endpoint) at 99% Specificity: CCoR vs. RCRI**

sex	cohort	model	sensitivity	PPV	acc	LR+	LR-	AUC
Female	< 65	RCRI	0.01 ± 0.02	0.009 ± 0.000	0.987 ± 0.006	0.04 ± 0.1	1.00 ± 0.02	0.647 ± 0.044
Female	< 65	CCoR	0.11 ± 0.01	0.073 ± 0.023	0.987 ± 0.006	22.87 ± 8.5	0.90 ± 0.01	0.787 ± 0.039
Male	< 65	RCRI	0.09 ± 0.02	0.032 ± 0.009	0.987 ± 0.000	9.33 ± 2.8	0.92 ± 0.02	0.688 ± 0.037
Male	< 65	CCoR	0.14 ± 0.04	0.056 ± 0.004	0.987 ± 0.000	16.83 ± 1.3	0.87 ± 0.04	0.797 ± 0.033
Female	65+	RCRI	0.04 ± 0.04	0.013 ± 0.002	0.987 ± 0.006	3.66 ± 0.6	0.97 ± 0.03	0.671 ± 0.030
Female	65+	CCoR	0.10 ± 0.03	0.041 ± 0.002	0.987 ± 0.000	12.08 ± 0.7	0.91 ± 0.04	0.787 ± 0.027
Male	65+	RCRI	0.03 ± 0.00	0.010 ± 0.001	0.987 ± 0.000	2.79 ± 0.4	0.98 ± 0.00	0.667 ± 0.028
Male	65+	CCoR	0.09 ± 0.03	0.032 ± 0.002	0.987 ± 0.000	9.32 ± 0.6	0.92 ± 0.03	0.780 ± 0.025
Female	all patients	RCRI	0.05 ± 0.01	0.018 ± 0.003	0.987 ± 0.000	5.17 ± 0.9	0.96 ± 0.01	0.692 ± 0.025
Female	all patients	CCoR	0.14 ± 0.06	0.048 ± 0.001	0.987 ± 0.006	14.48 ± 0.3	0.87 ± 0.06	0.809 ± 0.021
Male	all patients	RCRI	0.05 ± 0.01	0.018 ± 0.002	0.987 ± 0.000	5.15 ± 0.7	0.96 ± 0.01	0.710 ± 0.022
Male	all patients	CCoR	0.14 ± 0.02	0.047 ± 0.007	0.987 ± 0.000	13.98 ± 2.1	0.87 ± 0.02	0.813 ± 0.019
Female	frail***	RCRI	0.03 ± 0.01	0.012 ± 0.003	0.987 ± 0.000	3.43 ± 0.9	0.98 ± 0.01	0.676 ± 0.032
Female	frail	CCoR	0.12 ± 0.03	0.041 ± 0.009	0.987 ± 0.000	11.78 ± 2.7	0.89 ± 0.03	0.807 ± 0.027
Male	frail	RCRI	0.06 ± 0.01	0.020 ± 0.003	0.987 ± 0.000	5.82 ± 0.9	0.95 ± 0.01	0.736 ± 0.029
Male	frail	CCoR	0.17 ± 0.03	0.059 ± 0.009	0.987 ± 0.000	17.76 ± 3.0	0.84 ± 0.03	0.825 ± 0.025
Female	high risk****	RCRI	0.02 ± 0.03	0.008 ± 0.001	0.987 ± 0.006	2.35 ± 0.4	0.99 ± 0.02	0.584 ± 0.032
Female	high risk	CCoR	0.08 ± 0.00	0.029 ± 0.006	0.987 ± 0.006	8.45 ± 1.9	0.93 ± 0.01	0.742 ± 0.028
Male	high risk	RCRI	0.03 ± 0.03	0.009 ± 0.001	0.987 ± 0.006	2.69 ± 0.4	0.98 ± 0.02	0.628 ± 0.028
Male	high risk	CCoR	0.09 ± 0.02	0.033 ± 0.007	0.987 ± 0.000	9.66 ± 2.3	0.92 ± 0.02	0.737 ± 0.026
Female	low risk†	CCoR	0.28 ± 0.07	0.092 ± 0.002	0.988 ± 0.006	28.78 ± 0.7	0.72 ± 0.07	0.779 ± 0.040
Male	low risk	CCoR	0.12 ± 0.04	0.047 ± 0.004	0.987 ± 0.000	6.78 ± 1.1	0.89 ± 0.05	0.793 ± 0.035

Abbreviations, AUC, area under the receiver operating characteristic curve; CCoR, Cardiac Co-Morbidity Risk Score; LR+, positive likelihood ratio; LR-, negative likelihood ratio; NPV, negative predictive value; PPV, positive predictive value; acc, accuracy; RCRI, Revised Cardiac Risk Index

*50% (n=445391) of cohort used for validation

**Because of insufficient availability of relevant laboratory data in the Truven dataset, presence of at least one diagnostic code for chronic kidney disease stage III or higher in the medical record in the year before the date of arthroplasty was used as a surrogate for the RCRI condition, serum creatinine concentration > 2.0mg/dL (to convert to micromoles per liter, multiply by 88.4).

***Frail subcategory was defined by codes specified in Table S7

****Low risk subcohort comprises patients with RCRI score 0. High risk patients have RCRI score > 0.

†No RCRI performance logged for low-risk patients, since their RCRI score is zero.

TABLE S16: Statistical significance of CCoR AUC $>$ RCRI AUC ($\star$ denotes signifance at 95% level, $\star\star$ denotes significance at 99% level)

sex	model	weeks after surgery	RCRI auc	CCoR auc	p value	significance
Female	all patients	2	0.692	0.809	0.010	**
		4	0.688	0.801	0.007	**
	frail[†]	2	0.676	0.807	0.017	*
		4	0.670	0.791	0.014	*
	high risk[‡]	2	0.584	0.742	0.005	**
		4	0.581	0.737	0.003	**
	65+	2	0.671	0.787	0.020	*
		4	0.664	0.771	0.020	*
	<65	2	0.647	0.787	0.036	*
		4	0.639	0.775	0.028	*
Male	all patients	2	0.710	0.813	0.010	*
		4	0.705	0.802	0.009	**
	frail	2	0.736	0.825	0.045	*
		4	0.727	0.810	0.042	*
	high risk	2	0.628	0.737	0.017	*
		4	0.617	0.729	0.011	*
	65+	2	0.667	0.780	0.017	*
		4	0.661	0.762	0.019	*
	<65	2	0.688	0.797	0.047	*
		4	0.682	0.783	0.042	*

[†]Frail subcategory was defined by codes specified in Table S7

[‡]Low risk subcohort comprises patients with RCRI score 0. High risk patients have RCRI score >0.

TABLE S17: Out-of-sample performance achieved using only PFSA component of the CCoR model (Note: the performance is significantly degraded, with all p-values <0.01.)

sex	**prediction horizon**	**AUC**
Female	2 weeks	0.696 ± 0.082
Female	4 weeks	0.698 ± 0.074
Male	2 weeks	0.679 ± 0.074
Male	4 weeks	0.656 ± 0.067

SUPPLEMENTAL METHODS

A. Time-series Modeling of Diagnostic History

Individual diagnostic histories can have long-term memory [52], implying that the order, frequency, and comorbid interactions between diseases are important for assessing the future risk of our target phenotype. We analyze patient-specific diagnostic code sequences by first representing the medical history of each patient as a set of stochastic categorical time-series — one each for a specific group of related disorders — followed by the inference of stochastic models for these individual data streams. These inferred generators are from a special class of Hidden Markov Models (HMMs), referred to as Probabilistic Finite State Automata (PFSA) [53]. The inference algorithm we use is distinct from classical HMM learning, and has important advantages related to its ability to infer structure, and its sample complexity (See Supplementary text, Section VI). We infer a separate class of models for the positive and control cohorts, and then the problem reduces to determining the probability that the short diagnostic history from a new patient arises from the positive as opposed to the control category of the inferred models.

B. Inference & Event Periods

We train our predictive pipeline with all diagnostic codes that are recorded in the past 26years from the point at which a prediction is made. This period from which we use data to train our pipeline is called the "inference window". Our aim is to make predictions on the occurrence of the target diagnostic codes at 2year from the end of the inference window. For patients in the control cohort, we make sure that no target code appears for 26years after the end of the inference window. Additionally, when making predictions further into the future (upto 4 years, as described in the main text), we always make sure that the control group has no target codes for 1 year after the predcited time of diagnosis, $i.e.$, if we are making a prediction of a diagnosis 4 years in future, then control group patients are chosen to have no diagnosis in at least next 5 years.

C. Step 1: Partitioning The Human Disease Spectrum

We begin by partitioning the human disease spectrum into 26non-overlapping categories. Each category is defined by a set of diagnostic codes from the International Classification of Diseases, Ninth Revision (ICD9) (See Table SI-S7 for description of the categories used in this study). For this study, we ended up using 4879398 and 7753318 diagnostic codes for males and females respectively (17554 and 19209 unique codes) spanning both ICD9 and ICD10 protocols (using ICD10 General Equivalence Mappings (GEMS) [54] equivalents where necessary), from a total 445391 patients. Transforming the diagnostic histories to report only the broad categories reduces the number of distinct codes that the pipeline needs to handle, thus improving statistical power. Our categories largely align with the top-level ICD9 categories, with small adjustments, $e.g.$ bringing all infections under one category irrespective of the pathogen or the target organ. We do not pre-select the phenotypes; we want our algorithm to seek out the important patterns without any manual curation of the input data. For each patient, the past medical history is a sequence $(t_1, x_1), \cdots, (t_m, x_m)$, where t_i are timestamps and x_i are ICD9 codes diagnosed at time t_i. We map individual patient history to a three-alphabet categorical time series z^k corresponding to the disease category k, as follows. For each week i, we have:

$$z_i^k = \begin{cases} 0 & \text{if no diagnosis codes in week } i \\ 1 & \text{if there exists a diagnosis of category } k \text{ in week } i \\ 2 & \text{otherwise} \end{cases} \quad (1)$$

The time-series z^k is observed in the inference period. Thus, each patient is represented by 43 mapped trinary series.

D. Step 2: Model Inference & The Sequence Likelihood Defect Δ

The mapped series, disease-category, and perioperative cardiac event diagnosis-status are considered to be independent sample paths, and we want to explicitly model these systems as specialized HMMs (PFSAs). We model the positive and the control cohorts and each disease category separately, ending up with a total of 104 HMMs at the population level (26 categories, 2 perioperative cardiac event status categories: positive and control, and 2 sexes). Each of these inferred models is a PFSA; a directed graph with probability-weighted edges, and acts as an optimal generator of the stochastic process driving the sequential appearance of the three letters

(as defined by Eq. (1)) corresponding to disease category, and perioperative cardiac event status-type (See Section VI in the Supplementary text for background on PFSA inference).

To reliably infer the perioperative cardiac event status-type of a new patient, $i.e$, the likelihood of a diagnostic sequence being generated by the corresponding perioperative cardiac event status-type model, we generalize the notion of Kullbeck-Leibler (KL) divergence [55] between probability distributions to a divergence $\mathcal{D}_{\mathsf{KL}}(G||H)$ between ergodic stationary categorical stochastic processes [56] G, H as:

$$\mathcal{D}_{\mathsf{KL}}(G||H) = \lim_{n\to\infty} \frac{1}{n} \sum_{x:|x|=n} p_G(x) \log \frac{p_G(x)}{p_H(x)} \tag{2}$$

where $|x|$ is the sequence length, and $p_G(x), p_H(x)$ are the probabilities of sequence x being generated by the processes G, H respectively. Defining the log-likelihood of x being generated by a process G as :

$$L(x, G) = -\frac{1}{|x|} \log p_G(x) \tag{3}$$

The cohort-type for an observed sequence x — which is actually generated by the hidden process G — can be formally inferred from observations based on the following provable relationships (See Supplementary Text Section VI, Theorem 6 and 7):

$$\lim_{|x|\to\infty} L(x, G) = \mathcal{H}(G) \tag{4a}$$

$$\lim_{|x|\to\infty} L(x, H) = \mathcal{H}(G) + \mathcal{D}_{\mathsf{KL}}(G||H) \tag{4b}$$

where $\mathcal{H}(\cdot)$ is the entropy rate of a process *[32]*. Importantly, Eq. (4) shows that the computed likelihood has an additional non-negative contribution from the divergence term when we choose the incorrect generative process. Thus, if a patient is eventually going to be diagnosed with perioperative cardiac event, then we expect that the disease-specific mapped series corresponding to her diagnostic history be modeled by the PFSA in the positive cohort. Denoting the PFSA corresponding to disease category j for positive and control cohorts as G_+^j, G_0^j respectively, we can compute the *sequence likelihood defect* (SLD, Δ^j) as:

$$\Delta^j \triangleq L(G_0^j, x) - L(G_+^j, x) \to \mathcal{D}_{\mathsf{KL}}(G_0^j||G_+^j) \tag{5}$$

With the inferred PFSA models and the individual diagnostic history, we estimate the SLD measure on the right-hand side of Eqn. (5). The higher this likelihood defect, the higher the similarity of diagnosis history to that of women with perioperative cardiac event.

E. Step 3: Risk Estimation Pipeline With Semi-supervised & Supervised Learning Modules

The risk estimation pipeline operates on patient specific information limited to the available diagnostic history in the inference period, and produces an estimate of the relative risk of perioperative cardiac event, with an associated confidence value. To learn the parameters and associated model structures of this pipeline, we transform the patient specific data to a set of engineered features, and the feature vectors realized on the positive and control sets are used to train a gradient-boosting classifier [57]. The complete list of 380 features used is provided in Table 6.

We need two training sets: one to infer the models, and one to train the classifier with features derived from the inferred models. Thus, we do a random 3-way split of the set of unique patients into *feature-engineering* (25%), *training* (25%) and *test* (50%) sets. We use the feature-engineering set of ids first to infer our PFSA models *(unsupervised model inference in each category)*, which then allows us to train the gradient-boosting classifier using the training set and PFSA models *(classical supervised learning)*, and we finally execute out-of-sample validation on the test set. Fig. 1c in the main text shows the top 20 features ranked in order of their relative importance (relative loss in performance when dropped out of the analysis).

I. Threshold Selection on ROC Curve

Once the ROC curve has been computed, we must choose a decision threshold to trade-off true positive rate and false positive rate. In situations where the number of negatives vastly outnumber the number of positives (which is the case in our problem), it is better to base this trade-off on a measure that is independent of the number of true negatives. The two popular measures considered in the literature are accuracy and the F1-score:

$$\text{accuracy} = \frac{t_p + t_n}{t_p + f_p + f_n + t_n} \tag{6}$$

$$\text{F1} = \frac{2t_p}{2t_p + f_p + f_n} \tag{7}$$

The F1-score is the same as accuracy where the number of true negatives is the same as the number of true positives, thus partially correcting for the class imbalance.

The selection of the threshold may also be dictated by the current practice of ensuring high specificities in screening tests. Thus, a relevant clinically operating point is the one corresponding to 95% specificity, which is highlighted in Fig. 1a.

II. Note on Reciever Operating Characteristics (ROC) and Precision-recall Curves

The ROC curve is a plot between the False Positive rate (TPR) and the True Positive Rate (TPR), and the area under the ROC curve (AUC) is often used as a measure of classifier performance. For the same of completeness, we introduce the relevant definitions:

In the following P denotes the total number of positive samples (number of patients who are eventually diagnosed), and N denotes the total number of negative samples (number of patients in the control group).

Definition 1. *True positive rate, true negative rate, false positive rate, positive predictive value (**PPV**), and **prevalence** (ρ) are defined as:*

$$TPR = \frac{\mathrm{t_p}}{\mathrm{P}} = \frac{\mathrm{t_p}}{\mathrm{t_p} + \mathrm{f_n}} \tag{8}$$

$$TNR = \frac{\mathrm{t_n}}{\mathrm{N}} = \frac{\mathrm{t_n}}{\mathrm{t_n} + \mathrm{f_p}} \tag{9}$$

$$FPR = 1 - TNR \tag{10}$$

$$PPV = \frac{\mathrm{t_p}}{\mathrm{t_p} + \mathrm{f_p}} \tag{11}$$

$$\rho = \frac{\mathrm{P}}{\mathrm{N} + \mathrm{P}} \tag{12}$$

where as before $\mathrm{t_p}, \mathrm{t_n}, \mathrm{f_p}, \mathrm{f_n}$ are true positives, true negatives, false positives, and false negatives respectively.

Note that TPR is also referred to as **recall** or **sensitivity**, and PPV is also referred to as **precision**. True negative rate is also known as **specificity**.

A **precision-recall curve**, or a PPV-sensitivity curve is a plot between PPV and TPR.

Denoting sensitivity by s, and specifciyty by c, it follows that:

$$\mathrm{PPV} = \frac{\mathrm{t_p}/\mathrm{P}}{\mathrm{t_p}/\mathrm{P} + (\mathrm{f_p}/\mathrm{N})(\mathrm{N}/\mathrm{P})} = \frac{\mathrm{TPR}}{\mathrm{TPR} + ((\mathrm{N} - \mathrm{t_n})/\mathrm{N})(\mathrm{N}/\mathrm{P})} \tag{13}$$

$$\Rightarrow \mathrm{PPV} = \frac{\mathrm{s}}{\mathrm{s} + (1 - \mathrm{c})(\frac{1}{\rho} - 1)} \tag{14}$$

Thus, we note that for a fixed specificity and sensitivity, the PPV depends on prevalence. Indeed, it is clear from the above argument that PPV decreases with decreasing prevalence, and vice versa.

III. Effect of Class Imbalance

ROC curves are generally assumed to be robust to class imbalance. Note that if we assume that patient outcomes are independent (which is well-justified in the case of a non-communicable condition, particularly in large databases), then $\mathrm{t_p}$ should scale linearly with the total number of positives P, implying:

$$\mathrm{TPR} = \frac{\mathrm{t_p}}{\mathrm{P}} = \frac{\mathrm{t_p'}}{\mathrm{P'}} \tag{15}$$

implying that with different sizes of the set of positive samples (or negative samples), the ROC curve remains unchanged. In particular, note that even if the prevalence is very small (say 0.01%), we cannot cheat to boost the AUC by labeling all predictions as negative, or stating that risk is always zero: in that case, our P is very small, but our $\mathrm{t_p} = 0$ strictly, implying that our $\mathrm{TPR} = 0$, thus leading to a zero AUC. We can cheat to boost the accuracy (See the previous section), but not the AUC.

Note that while relative class sizes or imbalance does not affect the ROC (under the assumption that true positives and true negatives scale with the number of positives and negatives), very small absolute sample sizes might still result in poor performance of the model.

The precision-recall curves do get affected by class imbalance, or the prevalence, as shown by Eq (14). However, in diagnostic analysis, they are important since we are generally less interested in the number of true negatives; the ratio of false positives to the total number of positive recommendations by the algorithm is much more relevant, $i.e.$, the PPV or the precision.

IV. Generating PFSA Models From Set of Input Streams with Variable Input Lengths

Our PFSA reconstruction algorithm [53] is distinct from standard HMM learning. We do not need to pre-specify structures, or the number of states in the algorithm, and all model parameters are inferred directly from data. Additionally, we can operate either with 1) a single input stream, or 2) a set of input streams of possibly varying lengths which are assumed to be different and independent sample paths from the unknown stochastic generator we are trying to infer. At an intuitive level, we use the input data to infer the length of histories one must remember to estimate the current state, and predict futures for the process being modeled. Thus, we do not step through the symbol streams with a pre-specified model structure, and avoid the need to have equal-length inputs. More details of the algorithm are provided in the next section.

The ability to model a set of input streams of varying lengths is particularly important, since medical histories of different patients are typically of different lengths.

V. Probabilsitic Finite State Automata Inference

A. Probabilistic Finite-State Automaton

Let Σ be a finite alphabet of symbols with size $|\Sigma|$. The set of sequences of length d over Σ is denoted by Σ^d. The set of finite but unbounded sequences over Σ is denoted by $\Sigma^\star$, the Kleene star operation [58], $i.e.$ $\Sigma^\star = \bigcup_{d=0}^{\infty} \Sigma^d$. We use lower case Greek, for example σ or τ, for symbols in Σ, and lower case Latin, for example x or y, for sequences of symbols, $i.e.$ $x = \sigma_1\sigma_2\ldots\sigma_n$. We use $|x|$ to denote the length of x. The empty sequence is denoted by λ.

We denote the set of strictly infinite sequences over Σ by Σ^ω, and the set of strictly infinite sequences having x as prefix by $x\Sigma^\omega$. Let $\mathcal{S} = \{x\Sigma^\omega : x \in \Sigma^\star\} \cup \{\emptyset\}$, we can verify that $\mathcal{S}$ is a semiring [59] over Σ^ω. We use $\mathcal{F}$ to denote the sigma algebra generated by $\mathcal{S}$.

Definition 2 (Stochastic Process over Σ)**.** *A stochastic process over a finite alphabet Σ is a collection of Σ-valued random variables $\{X_t\}_{t\in\mathbb{N}}$ indexed by positive integers [56].*

We are specifically interested in processes in which the X_is are not necessarily independently distributed.

Definition 3 (Sequence-Induced Measure and Derivative)**.** *For a process $\mathscr{P}$, let $\Pr_{\mathscr{P}}(x)$ or simply $\Pr(x)$ denote the probability $\mathscr{P}$ producing a sample path prefixed by x. The **measure** μ_x **induced by a sequence** $x \in \Sigma^\star$ is the extension [59] to $\mathcal{F}$ of the premeasure defined on the semiring $\mathcal{S}$ given by*

$$\forall x, y \in \Sigma^\star, \mu_x(y\Sigma^\omega) \triangleq \frac{\Pr(xy)}{\Pr(x)}, \text{ if } \Pr(x) > 0 \tag{16}$$

*For any $d \in \mathbb{N}$, the **d-th order derivative** of a sequence x, written as ϕ_x^d, is defined to be the marginal distribution of μ_x on Σ^d, with the entry indexed by y denoted by $\phi_x^d(y)$. The first-order derivative is called the **symbolic derivative** and is denoted by ϕ_x for short.*

Definition 4 (Probabilistic Nerode Equivalence and Causal States [60])**.** *For any pair of sequences $x, y \in \Sigma^\star$, x is equivalent to y, written as $x \sim y$, if and only if either $\Pr(x) = \Pr(y) = 0$, or $\mu_x = \mu_y$. The equivalence class of a sequence x is denoted by $[x]$ and is called a **causal state** [61]. The cardinality of the set of causal states is called the **probabilistic Nerode index**, or the Nerode index for simplicity.*

We can see from the definition that causal states captures how the history of a process influences its future. Since the probabilistic Nerode equivalence is right invariant, it gives rise naturally to a automaton structure introduced below.

Definition 5 (Probabilistic Finite-State Automaton (PFSA))**.** *A PFSA G is defined by a quadruple $(Q, \Sigma, \delta, \widetilde{\pi})$, where Q is a finite set, Σ is a finite alphabet, $\delta : Q \times \Sigma \to \Sigma$ is called the transition map, and $\widetilde{\pi} : Q \to \mathbf{P}_\Sigma$, where*

$\mathbf{P}_\Sigma$ *is the space of probability distributions over* Σ*, is called the transition probability. The entry of* $\widetilde{\pi}(q)$ *indexed by* σ *is denoted by* $\widetilde{\pi}(q,\sigma)$*.*

Definition 6 (Transition and Observation Matrices)**.** *The transition matrix* Π *is the* $|Q|\times|Q|$ *matrix with the entry indexed by* q, q'*, written as* $\pi_{q,q'}$*, satisfying*

$$\pi_{q,q'} \triangleq \sum_{\{\sigma\in\Sigma|\delta(q,\sigma)=q'\}} \widetilde{\pi}(q,\sigma) \tag{17}$$

and the observation matrix $\widetilde{\Pi}$ *is a* $|Q|\times|\Sigma|$ *matrix with the entry indexed by* q,σ *equaling* $\widetilde{\pi}(q,\sigma)$*.*

We note that both Π and $\widetilde{\Pi}$ are stochastic, i.e. non-negative with rows summing up to 1.

Definition 7 (Extension of δ and $\widetilde{\pi}$ to $\Sigma^\star$)**.** *For any* $x=\sigma_1\dots\sigma_k$*,* $\delta(q,x)$ *is defined recursively by*

$$\delta(q,x) \triangleq \delta\left(\delta\left(q,\sigma_1\dots\sigma_{k-1}\right),\sigma_k\right) \tag{18}$$

with $\delta(q,\lambda)=q$*, and* $\widetilde{\pi}(q,x)$ *is defined recursively by*

$$\widetilde{\pi}(q,x) \triangleq \prod_{i=1}^{k} \widetilde{\pi}\left(\delta\left(q,\sigma_1\dots\sigma_{i-1}\right),\sigma_i\right) \tag{19}$$

with $\widetilde{\pi}(q,\lambda)=1$*.*

Definition 8 (Strongly Connected PFSA)**.** *We say a PFSA is strongly connected if the underlying directed graph is strongly connected [62]. More precisely, a PFSA* $G=(Q,\Sigma,\delta,\widetilde{\pi})$ *is strongly connected if for any pair of distinct states* q *and* $q'\in Q$*, there is an* $x\in\Sigma^\star$ *such that* $\delta(q,x)=q'$*.*

We assume all PFSA in the discussions in the sequel are strongly connected if not specified otherwise. For strongly connected PFSA G, there is a unique probability distribution over Q that satisfies $\mathbf{v}^T\Pi=\mathbf{v}^T$. This is the **stationary distribution** [63], [64] of G and is denoted as $\wp_G$, or $\wp$ if G is understood.

Definition 9 (Γ-Expression)**.** *We can encode the information contained in* δ *and* $\widetilde{\pi}$ *by a set of* $|Q|\times|Q|$ *matrices* $\mathbf{\Gamma}=\{\Gamma_\sigma|\sigma\in\Sigma\}$*, where*

$$\Gamma_\sigma\big|_{q,q'} \triangleq \begin{cases} \widetilde{\pi}(q,\sigma) & \text{if } \delta(q,\sigma)=q', \\ 0 & \text{if otherwise.} \end{cases} \tag{20}$$

Γ_σ *is called* ***event-specific transition matrix****, with the event being that* σ *is current the output.* Γ_σ *can also be extended to arbitrary* $x\in\Sigma^\star$ *by defining* $\Gamma_x=\prod_{i=1}^{k}\Gamma_{\sigma_i}$ *with* $\Gamma_\lambda=I$*.*

Definition 10 (Sequence-Induced Distribution on States)**.** *For a PFSA* $G=(Q,\Sigma,\delta,\widetilde{\pi})$ *and a distribution* $\wp_0$ *on* Q*, the* ***distribution on*** Q ***induced by a sequence*** x *is given by* $\wp^T_{G,\wp_0}(x)=\left[\!\left[\wp_0^T\Gamma_x\right]\!\right]$ *with* $\wp_{G,\wp_0}(\lambda)=\wp_0$*. The entry indexed by* $q\in Q$ *of the vector* $\wp_{G,\wp_0}(x)$ *is written as* $\wp_{G,\wp_0}(x,q)$*. When* $\wp_0=\wp_G$*, the stationary distribution of* G*, we write* $\wp_{G,\wp_0}(x)$ *as* $\wp_G(x)$*, or simply as* $\wp(x)$*, if* G *is understood.*

Definition 11 (Stochastic Process Generated by a PFSA)**.** *Let* $G=(Q,\Sigma,\delta,\widetilde{\pi})$ *be a PFSA and let* $\wp_0$ *be a distribution on* Q*, the* Σ*-valued stochastic process* $\{X_t\}_{t\in\Sigma}$ *generated by* G *and* $\wp_0$ *satisfies that* X_1 *follows the distribution* $\wp_0$ *and* X_{t+1} *follows the distribution* $\wp_{G,\wp_0}(X_1\cdots X_t)$ *for* $t\in\mathbb{N}$*.*

For the rest of this paper, we will assume $\wp_0=\wp_G$ if not specified otherwise. We can show that, when initialized with $\wp_G$, the process generated by a PFSA G is stationary and ergodic. We also note the, for the process generate by G, we have $\phi_x=\wp_G(x)^T\widetilde{\Pi}$. Since $\wp_G(\lambda)=\wp_G$, the symbolic derivative of the empty sequence ϕ_λ is the stationary distribution on the symbols.

Definition 12 (Synchronizable PFSA and Synchronizing Sequence)**.** *A* ***synchronizing sequence*** *is a finite sequence that sends an arbitrary state of the PFSA to a fixed state [65]. To be more precise, let* $G=(Q,\Sigma,\delta,\widetilde{\pi})$ *be a PFSA, we say a sequence* $x\in\Sigma^\star$ *is a synchronizing sequence to a state* $q\in Q$ *if* $\delta(q',x)=q$ *for all* $q'\in Q$*. A PFSA is* ***synchronizable*** *if it has at least one synchronizing sequence. Given a sample path generated by a PFSA, we say the PFSA is* ***synchronized*** *if a synchronizing sequence transpires in the sample path.*

Definition 13 (Equivalence and Irreducibility)**.** *Two PFSA* G *and* H *are* ***equivalent*** *if they generate the same stochastic process. A PFSA* G *is said to be* ***irreducible****, if there is not another PFSA with smaller state set that is equivalent to* G*.*

Definition 14. *Consider a PFSA* G *over state set* Q*. For a give* $\varepsilon>0$*, we say a sequence* x *is a* ε*-synchronizing sequence to a state* $q\in Q$ *if*

$$\left\|\wp_G(x)-\mathbf{e}_q\right\|_\infty \leqslant \varepsilon. \tag{21}$$

Algorithm 1: `GenESeSS`

Data: A sequence x over alphabet Σ, $0 < \varepsilon < 1$
Result: State set Q, transition map δ, and transition probability $\widetilde{\pi}$

/* **Step One: Approximate ε-synchronizing sequence** */
Let $L = \left\lceil \log_{|\Sigma|} 1/\varepsilon \right\rceil$;
Calculate the **derivative heap** $\mathcal{D}_\varepsilon^x$ equaling $\left\{\hat{\phi}_y^x \,:\, y \text{ is a sub-sequence of } x \text{ with } |y| \leqslant L\right\}$;
Let $\mathcal{C}$ be the convex hull of D_ε^x;
Select x_0 with $\hat{\phi}_{x_0}^x$ being a vertex of $\mathcal{C}$ and has the highest frequency in x;
/* **Step Two: Identify transition structure** */
Initialize $Q = \{q_0\}$;
Associate to q_0 the **sequence identifier** $x_{q_0}^{id} = x_0$ and the probability vector $d_{q_0} = \hat{\phi}_{x_0}^x$;
Let $\widetilde{Q}$ be the set of states that are just added and initialize it to be Q;
while $\widetilde{Q} \neq \emptyset$ **do**
  Let $Q_{new} = \emptyset$ be the set of new states;
  for $(q, \sigma) \in \widetilde{Q} \times \Sigma$ **do**
    Let $x = x_q^{id}$ and $d = \hat{\phi}_{x\sigma}^x$;
    if $\|d - d_{q'}\|_\infty < \varepsilon$ *for some* $q' \in Q$ **then**
      Let $\delta(q, \sigma) = q'$;
    else
      Let $Q_{new} = Q_{new} \cup \{q_{new}\}$ and $Q = Q \cup \{q_{new}\}$;
      Associate to q_{new} the sequence identifier $x_{q_{new}}^{id} = x\sigma$ and the probability vector $d_{q_{new}} = d$;
      Let $\delta(q, \sigma) = q_{new}$;
  Let $\widetilde{Q} = Q_{new}$;
Take a strongly connected subgraph of the labeled directed graph defined by Q and δ, and denote the vertex set of the subgraph again by Q;
/* **Step Three: Identify transition probability** */
Initialize counter $N[q, \sigma]$ for each pair $(q, \sigma) \in Q \times \Sigma$;
Choose a random starting state $q \in Q$;
for $\sigma \in x$ **do**
  Let $N[q, \sigma] = N[q, \sigma] + 1$;
  Let $q = \delta(q, \sigma)$;
Let $\widetilde{\pi}(q) = \left[\!\left[(N[q, \sigma])_{\sigma \in \Sigma} \right]\!\right]$;
return Q, δ, $\widetilde{\pi}$;

While there exists PFSA that is not synchronizable, we can show that an irreducible PFSA always has an ε-synchronizing sequence for some state q for arbitrarily small $\varepsilon > 0$. Moreover, we can show that as length increases, sequences produced by PFSA become uniformly ε-synchronizing. These two are the underpinning properties for the inference algorithm of PFSA (See Alg. 1), because they imply that ϕ_x can be used to approximate $\widetilde{\pi}(q)$ if x are properly prefixed and long enough.

Definition 15 (Joint ε-Synchronizing Sequence)**.** *Let G and H be two PFSA over state sets Q_G and Q_H, respectively. For a fixed ε, a sequence x is said to be **jointly ε-synchronizing** to $(q, r) \in Q_G \times Q_H$ if x is ε-synchronizing to q and to r simultaneously. We define*

$$\Sigma_{\varepsilon,(q,r)}^d \triangleq \left\{x \in \Sigma^d : \; x \textit{ jointly } \varepsilon\textit{-synchronizing to } (q, r)\right\} \tag{22}$$

Definition 16 (Joint Pair of States)**.** *Let G and H be two PFSA over state sets Q_G and Q_H, respectively. Define*

$$p_G(q, r) \triangleq \lim_{d \to \infty} p_G\left(\Sigma_{\varepsilon,(q,r)}^d\right) \tag{23}$$

*A pair of states $(q, r) \in Q_G \times Q_H$ is called a G-**joint pair** of states if $p_G(q, r) > 0$. We also define*

$$Q_c \triangleq \{(q, r) \in Q_G \times Q_H : \; (q, r) \textit{ is a } G\textit{-joint pair}\} \tag{24}$$

The inference algorithm for PFSA is called **`GenESeSS`** for Generator Extraction Using Self-similar Semantics. With an input sequence x and a hyperparameter ε, **`GenESeSS`** outputs a PFSA in the following three steps: 1) approximate an almost synchronizing sequence; 2) identify the transition structure of the PFSA; 3) calculate the transition probabilities of the PFSA. See Alg. 1 [53] for details.

Algorithm 2: Log-likelihood

Data: A PFSA $G = (\Sigma, Q, \delta, \widetilde{\pi})$ and a sequence x over alphabet Σ
Result: Log-likelihood $L(x, G)$ of G generating x

```
Calculate the state transition matrix Π and observation Π̃;
Calculate the stationary distribution over states φ_G of G from Π;
Calculate the stationary distribution of alphabet φ_λ^T = φ_G^T Π̃;
Initialize p by φ_G and q by φ_λ;
Let L = 0;
for i from 1 to |x| do
    Let σ be the i-th entry of x;
    Let L = L − log q|_σ;
    Let p^T = ⟦p^T Γ_σ⟧ where Γ_σ is defined in 9;
    Let q^T = p^T Π̃;
return L/|x|;
```

VI. Theoretical Development of Sequence Likelihood Defect

Definition 17 (Entropy Rate and KL Divergence)**.** *By entropy rate of a PFSA, we mean the entropy rate of the stochastic process generated by the PFSA [32]. Similarly, by KL divergence of two PFSA, we mean the KL divergence between the two processes generated by them [66]. More precisely, we have*

$$\mathcal{H}(G) = -\lim_{d\to\infty} \frac{1}{d} \sum_{x\in\Sigma^d} p(x) \log p(x) \tag{25}$$

and the KL divergence

$$\mathcal{D}_{KL}(G \,\|\, H) = \lim_{d\to\infty} \frac{1}{d} \sum_{x\in\Sigma^d} p_G(x) \log \frac{p_G(x)}{p_H(x)} \tag{26}$$

whenever the limits exist.

Theorem 1 (Closed-form Formula for Entropy Rate and KL Divergence)**.** *The entropy rate of a PFSA* $G = (\Sigma, Q, \delta, \widetilde{\pi})$ *is given by*

$$\mathcal{H}(G) = \sum_{q\in Q} \wp_G(q) \cdot h(\widetilde{\pi}(q)) \tag{27}$$

where $h(\mathbf{v})$ *is the based-2 entropy of the probability vector* $\mathbf{v}$*.*

Consider two PFSA $G = (Q_G, \Sigma, \delta_G, \widetilde{\pi}_G)$ *and* $H = (Q_H, \Sigma, \delta_H, \widetilde{\pi}_H)$ *with* μ_G *being absolutely continuous with respect to* μ_H*. Let* Q_c *be the set of* G*-joint pairs of states, we have*

$$\mathcal{D}_{KL}(G \,\|\, H) = \sum_{(q,r)\in Q_c} p_G(q,r)\, D_{KL}(\widetilde{\pi}_G(q) \,\|\, \widetilde{\pi}_H(r)) \tag{28}$$

Definition 18 (Log-likelihood)**.** *Let* $x \in \Sigma^d$*, the log-likelihood [32] of a PFSA* G *generating* x *is given by*

$$L(x, G) = -\frac{1}{d} \log p_G(x) \tag{29}$$

The calculation of log-likelihood is detailed in Alg. 2.

Theorem 2 (Convergence of log-likelihood)**.** *Let* G *and* H *be two reduced PFSA, and let* $x \in \Sigma^d$ *be a sequence generated by* G*. Then we have*

$$L(x, H) \to \mathcal{H}(G) + \mathcal{D}_{KL}(G \,\|\, H) \tag{30}$$

in probability as $d \to \infty$*.*

Proof. We first notice that

$$\sum_{x\in\Sigma^d} p_G(x) \log \frac{p_G(x)}{p_H(x)} = \sum_{x\in\Sigma^{d-1}} \sum_{\sigma\in\Sigma} p_G(x)\wp_G(x)\, \widetilde{\Pi}_G\Big|_\sigma \log \frac{p_G(x)\wp_G(x)\, \widetilde{\Pi}_G\Big|_\sigma}{p_H(x)\wp_H(x)\, \widetilde{\Pi}_H\Big|_\sigma} \tag{31}$$

$$= \sum_{x\in\Sigma^{d-1}} p_G(x) \log \frac{p_G(x)}{p_H(x)} + \underbrace{\sum_{x\in\Sigma^{d-1}} p_G(x) \sum_{\sigma\in\Sigma} \wp_G(x)\, \widetilde{\Pi}_G\Big|_\sigma \log \frac{\wp_G(x)\, \widetilde{\Pi}_G\Big|_\sigma}{\wp_H(x)\, \widetilde{\Pi}_H\Big|_\sigma}}_{D_d} \tag{32}$$

By induction, we have $\mathcal{D}_{KL}(G \,\|\, H) = \lim_{d\to\infty} \frac{1}{d}\sum_{i=1}^{d} D_i$, and hence by Cesàro summation theorem [67], we have $\mathcal{D}_{KL}(G \,\|\, H) = \lim_{d\to\infty} D_d$. Let $x = \sigma_1\sigma_2...\sigma_n$ be a sequence generated by G. Let $x^{[i-1]}$ is the truncation of x at the $(i-1)$-th symbols, we have

$$-\frac{1}{n}\sum_{i=1}^{n} \log \wp_H\left(x^{[i-1]}\right)\widetilde{\Pi}_H\Big|_{\sigma_i} = \underbrace{\frac{1}{n}\sum_{i=1}^{n} \log \frac{\wp_G\left(x^{[i-1]}\right)\widetilde{\Pi}_G\Big|_{\sigma_i}}{\wp_H\left(x^{[i-1]}\right)\widetilde{\Pi}_H\Big|_{\sigma_i}}}_{A_{x,n}} - \underbrace{\frac{1}{n}\sum_{i=1}^{n} \log \wp_G\left(x^{[i-1]}\right)\widetilde{\Pi}_G\Big|_{\sigma_i}}_{B_{x,n}} \tag{33}$$

Since the stochastic process G generates is ergodic, we have

$$\lim_{n\to\infty} A_{x,n} = \lim_{d\to\infty} D_d = \mathcal{D}_{KL}(G \,\|\, H) \tag{34}$$

and $\lim_{n\to\infty} B_{x,n} = \mathcal{H}(G)$. □

VII. Pipeline Optimization: Hyper-training, Training, & Validation

Our pipeline comprises a network of individually trained light gradient boosting machine (LGBM) *[32]* classifiers that focus on complementary aspects of the problem, and operate on different categories of input features as described next. Importantly, some of these features need to be generated non-trivially from the raw data, and these *feature generators* have parameters that need to be trained as well (or comprise models that need to be inferred). We call this inference of the feature-generators as **hyper-training**. Importantly, this is different from the more common notion of hyper-parameters. Hyper-parameters are one or more variables whose scalar values are commonly tuned by grid-search or via some meata-heuristics to optimize classifiers, whereas hyper-training produces generators of features, not simply a set of numbers.

Hyper-training & Training

Trinary Quantization of Medical Histories: The medical histories are mapped into trinary disease-phenotype-specific data-streams to enable generation of some of the features described below, as outlined in Section -C (Step 1).

Feature Categories: The features used in the pipeline maybe categorized as follows:

PFSA scores: The PFSA scores are computed on the basis of the inferred PFSA models as described in the previous sections. The generation of the PFSA models from the trinary data-streams is the first hyper-training step. These scores consist of the negative and positive log-likelihood of a phenotype-specific quantized medical history being generated by the PFSA models for the positive cohort and the control cohort of sex-stratified patients, and the corresponding sequence likelihood defects (See SI-Section -D). Recall that PFSAs are specialized HMMs, and these measures encode the dynamics of the underlying processes, and are sensitive to the ordering, and frequency of the codes at the resolution of the disease phenotypes. Also, recall that disases pheonotypes are broad categories of diagnostic codes, and that we generate PFSA models for each category, and separately for the sexes and the positive cohort and the control cohorts).

Prevalence scores (p-scores): The p-scores focus on individual diagnostic codes, and we create a dictionary of the ratio of relative prevalence of each code (relative to the set of all codes present) in the positive category (for each sex) to the control category. This is the second hyper-training step. In the later steps of the pipeline, we use dictionary look ups to map codes to their p-scores, and also their aggregate measures such as mean, median, and variance to train a downstream LGBM.

Rare scores: These scores consist of a subset of p-scores which correspond to codes with particularly high and low relative prevalences (p-score > 2 or $< .5$). Thus, this feature category depends on the p-score dictionary generated in the second hyper-training step.

Sequence scores: Sequence scores are relatively straight-forward statsitical measures such as mean, median, variance, time since last occurrence $\mathrm{etc}.$. on the trinary phenotype-specific sex-stratified histories. No hyper-training is required for the generation of the sequence features.

Thus we require three splits of the training dataset. The first split is used to carry out hyper-training of the PFSA models and the p-score dictionary. The second split is used to train the score-category specific LGBMs, one for each feature category. And the third split is used to train the final LGBM that takes inputs from the outputs of the four LGBMs in the previous layer.

Validation

In validation, or actual prediction of patient fate, we use the trinary mapping, generate the features using the PFSA models and the p-score dictionary, and calculate the raw-risk via the trained LGBM network. The relative score is then obtained by a choice of the operating point reflecting the specificity/sensitivity trade-off discussed before.