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Examining the relationship between
antibiotic prescribing and patient-experience survey results
for acute adult bronchitis in an outpatient setting

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by

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Dedication

When I think about how I ended up on this page, I'm reminded of the ocean my family crossed, the hundreds of miles driven, and the hours of phone calls and texts in-between. I dedicate this page to my family and friends for their unwavering support and for believing in me so utterly that their conviction has become my confidence. To my great grandmother, for planting in me the idea that I had something unique to offer the world. To my mother, for teaching me the strength of unconditional love, curiosity, and resilience. To my brother, for demonstrating the power that comes from embracing change and for reminding me to prioritize fun. To my best friend Jeanne, for accompanying me on all these adventures and for sheltering my soul. To my best friend Bianca, for refusing to let me discount my worth and for being my kindred spirit in matters of principle and loyalty.

Acknowledgements

Abstract

Examining the relationship between
antibiotic prescribing and patient-experience survey results
for acute adult bronchitis in an outpatient setting

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Background: With antibiotic resistance on the rise, there is sustained interest in promoting antibiotic stewardship. Acute adult bronchitis (AAB) is an upper respiratory tract infection primarily of viral etiology. Because of this, evidence-based guidelines do not recommend the use of antibiotics in AAB. Despite this evidence, care providers continue to over-prescribe with concerns about patient expectations and patient satisfaction often cited as contributory factors.

Objectives: The objective of this study is to examine the relationship between antibiotic prescribing and patient-experience survey results.

Methods: Visit-level data were matched to patient satisfaction surveys for the first visit and first survey for each patient. Descriptive statistics and logistic regression were used. The dependent variable was a PS survey item asking patients to rate their care provider from 0 (worst) to 10 (best). A dichotomous variable was created using top box scores

(9&10) vs. non-top box scores (0-8). This primary independent variable was used to group patients into three cohorts: (1) those who received an antibiotic prescription; (2) those who received only a non-antibiotic prescription; (3) those who received no prescription.

Results: A total of 49,638 visits coded for AAB were identified. With a match rate of 7.4%, 3,556 visits were included in the final sample. Of these visits, 84% resulted in an antibiotic prescription, 11% in a non-antibiotic prescription, and just 5% in no prescription. Descriptive statistics demonstrated that cohorts differed in age, sex, ethnicity, insurance, visit provider age, and visit provider type. A logistic regression model with multiple imputations for missing data found that receipt of a prescription did not predict receipt of a top box score. The results of this study indicate that receipt of an antibiotic prescription is not a predictor of high provider ratings, but that providers can potentially improve their ratings by expressing concern for the patient's condition, taking more time with their patients, and spending patient time explaining diagnoses, treatment options, or reasons for non-treatment.

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Chapter 1: Introduction

BACKGROUND

As our world scrambles and slows to face the challenges of a global pandemic caused by a novel viral strain of the coronavirus family known as COVID-19, we are reminded of the devastating power of infectious diseases.[1] Infectious diseases can result from a myriad of organisms including those of viral, bacterial, and fungal etiologies. Each causative organism comes with unique traits in terms of how quickly they replicate, how easily they spread, how fatal the resultant infection is to the host, and how the infection can be treated or avoided. Because of these different traits, effective treatment hinges on accurate identification of the causative organism. While the focus of this present study is an acute respiratory tract infection (ARTI) known as acute adult bronchitis (AAB), understanding the importance of AAB requires examination of diagnostic, therapeutic, and historical contexts.

Positively identifying the causative organism for an infection can be challenging for healthcare providers as many organ system specific illnesses present with common symptoms regardless of etiology. This is particularly true in respiratory illnesses, where differences between diseases may only be discernable for those with severe disease, or with the use of a laboratory test or culture. When a clinical diagnosis based on symptomology is not possible, providers must decide if therapy should be delayed until a diagnostic test confirms the causative organism, or if empiric therapy should be initiated. When bacterial etiology is possible, such as for pneumonia requiring hospital admission, clinical guidelines recommend empiric antibiotic treatment.[2] This is because antibiotics have well known spectrums of bacterial coverage, and are reliably effective and often necessary to cure the underlying infection. Empiric treatment is not as common when

viral etiology is suspected, as antiviral treatment options have narrow or less defined viral coverage as well as windows of efficacy and come at a higher cost. An example of this is the antiviral drug oseltamivir which can only be used to treat influenza viruses and must be initiated within two days of symptom onset to be effective.[3] A five-day course of the antibiotic amoxicillin has an average wholesale price (AWP) of $2.85 compared to a comparable five-day course of oseltamivir at $68.30.[4,5] Altogether, these factors make antibiotics an attractive treatment option when a bacterial organism is being considered in a differential diagnosis for an infection. This contributes to unnecessary antibiotic use, which leads to antibiotic resistance. The dangers of antibiotic resistance can be illustrated by comparing the current global crisis surrounding the COVID-19 pandemic to historic bacterial epidemics and pandemics.

While COVID-19 is often compared to other modern viral respiratory illnesses such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS), or older viral scourges such as smallpox or polio, it is easy to forget that some of the most contagious and deadly infections in human history have been caused instead by bacteria. In fact, the deadliest pandemics have been caused by the bacteria *Yersinia pestis,* commonly known as the plague. The Centers for Disease Control and Prevention (CDC) notes that mortality due to the plague in the pre-antibiotic era was 66% and dropped to 11% with the introduction of antibiotics.[6] The World Health Organization (WHO) reports that an outbreak of the plague in the fourteenth century caused an estimated 50 million deaths, including a quarter of the European population.[7] Comparatively, COVID-19 was declared a public health emergency by the WHO when mortality was projected to be between 3-4%.[8,9] Given the considerable strain that COVID-19 has placed on both developed and developing countries, it stands to reason that with antibiotic resistance, the return of bacterial epidemics and pandemics could

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prove to be devastating on a scale not seen in modern times (Figure 1.1). This threat has already been observed with tuberculosis, another historically widespread infection that is considered a relative rarity in the United States. Tuberculosis is caused by the bacterium *Mycobacterium tuberculosis* and drug-resistant strains have been declared a global public health threat by the WHO, with a 2019 WHO report finding that 3.4% of new and 18% of previously treated cases of tuberculosis had gained multidrug resistance.[10]

Figure 1.1: Consequences of antibiotic resistance – the implications of COVID-19 on global preparedness for the return of bacterial epidemics and pandemics[6,8,9,11]

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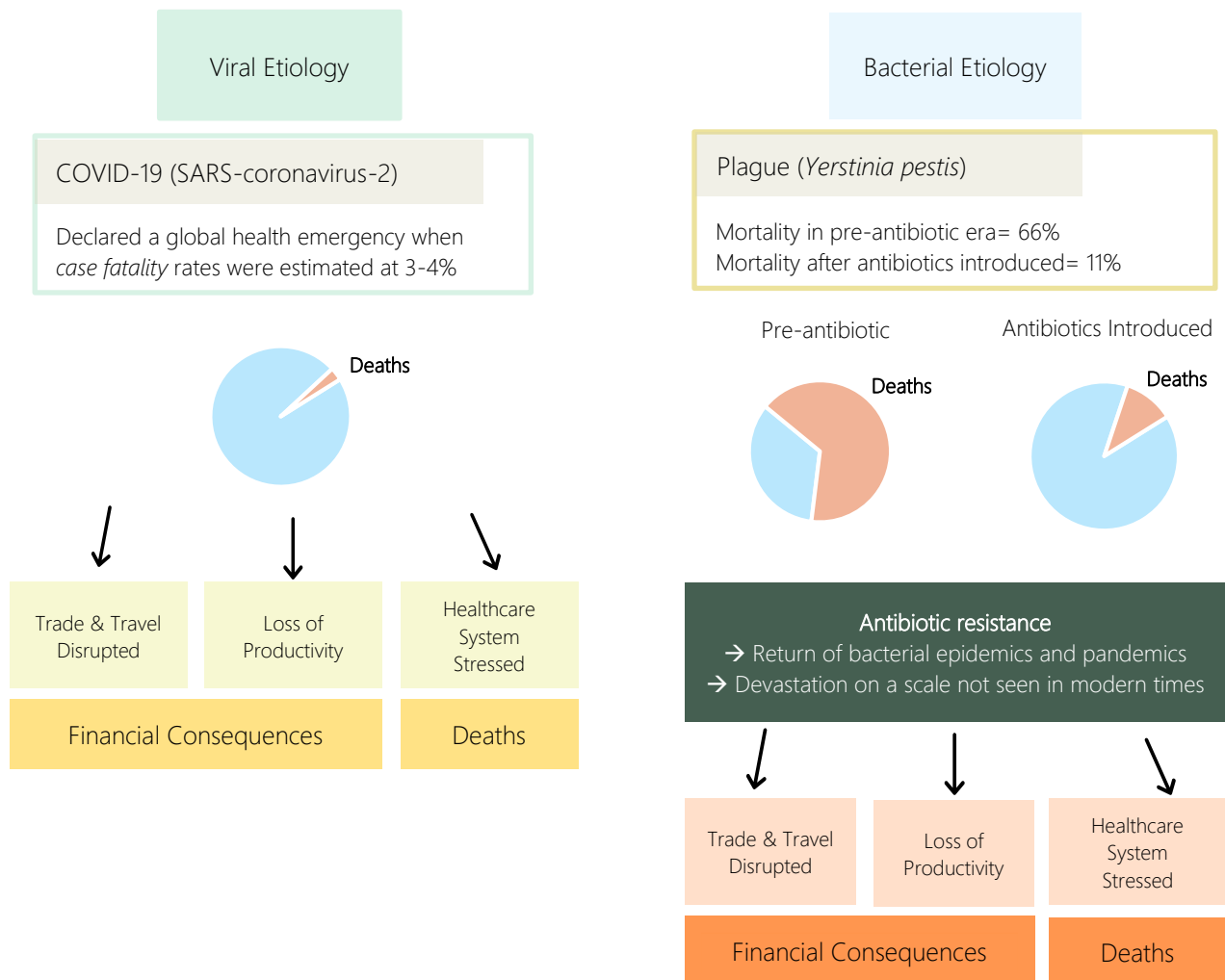
Though the seriousness of some of these bacterial illnesses such as the plague and tuberculosis are still widely appreciated, the advent, effectiveness, and widespread use of antibiotics has diminished our appreciation for the dangers posed by common bacterial illnesses such as bacterial pneumonia, skin and soft tissue infections (SSTI), and certain sexually transmitted infections (STI). Because of the availability and efficacy of antibiotics since the 1920s, most Americans have never lived in a world where a simple skin infection could prove lethal.[12] As bacteria gain resistance to the available antibiotic options, diseases considered treatable become deadly and unmanageable once again. A 2019 CDC update on the threat of antibiotic resistance in the United States found eighteen urgent, serious, and concerning antibiotic resistance threats, including organisms such as carbapenem-resistant *Acinetobacter* which is known to cause pneumonia, wound, bloodstream, and urinary tract infections, and drug-resistant *Neisseria gonorrhoeae* which causes the easily communicable STI gonorrhea.[13]

CONSEQUENCES OF ANTIBIOTIC RESISTANCE

The CDC estimates that more than 2.8 million antibiotic resistant infections occur in the United States each year, with 35,000 of these patients dying as a direct result of the infection.[13] These antibiotic resistant infections are estimated to incur at least $20 billion excess direct healthcare costs and an additional $35 billion in lost productivity annually.[14] Antibiotics are also implicated in 13.7% of adult emergency department visits for adverse drug events, with 61.5% of antibiotic expenditures occurring in the outpatient setting.[15,16]

A review of 2013 data by the CDC revealed that an estimated 10% of adult outpatient visits resulted in an antibiotic prescription, amounting to 269 million antibiotic prescriptions dispensed from outpatient pharmacies in the United States alone.[17] A review of 2011 data implicated antibiotics in an estimated 453,000 cases of *Clostridioides*

(formerly *Clostridium*) *difficile* infection (CDI), with a third of these infections determined to be community-associated.[17] CDI is associated with prior antibiotic exposure, results in life-threatening diarrhea and colitis, and has been identified as a threat by the CDC due to rising antibiotic resistance.[18]

NATIONAL ACTION PLAN FOR COMBATING ANTIBIOTIC-RESISTANT BACTERIA

In recognition of the threat of antibiotic resistance, in 2015 the CDC and White House presented a 5-year US National Action Plan for Combating Antibiotic-Resistant Bacteria. The plan came with several goals, including Goal 1: Slow the emergence of resistant bacteria and prevent the spread of resistant infections.[19] One of the targeted outcomes for this goal was the reduction of inappropriate antibiotic use in the outpatient setting by 50%.[19] A subsequent 2016 release of the CDC's Morbidity and Mortality Weekly Report (MMWR) provided an update on the Core Elements of Outpatient Antibiotic Stewardship. One of the recommendations from this report was to identify high-priority conditions for intervention, with one of the high-priority categories being "conditions for which antibiotics are overprescribed, such as conditions for which antibiotics are not indicated (e.g., acute bronchitis…)."[17]

ACUTE ADULT BRONCHITIS

ARTIs are the most common reason for outpatient visits and outpatient antibiotic prescriptions in adults.[20] The CDC reported in 2017 that 30% of all outpatient antibiotic prescriptions and 50% of those written specifically for ARTI were unnecessary (Table 1.1).[21]

Table 1.1:   Percent of outpatient antibiotic prescriptions that were unnecessary[21]

Age Group	All Conditions*	Acute respiratory conditions‡
0-19 year olds	29%	34%
20-64 year olds	35%	70%
≥65 year olds	18%	54%
All ages	30%	50%

∗   All conditions included acute respiratory conditions, urinary tract infections, miscellaneous bacterial infections, and other conditions.

‡   Acute respiratory conditions included ear infections, sinus infections, sore throats, pneumonia, acute bronchitis, bronchiolitis, upper respiratory infections (i.e., common colds), influenza, asthma, allergy, and viral pneumonia.

As discussed in the introduction, there are many factors that make antibiotics an attractive treatment option when a bacterial organism is being considered in a differential diagnosis for an infection. With many of the guidelines for infectious diseases recommending empiric antibiotic therapy, it can be difficult to promote antibiotic avoidance when bacterial etiology is probable. Because of this, infectious diseases that are known to be primarily viral in etiology present a unique opportunity for antibiotic stewardship efforts. ARTIs, including AAB, fit this description and are thus targeted by stewardship initiatives.

Figure 1.2: Contextual factors that make acute adult bronchitis a target for antibiotic stewardship efforts[2–5]

Viral Etiology

Influenza

oseltamivir:　　AWP 5-day course: $68.30
　　　　　　　　narrow window of opportunity
　　　　　　　　limited effectiveness

Bacterial Etiology

Pneumonia

amoxicillin:　　AWP 5-day course: $2.85
　　　　　　　　guideline recommended
　　　　　　　　curative

Not an attractive empiric option

Secondary Bacterial Infections

Very attractive empiric option

Antibiotics are often over-used, even when bacterial etiology is improbable.

Both Bacterial & Viral Etiology Possible

Empiric antibiotic treatment recommended.

Infections known to be primarily viral in etiology present a unique opportunity for antibiotic stewardship efforts.

In 2016 the American College of Physicians (ACP) and CDC released a joint statement of advice for high-value care promoting appropriate antibiotic use for ARTIs in adults. These recommendations can be found in Table 1.2 and were the result of a literature review of existing evidence for acute bronchitis, respiratory tract infection, pharyngitis, rhinosinusitis, and the common cold.

Table 1.2: Appropriate antibiotic use for ARTIs in adults - advice for high-value care[20]

Advice #	Recommendation
High-Value Care Advice 1	Clinicians should not perform testing or initiate antibiotic therapy in patients with bronchitis unless pneumonia is suspected.
High-Value Care Advice 2	Clinicians should test patients with symptoms suggestive of group A streptococcal pharyngitis (for example, persistent fevers, anterior cervical adenitis, and tonsillopharyngeal exudates or other appropriate combination of symptoms) by rapid antigen detection test and/or culture for group A Streptococcus. Clinicians should treat patients with antibiotics only if they have confirmed streptococcal pharyngitis.
High-Value Care Advice 3	Clinicians should reserve antibiotic treatment for acute rhinosinusitis for patients with persistent symptoms for more than 10 days, onset of severe symptoms or signs of high fever (>39 °C) and purulent nasal discharge or facial pain lasting for at least 3 consecutive days, or onset of worsening symptoms following a typical viral illness that lasted 5 days that was initially improving (double sickening).
High-Value Care Advice 4	Clinicians should not prescribe antibiotics for patients with the common cold.

As defined by High-Value Care Advice 1, acute uncomplicated (where pneumonia is not suspected) bronchitis is specifically identified as a diagnosis where clinicians should not perform testing or initiate antibiotic therapy. This is because 90% of cases with otherwise healthy patients presenting in the outpatient setting have been found to be caused by viral organisms, and because antibiotic use in this population has demonstrated limited benefit but led to increased risk of adverse events compared to

placebo.[20] Instead, the recommendation is supportive care to provide symptomatic relief such as cough suppressants, expectorants, decongestants, and inhalers. The ACP/CDC report also found that AAB is one of the most common adult outpatient diagnoses, accounting for 100 million or 10% of outpatient visits in the United States annually, with more than 70% of visits resulting in an antibiotic prescription despite its viral origins.[20]

KEY STAKEHOLDERS AND PERFORMANCE METRICS

Because of the clear opportunities for intervention that it presents, AAB has long been the focus of various stakeholder stewardship initiatives, including those discussed thus far from federal sources like the CDC or White House as well as clinical groups like the ACP. Such federal and clinical guidance often align with or result in the creation or adoption of quality and performance measures by other healthcare stakeholders including quality assurance bodies, insurers, and health systems. The prominent quality assurance body in this arena is the National Committee for Quality Assurance (NCQA), which publishes annual specifications for its quality metrics which are known as Healthcare Effectiveness Data and Information Set (HEDIS) measures. The NCQA HEDIS measures are traditionally used to evaluate health plans and are therefore set up for calculations based on health plan claims data.[22] "Avoidance of antibiotic treatment in adults with acute bronchitis (AAB)" has been a HEDIS performance measure since 2005.[23] An updated version of the technical specifications is published annually, with key elements extracted from the 2019 version in Table 1.4 and the full set of technical specifications attached as Appendix A.

Table 1.3:   Select technical specifications for 2019 HEDIS for "Avoidance of Antibiotics Treatment in AAB"[24]

Description	The percentage of adults 18–64 years of age with a diagnosis of acute bronchitis who were not dispensed an antibiotic prescription.
Calculation	The measure is reported as an inverted rate [1 – (numerator/eligible population)]. A higher rate indicates appropriate treatment of adults with acute bronchitis (i.e., the proportion for whom antibiotics were not prescribed).
Episode Date	The date of service for any outpatient or ED visit during the Intake Period with a diagnosis of acute bronchitis.
Index Episode Start Date	The earliest Episode Date during the Intake Period that meets all of the following criteria: - A 30-day Negative Medication History prior to the Episode Date. - A 12-month Negative Comorbid Condition History prior to and including the Episode Date. - A Negative Competing Diagnosis during the 38-day period from 30 days prior to the Episode Date through 7 days after the Episode Date. - The member was continuously enrolled 1 year prior to the Episode Date through 7 days after the Episode Date.

The AAB HEDIS measure has been adopted by commercial health plans as well as the Centers for Medicare and Medicaid (CMS). CMS has adopted the AAB HEDIS specifications as CMS Quality ID #116 for evaluating Qualified Health Plans, and as a factor in its Merit-based Incentive Payment System (MIPS) program for providers.[25,26] Because health plans and providers are evaluated based on their HEDIS performances, the health systems with and within which they work are also motivated to avoid antibiotic use for this indication.

THE ROLE OF EXPECTATION IN INAPPROPRIATE ANTIBIOTIC PRESCRIBING

Despite these factors, over 70% of outpatient AAB visits continue to result in a prescription for antibiotics.[20] In addition to the previously mentioned reasons for antibiotic overuse, studies attempting to identify why clinicians inappropriately prescribe antibiotics have found provider perception of patient expectation to be a predictor of

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overprescribing. This is thought to be related to the fact that patient experiences are quantified in the United States through patient experience surveys which are used to evaluate provider performance and may be tied to provider reimbursement.[27]

A 2015 CDC MMWR looked at national internet survey data regarding knowledge and attitudes about antibiotic use in upper respiratory infections. Surveys were distributed between 2012 to 2013 to 9,123 patients and 3,149 healthcare providers, with 7,546 (83% response rate) and 1,503 (48% response rate) surveys returned respectively. This report looked at both patient expectations for an antibiotic and provider perceptions of patient expectations and found that while 26% of consumers reported expecting an antibiotic for a cough or cold visit, 54% of providers perceived that patients would have such expectations. Interestingly, this report also looked at adult Hispanic consumers separately and found that a higher proportion of this group (41%) expected an antibiotic.[28] A smaller 2014 study involving semi-structured interviews sampled thirteen primary care clinicians to explore provider perceptions about antibiotic prescribing for AAB. When interviewed about inappropriate antibiotic prescriptions for AAB, these clinicians cited patient demand as the main factor.[29]

A November 2018 research letter in the Journals of the American Medical Association (JAMA) Internal Medicine examined the relationship between antibiotics and patient satisfaction in the direct-to-consumer telemedicine setting. This study looked at encounters between 2013 and 2016 for respiratory tract infections (including but not limited to bronchitis, sinusitis, and pharyngitis) that occurred through a telemedicine platform. Patients received a single-item survey asking them to rate their satisfaction with the provider using a Likert scale response where "0" indicated "not satisfied at all" and "5" indicated "most satisfied." The researchers dichotomized these results and used a mixed-effects logistic regression model with patients grouped by whether they received

an antibiotic prescription, received a non-antibiotic prescription, or received no prescription. The final sample included 8,437 encounters conducted by 85 physicians with 5,580 (66.1%) of encounters resulting in prescription of an antibiotic. While most encounters (87%) received a rating of "5" (most satisfied), the study still found that receipt of an antibiotic prescription was strongly associated with a higher rating (adjusted odds ratio (AOR), 3.23; 95% confidence interval (CI), 2.67-3.91) as was receipt of a non-antibiotic prescription (AOR, 2.21; 95% CI, 1.80-2.71).[30] The results of this study, while limited to a telemedicine setting and including only one survey item, gives direction for future stewardship efforts by demonstrating that offering a non-antibiotic prescription may conserve patient satisfaction ratings while curbing inappropriate antibiotic prescribing.

PATIENT EXPERIENCE SURVEYS

In 2008, the Department of Health and Human Services endorsed the first standardized national survey of patient experience in the United States: The Hospital Consumer Assessment of Healthcare Providers and Systems (H-CAHPS). This survey was developed for the inpatient space and was tested and validated across 2,600 hospitals prior to endorsement and was one of the first shifts towards formalizing the focus on patient-centered care.[31] Eligible patients at participating institutions are contacted on a random basis between 48 hours and 42 days of discharge, with the standard H-CAHPS consisting of 27 items that include domains such as communication with nurses and doctors, responsiveness of hospital staff, pain management, and cleanliness of the hospital environment. This survey was quickly tied to payments, leading to its adoption across systems.

Corresponding surveys have since been developed for other settings such as home health, hospice, emergency department, and surgery clinics. In the outpatient setting the vendor Press Ganey has developed a patient experience survey called the Outpatient Medical Practice Survey (OMPS) based off the H-CAHPS instrument, sharing many of the same survey items. Though there is less literature validating this specific instrument, a 2017 study tested its psychometric properties and found it to be suitable for most metrics.[32] This was a single institution study analyzing surveys from 34,503 unique patients seen by 624 providers in 2013. The surveys looked at six scales identified as access, moving through the visit, nurse assistant, care provider, personal issues, and overall assessment. In terms of reliability, internal consistency was found to be high for all scales (Cronbach's α= 0.79-0.96). However, inter-item correlations were high for all but three of the items, suggesting some internal item redundancy. In terms of validity, the study looked at convergent and discriminant validity. Convergent validity was evaluated using a confirmatory factor analysis (CFA) and looking at average variance extracted (AVE) for each construct, with any value greater than 0.5 considered confirmatory. Convergent validity was also analyzed by looking at correlations between items and the overall assessment questions, with statistically significant (p, <0.05) correlations considered supportive of convergent validity. CFA was also used for discriminant validity by seeing if each construct AVE was greater than the squared correlation of the other constructs. The study supported the convergent and discriminant validity of the survey for all scales.

Another important takeaway from the article was related to the implications of using the instrument to guide payment decisions, with the authors noting that the instrument demonstrated a high ceiling effect which was found to impact quarterly percentile scores. This means that if the survey results are used to guide payment by

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ranking, a small score change could result in a disproportionate shift in ranking and thus reimbursement. While this study was limited to a single institution and showed that the Press Ganey outpatient survey has a ceiling effect like those seen with the CAHPS surveys, it also supports suitable psychometrics for its use in most metrics.

PATIENT EXPERIENCE VS. PATIENT SATISFACTION

In recent years, attention has been shifting to patient-centered care, such as the adoption and prospective requirement of Patient Reported Outcomes (PRO) data for new drug approvals by governing bodies such as the United States Food and Drug Administration (FDA). These patient-reported metrics can be difficult to interpret as they are largely intangible, relying heavily on development and standardized adoption of a robust theoretical framework. One such metric is patient satisfaction, where previous research has found inconsistencies in how it is defined across applications.[33]

One of the difficulties in defining patient satisfaction is that to measure satisfaction, we must also know the underlying expectations against which the patient's satisfaction or dissatisfaction is based. Thus, a critique against many of the instruments that purport to measure satisfaction is that they do not capture these patient expectations. The distinction is highlighted by CMS on their page describing their CAHPS tools, stating: "Experience is not the same as satisfaction. Patient experience surveys sometimes are mistaken for customer satisfaction surveys. Patient experience surveys focus on how patients experience or perceived key aspects of their care, not how satisfied they were with their care."[27] However, one of the survey items common to both the CAHPS tools and the Press Ganey OMPS that asks patients to rate their provider on a scale of "best provider ever" to "worst provider ever" is often used to serve as a surrogate for patient satisfaction with their provider.[32]

While the available literature on patient satisfaction argues for a need for more robust conceptualization of the construct, standardization of its operational definition, and instrument validation, the real-world practice of utilizing CAHPS and Press Ganey OMPS for the purposes of payment is widespread. In practice, the results of these tools are treated as indicators of patient satisfaction by providers, healthcare systems, and payers. For the purposes of this research, the Press Ganey OMPS will be considered a patient experience survey instrument, but analyses focusing on the survey item asking patients to rate their provider on a scale of "best provider ever" to "worst provider ever" will be considered an examination of patient satisfaction with the rated provider.

STUDY RATIONALE

The site of research for this study will be Baylor Scott & White Health (BSWH). BSWH is an integrated delivery network (IDN) and the largest not-for-profit healthcare system in Texas. With 50 hospitals, more than 7.4 million patient encounters annually, over 800 patient access points, 197 satellite outpatient facilities, and 4.3 million outpatient registrants across the system, BSWH offers a wealth of data for patient encounters.[34] BSWH has robust data repositories, including data from the electronic health record and from outside vendors such as Press Ganey, with OMPS collected regularly for outpatient encounters.

This project aims to generate evidence-based recommendations to promote antibiotic avoidance by elucidating the local relationship between antibiotic prescribing and patient experience survey ratings and to provide alternative strategies to providers to retain patient satisfaction in the absence of antibiotic prescribing.

Chapter 2: Methodology

STUDY OBJECTIVES AND HYPOTHESES

The aim of this study was to examine the relationship between prescription outcome and patient rating of the provider (patient satisfaction) for visits coded for acute adult bronchitis (AAB). Prescription outcome was categorized as receipt of an antibiotic prescription, receipt of a non-antibiotic prescription indicated for symptomatic relief of AAB, or no prescription. Patient rating of the provider was dichotomized into top box (high patient satisfaction) and non-top box (low patient satisfaction). The study objectives and hypotheses can be found in Table 2.1.

Figure 2.1: Operational definitions for primary dependent outcome (patient satisfaction) and primary predictor (prescription outcome)
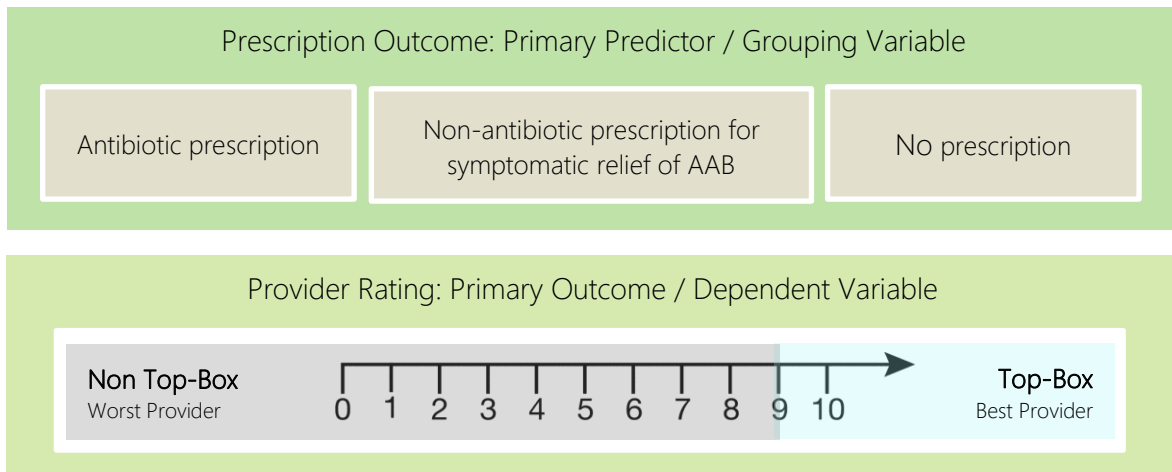
Table 2.1 Study objective and null hypotheses

Objective 1: To determine if patient characteristics differ between prescription outcome groups.
$H_0$1.1: The difference in patient age between prescription outcome groups is not statistically significant.
$H_0$1.2: The difference in patient gender between prescription outcome groups is not statistically significant.
$H_0$1.3: The difference in patient race between prescription outcome groups is not statistically significant.
$H_0$1.4: The difference in patient ethnicity between prescription outcome groups is not statistically significant.
$H_0$1.5: The difference in patient primary insurance between prescription outcome groups is not statistically significant.
$H_0$1.6: The difference in composite patient comorbidity index between prescription outcome groups is not statistically significant.
Objective 2: To determine if provider characteristics differ between prescription outcome groups.
$H_0$2.1: The difference in provider age between prescription outcome groups is not statistically significant.
$H_0$2.2: The difference in provider specialty between prescription outcome groups is not statistically significant.
Objective 3: To determine which variables predict top box vs. non-top box ratings.
$H_0$3.1: There is no relationship between prescription outcome and top box rating.
$H_0$3.2: There is no relationship between patient age and top box rating.
$H_0$3.3: There is no relationship between patient gender and top box rating.
$H_0$3.4: There is no relationship between patient race and top box rating.
$H_0$3.5: There is no relationship between patient ethnicity and top box rating.
$H_0$3.6: There is no relationship between patient primary insurance and top box rating.
$H_0$3.7: There is no relationship between composite patient comorbidity index and top box rating.
$H_0$3.8: There is no relationship between provider age and top box rating.
$H_0$3.9: There is no relationship between provider specialty and top box rating.
$H_0$3.10: There is no relationship between patient rating of other survey items and top box rating.

STUDY DESIGN & DATA SOURCES

This was a retrospective study utilizing electronic health record (EHR; Epic) data from Baylor Scott & White Health (BSWH) and associated Outpatient Medical Practice Survey (OMPS) data from Press Ganey. As mentioned in the "Key Stakeholders and Performance Measures" section, the National Committee for Quality Assurance (NCQA) publishes an annual technical specification for the Healthcare Effectiveness Data and Information Set (HEDIS) metric of "Avoidance of antibiotic treatment in AAB" with the 2019 iteration provided in full in Appendix A. Because HEDIS was developed to evaluate health plans, the HEDIS technical specifications are based on variables found in insurance claims data. As this present study utilized EHR data instead of claims data, the HEDIS technical specifications could not be exactly followed and were instead approximated by adapting the definitions to variables available through the EHR. These specifications were used to run a report through the EHR to identify eligible AAB visits. All referenced lists (e.g. diagnosis code value sets) used to build this EHR report are provided in Appendix B. Table 2.2 describes the specifications applied for the EHR report.

Table 2.2:   Study criteria for EHR report to identify eligible AAB visits

Age	Adults 18-64 years of age on visit date
Timeframe	Visits between January 1, 2017 and March 31, 2019
Inclusion	Outpatient visits with acute bronchitis ICD 9 or ICD 10 diagnosis codes • Antibiotic prescriptions will be identified as resultant of a visit when written for a listed antibiotic on the visit date. • Non-antibiotic prescriptions will be identified as resultant of a visit when written on the visit date.

Exclusion	Visits are excluded unless the following criteria are met:
	• A 30-day Negative Medication History for listed antibiotics
	  o No antibiotics ordered in the last 30 days from the current antibiotic ordered
	• A 12-month Negative Comorbid Condition History prior to and including the visit date for comorbid conditions coded for in any of these ICD code value sets:
	  o HIV Value Set
	  o HIV Type 2 Value Set
	  o Malignant Neoplasms Value Set
	  o Emphysema Value Set
	  o COPD Value Set
	  o Cystic Fibrosis Value Set
	  o Comorbid Conditions Value Set
	  o Disorders of the Immune System
	• A Negative Competing Diagnosis during the 38-day period from 30 days prior to the visit date to 7 days after the visit date for any competing diagnoses coded for in these ICD code value sets:
	  o Pharyngitis Value Set
	  o Competing Diagnosis Value Set

BSWH contracts with Press Ganey to have electronic OMPS collected from patients for outpatient encounters. Surveys are generated on a visit-specific basis and data from completed surveys are provided by the vendor to BSWH and loaded into a data warehouse. Because the surveys are visit-specific, they retain a visit-specific identifier generated by the EHR. To match eligible AAB visits to the visit-specific survey results, the eligible visit list generated from the EHR report was cross-referenced with the survey

data available in the data warehouse. Those visits with available survey data were linked using the visit-specific identifier.

STUDY VARIABLES

Demographic data were extracted from the EHR and survey data from a data warehouse. Table 2.3 provides a breakdown of variables collected from the EHR, while Table 2.4 provides the survey items and scales.

Table 2.3: Variables extracted from EHR

Variable	Category	Measurement	Format	Data Source
Patient age on visit date	Independent	Continuous	Mean (SD) or Median (IQR)	EHR
Gender	Independent	Categorical	Count (%) Female	EHR
Race	Independent	Categorical	Count (%) White Count (%) Black Count (%) Asian Count (%) Other Count (%) Unknown	EHR
Ethnicity	Independent	Categorical	Count (%) Hispanic Count (%) Non-Hispanic Count (%) Other	EHR
Primary Insurance Type	Independent	Categorical	Count (%) Commercial Count (%) Medicare Count (%) Other	EHR
Elixhauser Comorbidity Index	Independent	Continuous	Mean (SD) or Median (IQR)	EHR
Provider age on visit date	Independent	Continuous	Mean (SD) or Median (IQR)	EHR + Texas License Lookup
Provider Type	Independent	Categorical	Count (%) Family Medicine Physician Count (%) Internal Medicine Physician Count (%) Other Physician Count (%) Advanced Practice Provider	EHR + Texas License Lookup
Prescription Outcome	Independent	Categorical	Count (%) No Prescription Count (%) Antibiotic Prescription Count (%) Non-antibiotic Prescription	EHR

SD= Standard Deviation; IQR= Interquartile Range; EHR= Electronic Health Record

Table 2.4: Survey items with response scales grouped by survey scale

About You		
Survey Item	*Response Options*	*Key*
Our records show that you got care from the provider named below {PRECODE}. Is that right?	[Yes / No]	CG_1
Access		
Survey Item	*Response Options*	*Key*
Ease of getting through to clinic on the phone	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	A14
Was this visit with this provider an appointment for a check-up or routine care?	[Yes / No]	ACO_04
When you made this appointment for a check-up or routine care, did you get this appointment as soon as you thought you needed?	[Yes / No]	ACO_03
Moving through visit		
Survey Item	*Response Options*	*Key*
Wait time at clinic (from arriving to leaving)	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	V60
Nurse / Assistant		
Survey Item	*Response Options*	*Key*
Concern the nurse showed for your problem	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	N2
Friendliness / courtesy of the nurse / assistant	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	N1
Care Provider		
Survey Item	*Response Options*	*Key*
Friendliness / courtesy or the care provider	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	CP1
Concern the care provider showed for your questions or worries	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	CP3
Care provider's efforts to include you in decisions about your treatment	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	CP4
Amount of time the care provider spent with you	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	CP8
Explanations the care provider gave you about your problem or condition	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	CP2
Personal Issues		
Survey Item	*Response Options*	*Key*
Cleanliness of our practice	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	O2
How well staff protected your safety (by washing hands, wearing gloves, etc.)	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	I60
Overall Assessment		
Survey Item	*Response Options*	*Key*
How well staff worked together to care for you	[1 – Very Poor / 2 – Poor / 3 – Fair / 4 – Good / 5 – Very Good]	O15
Global Rating		
Survey Item	*Response Options*	*Key*
Would you recommend this provider's office to your family and friends?	[Yes, definitely / Yes, somewhat / No]	CG_26
Using any number from 0 to 10, where 0 is the worst provider possible and 10 is the best provider possible, what number would you use to rate this provider?	[0 – Worst provider possible / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 – Best provider possible]	CG_25

STATISTICAL ANALYSIS

Figure 2.2: Schematic of data analysis plan
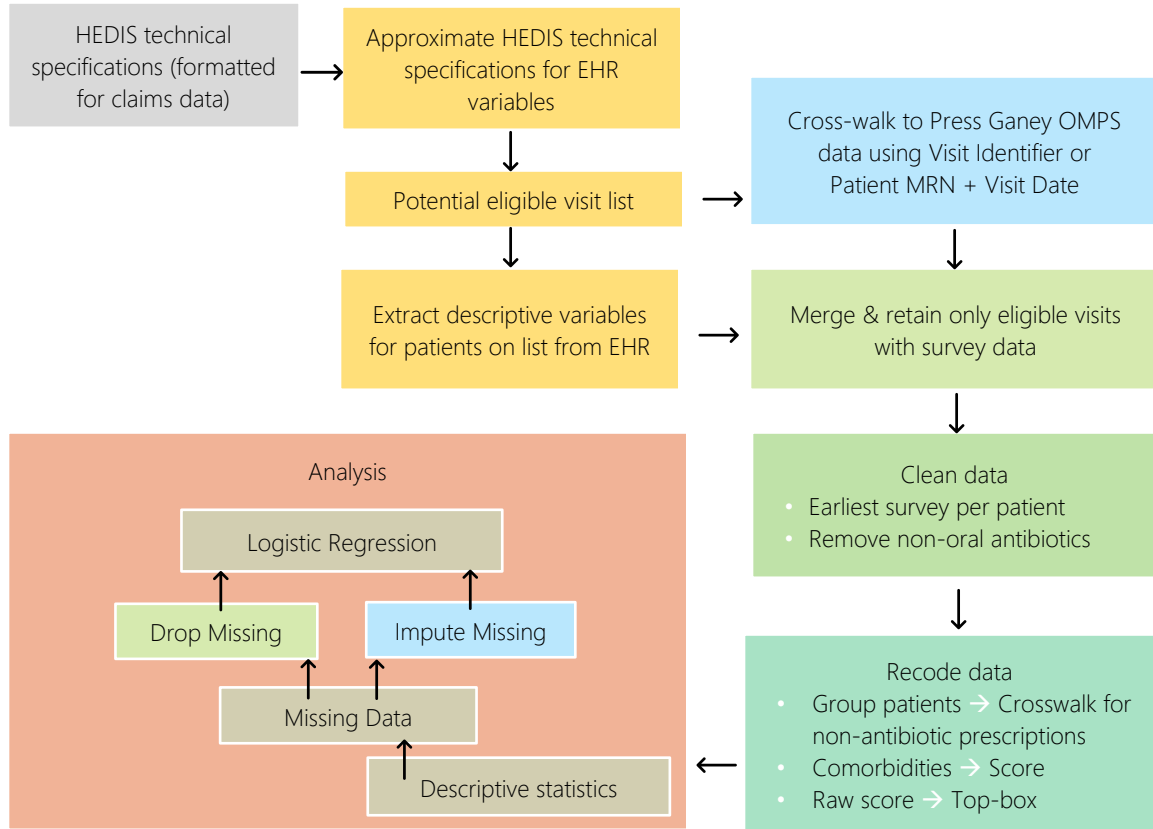
Descriptive statistics were performed with continuous variables described in mean with standard deviation (SD) or median with interquartile range (IQR) and categorical variables described in frequency with percentages. To compare the three prescription order groups, Kruskal-Wallis statistics were used for continuous measures and chi-square statistics for categorical measures.

Multivariate logistic regression models were used to determine which variables predict top box vs. non top box ratings. The dependent outcome variable was the dichotomized response to the question, "Using any number from 0 to 10, where 0 is the

worst provider possible and 10 is the best provider possible, what number would you use to rate this provider?" Top box was defined as rating the provider with a 9 or 10. Respondents who rate the provider as 9 or 10 will be considered as being in the top box (Yes). All other respondents will be considered as not being in the top box (No). Other survey items scored on a Likert-scale were similarly recoded into a Top box where the highest score of 5 was considered top box (Yes) while all other responses were considered as not being in the top box (No). The primary independent variable in the model was antibiotic order status. The Elixhauser Comorbidity Index (ECI) score was approximated with EHR comorbidity data with a lookback of one-year from visit date specified. These data were fed into a program made available by the United States Department of Health and Human Services' Agency of Healthcare Research and Quality (AHRQ), with a weighted sum score utilized.[35]

Missing data were omitted from the descriptive analyses but reviewed to determine inclusion in the logistic regression model. The data were examined for magnitude of missing contributions per item, missing data patterns, as well as implications of variable removal on both the model and the clinical value of the results. Multicollinearity was evaluated for the variables included in the final model.

An $\alpha <0.05$ was used as the threshold for statistical significance. Data processing, cleaning, and analysis were conducted using Microsoft Excel and SAS version 9.4 (SAS Institute, Cary, North Carolina).

Chapter 3: Results

STUDY SAMPLE

From January 1, 2017 through March 31, 2019 a total of 49,637 outpatient acute adult bronchitis (AAB) visits at Baylor Scott & White Health (BSWH) were identified through an Electronic Health Record (EHR) report built to approximate the Healthcare Effectiveness Data and Information Set (HEDIS) technical specifications, with additional demographic data extracted from the medical chart to help characterize the population. These visits were linked to available patient-experience survey data, resulting in a modest 3,682 matches for a 7.4% match rate. After removing surveys that were missing data for the primary predictor (patient satisfaction), removing all but the first eligible survey per patient, and removing any entries that did not otherwise meet inclusion criteria, the list was reduced to one survey per visit and one visit per patient at 3,556 unique patients.

Figure 3.1: Match rate for survey data & prescription outcome
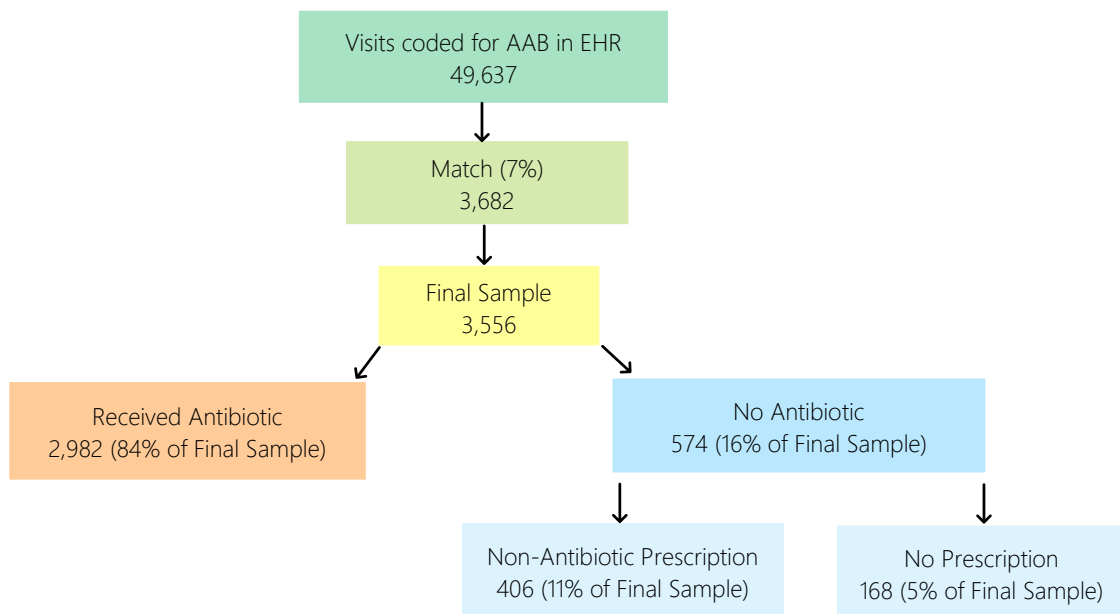
DESCRIPTIVE STATISTICS

Upon reviewing the data, categories had to be collapsed for race, ethnicity, and insurance type to provide more robust groups. The final categories and groupings are as reported in Table 3.1.

Table 3.1: Demographics and descriptive statistics by prescription order group

Variable	Qualifying Antibiotic Prescription (N= 2,982)	Qualifying Non-Antibiotic Prescription (N= 406)	No Qualifying Prescription (N= 168)	p-value
Mean Patient Age (SD)†	59 (14)	59 (14)	62 (15)	0.002*
Count of Female (%)‡	1790 (60%)	265 (68%)	126 (68%)	0.001*
Count by Race (%)‡	White, 2558 (86%) Black, 179 (6%) Other, 241 (8%)	White, 331 (85%) Black, 26 (7%) Other, 34 (9%)	White, 159 (87%) Black, 13 (7%) Other, 11 (6%)	0.57
Count of Hispanic or Latino (%)‡	178 (6%)	34 (9%)	13 (7%)	0.01*
Count of Primary Insurance Type (%)‡	Commercial, 1788 (61%) Medicare, 1105 (38%) Other, 22 (1%)	Commercial, 233 (61%) Medicare, 148 (39%) Other, 0	Commercial, 91 (50%) Medicare, 90 (50%) Other, 1	0.01*
Mean Elixhauser Comorbidity Index score (SD)†	0.3 (2.9)	0.6 (3.5)	0.5 (3.5)	0.59
Mean Provider Age (SD)†	47 (11)	43 (11)	48 (11)	<0.001*
Count by Provider Type (%)‡	FM, 1412 (48%) IM, 751 (25%) Specialist, 45 (2%) APP, 767 (26%)	FM, 159 (41%) IM, 95, (24%) Specialist, 5 (1%) APP, 132 (34%)	FM, 67 (37%) IM, 73 (40%) Specialist, 10 (5%) APP, 33 (18%)	<0.001*
Count Patient Satisfaction Top-Box (%)‡	2664 (89%)	348 (89%)	166 (91%)	0.89

*p < 0.05   † Kruskal-Wallis test   ‡ Chi-square test
FM= Family Medicine physician; IM= Internal Medicine physician; APP= Advanced Practice Provider

All demographic variables except for patient race and Elixhauser Comorbidity Index (ECI) score met the prespecified study cutoff for statistical significance (α <0.05)

as shown in Table 3.1. Meanwhile, Table 3.2 below relates these results to the variable-specific hypotheses under study Objectives 1 and 2.

Table 3.2: Summary of results for demographic and descriptive objectives and hypothesis testing

Objective 1: To determine if patient characteristics differ between prescription outcome groups.	
$H_0$1.1: The difference in patient age between prescription outcome groups is not statistically significant.	**Rejected**
$H_0$1.2: The difference in patient gender between prescription outcome groups is not statistically significant.	**Rejected**
$H_0$1.3: The difference in patient race between prescription outcome groups is not statistically significant.	Failed to reject
$H_0$1.4: The difference in patient ethnicity between prescription outcome groups is not statistically significant.	**Rejected**
$H_0$1.5: The difference in patient primary insurance between prescription outcome groups is not statistically significant.	**Rejected**
$H_0$1.6: The difference in composite patient comorbidity index between prescription outcome groups is not statistically significant.	Failed to reject
Objective 2: To determine if provider characteristics differ between prescription outcome groups.	
$H_0$2.1: The difference in provider age between prescription outcome groups is not statistically significant.	**Rejected**
$H_0$2.2: The difference in provider specialty between prescription outcome groups is not statistically significant.	**Rejected**

Table 3.2: Survey response distribution

About You	
Our records show that you got care from the provider named below {PRECODE}. Is that right?	Yes, 3550 (99.8%) *Missing, 6 (0.2%)*
Access	
Ease of getting through to clinic on the phone	Top-Box / Very Good, 2121 (60%) *Missing, 522 (15%)*
Was this visit with this provider an appointment for a check-up or routine care?	Yes, 288 (8%) *Missing, 3159 (89%)*
When you made this appointment for a check-up or routine care, did you get this appointment as soon as you thought you needed?	Yes, 271 (8%) *Missing, 3272 (92%)*
Moving through visit	
Wait time at clinic (from arriving to leaving)	Top-Box / Very Good, 2433 (68%) *Missing, 14 (0.4%)*
Nurse / Assistant	
Concern the nurse showed for your problem	Top-Box / Very Good, 1960 (55%) *Missing, 1125 (32%)*
Friendliness / courtesy of the nurse / assistant	Top-Box / Very Good, 3025 (85%) *Missing, 11 (0.3%)*
Care Provider	
Friendliness / courtesy or the care provider	Top-Box / Very Good, 3254, (92%) *Missing, 47 (1%)*
Concern the care provider showed for your questions or worries	Top-Box / Very Good, 3212 (90%) *Missing, 11 (0.3%)*
Care provider's efforts to include you in decisions about your treatment	Top-Box / Very Good, 3120 (88%) *Missing, 48 (2%)*
Amount of time the care provider spent with you	Top-Box / Very Good, 3010 (85%) *Missing, 44 (1%)*
Explanations the care provider gave you about your problem or condition	Top-Box / Very Good, 3061 (86%) *Missing, 108 (3%)*
Personal Issues	
Cleanliness of our practice	Top-Box / Very Good, 326 (9%) *Missing, 0*
How well staff protected your safety (by washing hands, wearing gloves, etc.)	Top-Box / Very Good, 2696 (76%) *Missing, 437 (12%)*
Overall Assessment	
How well staff worked together to care for you	Top-Box / Very Good, 2707 (76%) *Missing, 441 (12%)*
Global Rating	
Would you recommend this provider's office to your family and friends?	Yes - definitely, 3289 (92%) Yes - somewhat, 175 (5%) No, 46 (1%) *Missing, 46 (1%)*
Using any number from 0 to 10, where 0 is the worst provider possible and 10 is the best provider possible, what number would you use to rate this provider?	**Top-Box / Best Provider, 3178 (89%)** *Missing, 0*

Due to the nature of the survey data, missing responses were expected and therefore reviewed prior to the logistic regression analysis. The first step of this process was to review the frequency with which variables were missing data (Table 3.3). A short description of each survey item is provided but note that Table 2.4 provides a key for which variable name (prefixed by 's_' for survey) corresponds to each survey item.

Table 3.3: Missing data evaluation for potential logistic regression variables, ordered by percent missing

Variable	N Miss	% Miss	Variable	N Miss	% Miss
s_aco04 (making appointment)	3272	92.0%	s_cp2 (provider – explanations)	13	0.4%
s_o2 (cleanliness)	3187	89.6%	s_cp3 (provider – concern)	11	0.3%
s_aco03 (routine appointment)	3159	88.8%	s_n1 (nurse - friendliness)	11	0.3%
s_n2 (nurse – concern)	1125	31.6%	s_cp1 (provider – friendliness)	10	0.3%
Provider age	640	18.0%	Provider specialty	7	0.2%
s_o15 (coordinated care)	441	12.4%	s_cg1 (provider confirmation)	6	0.2%
s_i60 (safety)	437	12.3%	Race	4	0.1%
s_a14 (phone)	213	6.0%	Sex	3	0.1%
Insurance	78	2.2%	Ethnicity	3	0.1%
s_cp4 (provider – shared decisions)	48	1.3%	Patient age	0	0.0%
s_cg26 (recommend)	46	1.3%	Elixhauser Comorbidity Index score	0	0.0%
s_cp8 (provider – time)	44	1.2%			
s_v60 (wait time)	14	0.4%	**s_cg25 (patient satisfaction)**	**0**	**0.0%**

Several processes exist in SAS that can be systematically applied to review missing data patterns and to impute data where missing.[36,37] All potential logistic regression variables were run through a SAS program to identify patterns in missing data, with the output provided in Appendix C. At this first stage, it was determined that three survey variables (O2, cleanliness; ACO3, ease of making appointment; and ACO4, if visit routine) would be dropped from the analysis due to the magnitude of missing data (88% to 92% missing) and their relative lack of clinical relevance. Although they were

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not missing substantial data, survey item CG26 (would you recommend the office to friends or family) was dropped from the analysis as it would not have led to clinically meaningful information if found to be predictive, and CG1 was dropped from the analysis as it only served to check that the patient was rating the correct provider (99.8% of respondents indicated "Yes"). Multicollinearity was evaluated for the remaining variables by calling to SAS PROC CORR to examine the correlation matrix, with none of the variables found to have a correlation of 0.8 or higher. Tolerance and Variance Inflation Factors (VIF) were also examined and none of the variables met the standard thresholds of below 0.1 or above 10 respectively.[38]

Common techniques for dealing with missing data include complete case analysis, available case analysis, mean imputation, single imputation, and stochastic imputation. For this study, an iterative form of stochastic imputation called multiple imputation was completed. This process consists of three phases: (1) Imputation phase; (2) Analysis phase; (3) Pooling phase. For the imputation phase, multiple imputation using a fully conditional specification algorithm through SAS PROC MI was used to generate 20 imputed datasets which were then fed into SAS PROC LOGISTIC to estimate a logistic regression model for each of the 20 imputed datasets for the analysis phase. These datasets were pooled together by SAS PROC MIANALYZE to produce log-odds estimates for each variable.

All logistic regression analyses were run to model provider rating top box, where the provider is rated as "best provider (9 or 10)." First, a logistic regression model was run using the original dataset including the missing values. The missing values resulted in 2,181 observations being dropped from the analysis out of 3,556 observations. The imputation model was run with the same variables, with the results of the two separate analyses presented in Table 3.4. Three variables (patient age; explanations from provider;

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safety) reached statistical significance across both models, with patient gender reaching significance only in the original model and three additional variables reaching significance only in the imputation model: concern expressed by provider; time spent with provider; clinic wait time. Table 3.5 below relates these results to the variable-specific hypotheses under study Objective 3.

Table 3.4: Top box (best provider) logistic regression analysis results: missing data model vs. multiple imputation model

Parameter		Model with Missing Data (2181 observations dropped)				Multiple Imputation Model			
		Odds Ratio	95% Confidence Interval		p-value	Odds Ratio	95% Confidence Interval		p-value
			Lower	Upper			Lower	Upper	
Intercept		-	-	-	0.97	-	-	-	0.80
Prescription Outcome	Antibiotic Rx	-	-	-	-	-	-	-	-
	Non-Antibiotic Rx	1.55	0.63	3.80	0.75	1.13	0.73	1.76	0.72
	No Rx	1.68	0.41	6.93	0.69	1.08	0.54	2.13	1.00
Patient Age		1.03	1.01	1.06	0.01	1.02	1.00	1.03	<0.01
Sex	Female	-	-	-	-	-	-	-	-
	Male	1.97	1.10	3.55	0.02	1.20	0.89	1.60	0.24
Race	White	-	-	-	-	-	-	-	-
	Black	2.41	0.80	7.26	0.13	1.04	0.63	1.74	0.58
	Other	0.91	0.27	3.04	0.41	0.80	0.48	1.34	0.38
Ethnicity	Hispanic	-	-	-	-	-	-	-	-
	Not Hispanic	<0.001	<0.001	>999.999	0.97	0.40	0.20	0.79	0.07
	Other	<0.001	<0.001	>999.999	0.97	0.45	0.17	1.16	0.39
Insurance	Commercial	-	-	-	-	-	-	-	-
	Medicare	1.15	0.53	2.48	0.10	1.32	0.88	1.98	0.08
	Other	0.22	0.04	1.21	0.07	0.51	0.14	1.84	0.18
Provider Specialty	Family Medicine Physician	-	-	-	-	-	-	-	-
	Internal Medicine Physician	0.74	0.39	1.40	0.83	0.89	0.62	1.29	0.21
	Other Physician	0.51	0.06	4.31	0.83	0.47	0.20	1.13	0.17
	Advanced Practice Provider	0.60	0.25	1.44	0.73	0.68	0.48	0.96	0.63

| Parameter | Model with Missing Data (2181 observations dropped) | | | | Multiple Imputation Model | | | |
| | Odds Ratio | 95% Confidence Interval | | p-value | Odds Ratio | 95% Confidence Interval | | p-value |
		Lower	Upper			Lower	Upper	
Elixhauser Comorbidity Index	1.05	0.94	1.17	0.40	1.00	0.95	1.05	0.96
Provider Age	0.99	0.97	1.02	0.66	1.00	0.99	1.02	0.76
CP1 – Provider -Friendliness	1.34	0.41	4.40	0.63	0.83	0.47	1.48	0.48
CP2 – Provider -Explanations	0.28	0.12	0.69	0.01	0.45	0.27	0.74	<0.01
CP3 – Provider -Concern	0.35	0.11	1.15	0.08	0.29	0.16	0.50	<.0001
CP4 – Provider -Shared decisions	1.25	0.41	3.75	0.69	0.94	0.53	1.68	0.84
CP8 – Provider -Time	0.57	0.21	1.55	0.27	0.46	0.28	0.76	<0.01
N1 – Nurse -Friendliness	0.70	0.26	1.90	0.48	0.76	0.42	1.35	0.43
N2 – Nurse -Concern	2.13	0.81	5.55	0.12	1.52	0.81	2.84	0.21
A14 – Phone	0.76	0.40	1.43	0.39	1.08	0.72	1.62	0.85
V60 – Wait time	0.53	0.28	1.03	0.06	0.42	0.30	0.58	<.0001
I60 – Protect	0.41	0.18	0.93	0.03	0.55	0.35	0.88	0.02
O15 – Work together	0.48	0.19	1.22	0.12	0.71	0.43	1.17	0.18

Table 3.5: Logistic regression model analysis results: missing data model vs. multiple imputation model

Objective 3: To determine which variables predict top box vs. non-top box ratings.		
	Missing Data Model	Multiple Imputation Model
$H_0$3.1: There is no relationship between prescription outcome and top box rating.	Fail to reject	Fail to reject
$H_0$3.2: There is no relationship between patient age and top box rating.	Rejected	Rejected
$H_0$3.3: There is no relationship between patient gender and top box rating.	Rejected	Fail to reject
$H_0$3.4: There is no relationship between patient race and top box rating.	Fail to reject	Fail to reject
$H_0$3.5: There is no relationship between patient ethnicity and top box rating.	Fail to reject	Fail to reject
$H_0$3.6: There is no relationship between patient primary insurance and top box rating.	Fail to reject	Fail to reject
$H_0$3.7: There is no relationship between composite patient comorbidity index and top box rating.	Fail to reject	Fail to reject
$H_0$3.8: There is no relationship between provider age and top box rating.	Fail to reject	Fail to reject
$H_0$3.9.1: There is no relationship between provider specialty and comorbidity index and top box rating.	Fail to reject	Fail to reject
$H_0$3.10.1: There is no relationship between patient rating of CP1 (provider – friendliness) items and top box rating.	Fail to reject	Fail to reject
$H_0$3.10.2: There is no relationship between patient rating of CP2 (provider – explanations) items and top box rating.	Rejected	Rejected
$H_0$3.10.3: There is no relationship between patient rating of CP3 (provider – concern) items and top box rating.	Fail to reject	Rejected
$H_0$3.10.4: There is no relationship between patient rating of CP4 (provider – shared decisions) items and top box rating.	Fail to reject	Fail to reject
$H_0$3.10.5: There is no relationship between patient rating of CP8 (provider – time) items and top box rating.	Fail to reject	Rejected
$H_0$3.10.6: There is no relationship between patient rating of N1 (nurse – friendliness) items and top box rating.	Fail to reject	Fail to reject
$H_0$3.10.7: There is no relationship between patient rating of N2 (nurse – concern) items and top box rating.	Fail to reject	Fail to reject
$H_0$3.10.8: There is no relationship between patient rating of A14 (phone) items and top box rating.	Fail to reject	Fail to reject
$H_0$3.10.9: There is no relationship between patient rating of V60 (wait time) items and top box rating.	Fail to reject	Rejected
$H_0$3.10.10: There is no relationship between patient rating of I60 (safety) items and top box rating.	Rejected	Rejected
$H_0$3.10.11: There is no relationship between patient rating of O15 (coordinated care) items and top box rating.	Fail to reject	Fail to reject

Chapter 4: Discussion and Conclusions

DISCUSSION

Given the premise of this study, it is particularly notable that 84% of the final sample of visits resulted in an antibiotic prescription. While some of this may be an artifact of the data, as discussed in the limitations section next, this number indicates there is significant room for improvement at BSWH for this stewardship metric. The demographic breakdown of the three cohorts showed statistically significant differences where the No-Prescription cohort is older, has a more even Commercial:Medicare insurance ratio at 50:50 (vs. 60:40 for the other cohorts), has a higher likelihood of being seen by an Internal Medicine physician at 40% (vs. 25% for the other cohorts), that the Antibiotic-Prescription cohort have a higher proportion of female sex, and that the Non-Antibiotic-Prescription cohort has a higher proportion of Hispanic ethnicity.

The logistic regression model with multiple imputed values suggested that prescription order status was not a predictor of how patients rated their provider, even when patients who received a non-antibiotic prescription were separated from patients who received no prescription. Meanwhile, three care-provider specific items were found to predict patients giving their provider a top box rating: (1) The concern a provider expresses for a patient's condition; (2) The explanations that a provider gave their patient about their disease or illness; (3) The time the provider spent with the patient. Two facility-related survey items asking about clinic wait time and how well protected patients felt by staff practices also reached statistical significance. For demographic variables, the only item to reach statistical significance was patient age.

LIMITATIONS

This was a retrospective study leveraging the robust data sources available at Baylor Scott & White Health. While the readily available nature of retrospective data is a strength for data collection, it comes with some inherent limitations. Purely retrospective studies such as this are at the mercy of which data are available and, more often, which data are not. As described in the results section, many of the survey variables in particular were missing responses and these variables were reviewed to determine if the variable would be dropped from the logistic regression model, if the variable would be included as-is but the observations with missing data dropped from the model, or if the missing values would be imputed. When imputing data some assumptions are made regarding the pattern of missing data, including the assumption that the data are missing at random. While the patterns were evaluated in the process of imputation for this study, it is possible that there was a reason certain data were missing and that not capturing those responses inherently biases us away from a true representation of the missing data. An example of this is a variable such as a survey question asking about income, where those who do not respond may be doing so purposefully and as a group are not represented by those who do respond.

Because the survey data were sent out electronically by the vendor and a response was not required, this study is also limited by potential biases such as self-selection bias, where non-response may be caused by lack of access to an electronic device while those who do respond may be more motivated and behave differently than the average patient. This limitation can have implications on the generalizability of these results to patients from different socioeconomic or cultural backgrounds that may not have been as well-represented in the sample. It is also notable that this population had a larger portion of female, non-Hispanic, and white patients which may limit our ability to generalize these

results to other parts of Texas, much less beyond. Another limitation of survey data is that the patient may not receive or take the survey immediately and thus their opinions may be influenced by factors agnostic to the clinic visit of interest. Patients may also be thinking of one provider (e.g. a nurse they interacted with) when rating another (e.g. the visit physician), though there was a survey item that asked patients to affirm the name of the provider they were completing the survey for to try to account for this.

This study was also limited in terms of data available to characterize the providers being rated. While provider date of birth is a field in the local Electronic Health Record (EHR), it was often not populated and had to be supplemented through manual lookup with the Texas Board of Medicine website.[39] This method had limited success for Advanced Practice Providers on their corresponding board website due to different information shared publicly by the respective oversight bodies. Provider race and ethnicity were not available in either source.

There are also assumptions made with EHR data that we must consider: the grouping variable in this study was prescription outcome, which was determined from medication orders in the patient chart. Medication orders can only tell us that the provider wrote the prescription and are not if the patient has filled or taken the medication. This is particularly problematic as one of the recommendations for antibiotic stewardship is a strategy called delayed prescribing, where a provider writes a prescription for an antibiotic for a patient but counsels them not to fill the prescription until certain signs, symptoms, or duration of illness indicate a potential secondary infection or more serious bacterial infection. Such mitigation strategies would not be captured in these data, and evaluation of provider prescribing habits utilizing this data may penalize those providers who are already engaging stewardship strategies. There are also nuances with diagnosis coding that may play a factor: at BSWH, there is no current requirement for a provider to

document the indication for an outpatient prescription. Therefore, prescriptions may both be incorrectly attributed to AAB if the patient has both AAB and a valid reason for an antibiotic prescription or may not be attributed to AAB if the provider chooses not to document the indication. Finally, while the multiple imputation logistic regression model did find statistical significance with six of the predictors, it is notable that almost 90% of visits resulted in a top box rating. With top box rating serving as the primary outcome, this means there is little variation in the dependent variable, which reduces our ability to detect differences caused by each predictor. This ceiling effect is seen consistently across patient-experience surveys including The Hospital Consumer Assessment of Healthcare Providers and Systems surveys and the Press Ganey Outpatient Medical Practice Survey.[32]

CONCLUSIONS

In a world where hand sanitizer and other disinfectant cleaning supplies have been on shortage for months, where personal protective equipment is scarce, and where even casual conversations are had from behind a mask or a full body-length away, the dangers of infectious disease are more apparent than ever. As demonstrated in the background discussion, antibiotic resistance and related stewardship activities have long been identified as targets for intervention by many stakeholders. Despite these broader and local initiatives, there is still significant opportunity for improvement on antibiotic avoidance for AAB at BSWH.

The aim of this project was to generate evidence-based recommendations to promote antibiotic avoidance by elucidating the local relationship between antibiotic prescribing and patient experience survey ratings and to provide alternative strategies to providers to retain patient satisfaction in the absence of antibiotic prescribing. The results

of this study indicate that receipt of an antibiotic prescription is not a predictor of high provider ratings, but that providers can potentially improve their ratings by expressing concern for the patient's condition, taking more time with their patients, and spending patient time explaining diagnoses, treatment options, or reasons for non-treatment. Other potentially modifiable factors were managing clinic wait times and fostering an environment in which patients feel their providers and staff are protecting their safety.

One factor to consider as we evaluate stewardship opportunities for AAB is that the metric itself, updated each year, changed significantly with the 2019 and 2020 iterations. The metric is no longer specific to adults and covers visits held in the telemedicine setting. With the majority of non-essential BSWH visits recently commuted to the telemedicine setting due to COVID-19, future research on this topic should include an evaluation of telemedicine visits.

Appendix A: 2019 HEDIS AAB Technical Specifications[24]

Avoidance of Antibiotic Treatment in Adults With Acute Bronchitis (AAB)

SUMMARY OF CHANGES TO 2019 HEDIS FOR QRS

- Incorporated telehealth into the measure specification.
- Deleted the instructions for identifying ED/observation visits that result in an inpatient stay; refer to General Guideline 35 for new instructions.
- Added a note to indicate that supplemental data may not be used for this measure.
- Removed "Lower 95% confidence interval" and "Upper 95% confidence interval" data elements from the Data Elements for Reporting tables.

Description

The percentage of adults 18–64 years of age with a diagnosis of acute bronchitis who were not dispensed an antibiotic prescription.

Calculation

The measure is reported as an inverted rate [1 – (numerator/eligible population)]. A higher rate indicates appropriate treatment of adults with acute bronchitis (i.e., the proportion for whom antibiotics *were not* prescribed).

Definitions

Intake Period	January 1–December 24 of the measurement year. The Intake Period captures eligible episodes of treatment.
Episode Date	The date of service for any outpatient or ED visit during the Intake Period with a diagnosis of acute bronchitis.
IESD	Index Episode Start Date. The earliest Episode Date during the Intake Period that meets all of the following criteria: • A 30-day Negative Medication History prior to the Episode Date. • A 12-month Negative Comorbid Condition History prior to and including the Episode Date. • A Negative Competing Diagnosis during the 38-day period from 30 days prior to the Episode Date through 7 days after the Episode Date. • The member was continuously enrolled 1 year prior to the Episode Date through 7 days after the Episode Date.
Negative Medication History	To qualify for Negative Medication History, the following criteria must be met: • A period of 30 days prior to the Episode Date, when the member had no pharmacy claims for either new or refill prescriptions for a listed antibiotic drug. • No prescriptions that were filled more than 30 days prior to the Episode Date and are active on the Episode Date. A prescription is considered active if the "days supply" indicated on the date when the member filled the prescription is the number of days or more

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	between that date and the relevant service date. The 30-day look-back period for pharmacy data includes the 30 days prior to the Intake Period.
Negative Comorbid Condition History	A period of 12 months prior to and including the Episode Date, when the member had no claims/encounters with any diagnosis for a comorbid condition.
Negative Competing Diagnosis	A period of 30 days prior to the Episode Date through 7 days after the Episode Date (38 total days), when the member had no claims/encounters with any competing diagnosis.

Eligible Population

Note: Members in hospice are excluded from the eligible population. Refer to General Guideline 10: Members in Hospice.

Product line	Exchange.
Ages	Adults 18 years as of January 1 of the year prior to the measurement year to 64 years as of December 31 of the measurement year.
Continuous enrollment	One year prior to the Episode Date through seven days after the Episode Date (373 total days).
Allowable gap	No more than one gap of 45 days is permitted during the 365 days (1 year) prior to the Episode Date.
	No gaps in enrollment are allowed on the IESD through 7 days after the IESD.
Anchor date	None.
Benefits	Medical and pharmacy.
Event/diagnosis	Follow the steps below to identify the eligible population:
Step 1	Identify all members who had an outpatient visit (Outpatient Value Set) with or without a telehealth modifier (Telehealth Modifier Value Set), a telephone visit (Telephone Visits Value Set), an online assessment (Online Assessment Value Set), an observation visit (Observation Value Set) or an ED visit (ED Value Set) during the Intake Period, with a diagnosis of acute bronchitis (Acute Bronchitis Value Set).
	Do not include ED visits or observation visits that result in an inpatient stay (Inpatient Stay Value Set).
Step 2	Determine all acute bronchitis Episode Dates. For each member identified in step 1, determine all outpatient, observation or ED visits with a diagnosis of acute bronchitis.
Step 3	Test for Negative Comorbid Condition History. Exclude Episode Dates when the member had a claim/encounter with any diagnosis for a comorbid condition during the 12 months prior to or on the Episode Date. A code from any of the following meets criteria for a comorbid condition:

- HIV Value Set.
- HIV Type 2 Value Set.
- Malignant Neoplasms Value Set.

- Other Malignant Neoplasm of Skin Value Set.
- Emphysema Value Set.
- COPD Value Set.
- Cystic Fibrosis Value Set.
- Comorbid Conditions Value Set.
- Disorders of the Immune System Value Set.

Step 4   Test for Negative Medication History. Exclude Episode Dates where a new or refill prescription for an antibiotic medication (AAB Antibiotic Medications List) was filled 30 days prior to the Episode Date or was active on the Episode Date.

Step 5   Test for Negative Competing Diagnosis. Exclude Episode Dates where during the period 30 days prior to the Episode Date through 7 days after the Episode Date (38 total days) the member had a claim/encounter with any competing diagnosis. A code from either of the following meets criteria for a competing diagnosis:

- Pharyngitis Value Set.
- Competing Diagnosis Value Set.

Step 6   Calculate continuous enrollment. The member must be continuously enrolled with no more than one gap in coverage from 365 days (1 year) prior to the Episode Date through 7 days after the Episode Date (373 total days).

Step 7   Select the IESD. This measure examines the earliest eligible episode per member.

Administrative Specification

Denominator   The eligible population.

Numerator   Dispensed prescription for an antibiotic medication (AAB Antibiotic Medications List) on or three days after the IESD.

AAB Antibiotic Medications

Description	Prescription		
Aminoglycosides	• Amikacin • Gentamicin	• Streptomycin	• Tobramycin
Aminopenicillins	• Amoxicillin	• Ampicillin	
Beta-lactamase inhibitors	• Amoxicillin-clavulanate • Ampicillin-sulbactam	• Piperacillin-tazobactam	• Ticarcillin-clavulanate
First-generation cephalosporins	• Cefadroxil	• Cefazolin	• Cephalexin
Fourth-generation cephalosporins	• Cefepime		
Ketolides	• Telithromycin		
Lincomycin derivatives	• Clindamycin	• Lincomycin	
Macrolides	• Azithromycin • Clarithromycin • Erythromycin	• Erythromycin ethylsuccinate • Erythromycin lactobionate	• Erythromycin stearate
Miscellaneous antibiotics	• Aztreonam • Chloramphenicol • Dalfopristin-quinupristin	• Daptomycin • Erythromycin-sulfisoxazole • Linezolid	• Metronidazole • Vancomycin
Natural penicillins	• Penicillin G benzathine-procaine • Penicillin G potassium	• Penicillin G procaine • Penicillin G sodium	• Penicillin V potassium • Penicillin G benzathine
Penicillinase resistant penicillins	• Dicloxacillin	• Nafcillin	• Oxacillin
Quinolones	• Ciprofloxacin • Gemifloxacin	• Levofloxacin • Moxifloxacin	• Norfloxacin • Ofloxacin
Rifamycin derivatives	• Rifampin		
Second generation cephalosporin	• Cefaclor • Cefotetan	• Cefoxitin • Cefprozil	• Cefuroxime
Sulfonamides	• Sulfadiazine	• Sulfamethoxazole-trimethoprim	
Tetracyclines	• Doxycycline	• Minocycline	• Tetracycline
Third generation cephalosporins	• Cefdinir • Cefditoren • Cefixime	• Cefotaxime • Cefpodoxime • Ceftazidime	• Ceftibuten • Ceftriaxone
Urinary anti-infectives	• Fosfomycin • Nitrofurantoin • Nitrofurantoin macrocrystals	• Nitrofurantoin macrocrystals-monohydrate • Trimethoprim	

Note

- *Although denied claims are not included when assessing the numerator, all claims (paid, suspended, pending and denied) must be included when identifying the eligible population.*
- *Supplemental data may not be used for this measure.*

Data Elements for Reporting

Organizations that submit HEDIS for QRS data to NCQA must provide the following data elements.

Table AAB-4: Data Elements for Avoidance of Antibiotic Treatment in Adults With Acute Bronchitis

Element	Administrative
Measurement year	✓
Data collection methodology (Administrative)	✓
Eligible population	✓
Numerator events by administrative data	✓
Numerator events by supplemental data	✓
Reported rate	✓

Appendix B: EHR Technical Specifications

DIAGNOSIS CODE VALUE SETS

Bronchitis Value Set								
ICD 9 Codes								
466.0								
ICD 10 Codes								
J20.3	J20.4	J20.5	J20.6	J20.7	J20.8	J20.9		

HIV Value Set								
ICD 9 Codes								
042	576.8	641.01	641.11	641.21	641.31	641.81	641.91	642.01
642.02	642.11	642.12	642.21	642.22	642.31	642.32	642.41	642.42
642.51	642.52	642.61	642.62	642.71	642.72	642.91	642.92	645.11
646.21	646.22	646.71	648.01	648.51	648.52	648.61	648.62	648.81
648.82	649.31	649.32	651.01	651.1	651.11	651.21	651.31	651.41
651.51	651.61	651.71	651.81	652.01	652.61	655.01	655.11	655.31
655.41	655.51	655.61	655.71	655.81	656.01	656.11	656.21	656.31
656.41	656.51	657.01	658.01	658.11	658.21	658.41	659.71	663.01
663.51	665.01	674.51	674.52	V08	V23.5	V27.1		
ICD 10 Codes								
B20	K83.5	K83.8	K87	O09.291	O09.292	O09.293	O09.299	O10.011
O10.012	O10.013	O10.02	O10.03	O10.111	O10.112	O10.113	O10.12	O10.13
O10.211	O10.212	O10.213	O10.22	O10.311	O10.312	O10.313	O10.32	O10.411
O10.412	O10.413	O10.42	O10.43	O10.911	O10.912	O10.913	O10.92	O11.1
O11.2	O11.3	O12.11	O12.12	O12.13	O12.21	O12.22	O12.23	O13.1
O13.2	O13.3	O14.02	O14.03	O14.12	O14.13	O14.22	O14.23	O14.92
O14.93	O15.02	O15.03	O15.1	O15.2	O16.1	O16.2	O16.3	O16.9
O24.011	O24.012	O24.013	O24.02	O24.111	O24.112	O24.113	O24.12	O24.311
O24.312	O24.313	O24.32	O24.410	O24.414	O24.419	O24.420	O24.424	O24.429
O24.811	O24.812	O24.813	O24.82	O24.911	O24.912	O24.913	O24.92	O26.611
O26.612	O26.613	O26.62	O26.831	O26.832	O26.833	O30.001	O30.002	O30.003
O30.011	O30.012	O30.013	O30.031	O30.032	O30.033	O30.041	O30.042	O30.043
O30.091	O30.092	O30.093	O30.101	O30.102	O30.103	O30.111	O30.112	O30.113
O30.121	O30.122	O30.123	O30.191	O30.192	O30.193	O30.201	O30.202	O30.203
O30.211	O30.212	O30.213	O30.221	O30.222	O30.223	O30.291	O30.292	O30.293
O30.801	O30.802	O30.803	O30.811	O30.812	O30.813	O30.821	O30.822	O30.823
O30.891	O30.892	O30.893	O30.91	O30.92	O30.93	O31.11X0	O31.11X1	O31.11X2

O31.11X3	O31.11X4	O31.11X5	O31.11X9	O31.12X0	O31.12X1	O31.12X2	O31.12X3	O31.12X4
O31.12X5	O31.12X9	O31.13X0	O31.13X1	O31.13X2	O31.13X3	O31.13X4	O31.13X5	O31.13X9
O31.21X0	O31.21X1	O31.21X2	O31.21X3	O31.21X4	O31.21X5	O31.21X9	O31.22X0	O31.22X1
O31.22X2	O31.22X3	O31.22X4	O31.22X5	O31.22X9	O31.23X0	O31.23X1	O31.23X2	O31.23X3
O31.23X4	O31.23X5	O31.23X9	O31.31X0	O31.31X1	O31.31X2	O31.31X3	O31.31X4	O31.31X5
O31.31X9	O31.32X0	O31.32X1	O31.32X2	O31.32X3	O31.32X4	O31.32X5	O31.32X9	O31.33X0
O31.33X1	O31.33X2	O31.33X3	O31.33X4	O31.33X5	O31.33X9	O31.8X10	O31.8X11	O31.8X12
O31.8X13	O31.8X14	O31.8X15	O31.8X19	O31.8X20	O31.8X21	O31.8X22	O31.8X23	O31.8X24
O31.8X25	O31.8X29	O31.8X30	O31.8X31	O31.8X32	O31.8X33	O31.8X34	O31.8X35	O31.8X39
O32.0XX0	O32.0XX1	O32.0XX2	O32.0XX3	O32.0XX4	O32.0XX5	O32.0XX9	O32.9XX0	O32.9XX1
O32.9XX2	O32.9XX3	O32.9XX4	O32.9XX5	O32.9XX9	O35.0XX0	O35.0XX1	O35.0XX2	O35.0XX3
O35.0XX4	O35.0XX5	O35.0XX9	O35.1XX0	O35.1XX1	O35.1XX2	O35.1XX3	O35.1XX4	O35.1XX5
O35.1XX9	O35.3XX0	O35.3XX1	O35.3XX2	O35.3XX3	O35.3XX4	O35.3XX5	O35.3XX9	O35.4XX0
O35.4XX1	O35.4XX2	O35.4XX3	O35.4XX4	O35.4XX5	O35.4XX9	O35.5XX0	O35.5XX1	O35.5XX2
O35.5XX3	O35.5XX4	O35.5XX5	O35.5XX9	O35.6XX0	O35.6XX1	O35.6XX2	O35.6XX3	O35.6XX4
O35.6XX5	O35.6XX9	O35.8XX0	O35.8XX1	O35.8XX2	O35.8XX3	O35.8XX4	O35.8XX5	O35.8XX9
O36.0110	O36.0111	O36.0112	O36.0113	O36.0114	O36.0115	O36.0119	O36.0120	O36.0121
O36.0122	O36.0123	O36.0124	O36.0125	O36.0129	O36.0130	O36.0131	O36.0132	O36.0133
O36.0134	O36.0135	O36.0139	O36.0910	O36.0911	O36.0912	O36.0913	O36.0914	O36.0915
O36.0919	O36.0920	O36.0921	O36.0922	O36.0923	O36.0924	O36.0925	O36.0929	O36.0930
O36.0931	O36.0932	O36.0933	O36.0934	O36.0935	O36.0939	O36.1110	O36.1111	O36.1112
O36.1113	O36.1114	O36.1115	O36.1119	O36.1120	O36.1121	O36.1122	O36.1123	O36.1124
O36.1125	O36.1129	O36.1130	O36.1131	O36.1132	O36.1133	O36.1134	O36.1135	O36.1139
O36.1910	O36.1911	O36.1912	O36.1913	O36.1914	O36.1915	O36.1919	O36.1920	O36.1921
O36.1922	O36.1923	O36.1924	O36.1925	O36.1929	O36.1930	O36.1931	O36.1932	O36.1933
O36.1934	O36.1935	O36.1939	O36.4XX0	O36.4XX1	O36.4XX2	O36.4XX3	O36.4XX4	O36.4XX5
O36.4XX9	O36.5110	O36.5111	O36.5112	O36.5113	O36.5114	O36.5115	O36.5119	O36.5120
O36.5121	O36.5122	O36.5123	O36.5124	O36.5125	O36.5129	O36.5130	O36.5131	O36.5132
O36.5133	O36.5134	O36.5135	O36.5139	O36.5910	O36.5911	O36.5912	O36.5913	O36.5914
O36.5915	O36.5919	O36.5920	O36.5921	O36.5922	O36.5923	O36.5924	O36.5925	O36.5929
O36.5930	O36.5931	O36.5932	O36.5933	O36.5934	O36.5935	O36.5939	O36.8120	O36.8121
O36.8122	O36.8123	O36.8124	O36.8125	O36.8129	O36.8130	O36.8131	O36.8132	O36.8133
O36.8134	O36.8135	O36.8139	O40.1XX0	O40.1XX1	O40.1XX2	O40.1XX3	O40.1XX4	O40.1XX5
O40.1XX9	O40.2XX0	O40.2XX1	O40.2XX2	O40.2XX3	O40.2XX4	O40.2XX5	O40.2XX9	O40.3XX0

O40.3XX1	O40.3XX2	O40.3XX3	O40.3XX4	O40.3XX5	O40.3XX9	O41.01X0	O41.01X1	O41.01X2
O41.01X3	O41.01X4	O41.01X5	O41.01X9	O41.02X0	O41.02X1	O41.02X2	O41.02X3	O41.02X4
O41.02X5	O41.02X9	O41.03X0	O41.03X1	O41.03X2	O41.03X3	O41.03X4	O41.03X5	O41.03X9
O41.1010	O41.1011	O41.1012	O41.1013	O41.1014	O41.1015	O41.1019	O41.1020	O41.1021
O41.1022	O41.1023	O41.1024	O41.1025	O41.1029	O41.1030	O41.1031	O41.1032	O41.1033
O41.1034	O41.1035	O41.1039	O41.1210	O41.1211	O41.1212	O41.1213	O41.1214	O41.1215
O41.1219	O41.1220	O41.1221	O41.1222	O41.1223	O41.1224	O41.1225	O41.1229	O41.1230
O41.1231	O41.1232	O41.1233	O41.1234	O41.1235	O41.1239	O41.1410	O41.1411	O41.1412
O41.1413	O41.1414	O41.1415	O41.1419	O41.1420	O41.1421	O41.1422	O41.1423	O41.1424
O41.1425	O41.1429	O41.1430	O41.1431	O41.1432	O41.1433	O41.1434	O41.1435	O41.1439
O42.011	O42.012	O42.013	O42.02	O42.111	O42.112	O42.113	O42.12	O42.911
O42.912	O42.913	O42.92	O43.011	O43.012	O43.013	O43.212	O43.213	O43.222
O43.223	O43.232	O43.233	O44.01	O44.02	O44.03	O44.11	O44.12	O44.13
O45.001	O45.002	O45.003	O45.011	O45.012	O45.013	O45.021	O45.022	O45.023
O45.091	O45.092	O45.093	O45.8X1	O45.8X2	O45.8X3	O45.91	O45.92	O45.93
O46.001	O46.002	O46.003	O46.011	O46.012	O46.013	O46.021	O46.022	O46.023
O46.091	O46.092	O46.093	O46.8X1	O46.8X2	O46.8X3	O46.91	O46.92	O46.93
O48.0	O66.6	O67.0	O67.8	O67.9	O68	O69.0XX0	O69.0XX1	O69.0XX2
O69.0XX3	O69.0XX4	O69.0XX5	O69.0XX9	O69.4XX0	O69.4XX1	O69.4XX2	O69.4XX3	O69.4XX4
O69.4XX5	O69.4XX9	O71.02	O71.03	O76	O99.111	O99.112	O99.113	O99.12
O99.13	O99.411	O99.412	O99.413	O99.42	O99.43	O99.810	O99.814	O99.815
Z21	Z37.1	Z79.01						

Emphysema Value Set								
ICD 9 Codes								
140.0	140.1	140.3	140.4	140.5	140.6	140.8	140.9	141.0
141.1	141.2	141.3	141.4	141.5	141.6	141.8	141.9	142.0
142.1	142.2	142.8	142.9	143.0	143.1	143.8	143.9	144.0
144.1	144.8	144.9	145.0	145.1	145.2	145.3	145.4	145.5
145.6	145.8	145.9	146.0	146.1	146.2	146.3	146.4	146.5
146.6	146.7	146.8	146.9	147.0	147.1	147.2	147.3	147.8
147.9	148.0	148.1	148.2	148.3	148.8	148.9	149.0	149.1
149.8	149.9	150.0	150.1	150.2	150.3	150.4	150.5	150.8
150.9	151.0	151.1	151.2	151.3	151.4	151.5	151.6	151.8
151.9	152.0	152.1	152.2	152.3	152.8	152.9	153.0	153.1
153.2	153.3	153.4	153.5	153.6	153.7	153.8	153.9	154.0
154.1	154.2	154.3	154.8	155.0	155.1	155.2	156.0	156.1

156.2	156.8	156.9	157.0	157.1	157.2	157.3	157.4	157.8
157.9	158.0	158.8	158.9	159.0	159.1	159.8	159.9	160.0
160.1	160.2	160.3	160.4	160.5	160.8	160.9	161.0	161.1
161.2	161.3	161.8	161.9	162.0	162.2	162.3	162.4	162.5
162.8	162.9	163.0	163.1	163.8	163.9	164.0	164.1	164.2
164.3	164.8	164.9	165.0	165.8	165.9	170.0	170.1	170.2
170.3	170.4	170.5	170.6	170.7	170.8	170.9	171.0	171.2
171.3	171.4	171.5	171.6	171.7	171.8	171.9	172.0	172.1
172.2	172.3	172.4	172.5	172.6	172.7	172.8	172.9	173.00
173.01	173.02	173.09	173.10	173.11	173.12	173.19	173.20	173.21
173.22	173.29	173.30	173.31	173.32	173.39	173.40	173.41	173.42
173.49	173.50	173.51	173.52	173.59	173.60	173.61	173.62	173.69
173.70	173.71	173.72	173.79	173.80	173.81	173.82	173.89	173.90
173.91	173.92	173.99	174.0	174.1	174.2	174.3	174.4	174.5
174.6	174.8	174.9	175.0	175.9	176.0	176.1	176.2	176.3
176.4	176.5	176.8	176.9	179	180.0	180.1	180.8	180.9
181	182.0	182.1	182.8	183.0	183.2	183.3	183.4	183.5
183.8	183.9	184.0	184.1	184.2	184.3	184.4	184.8	184.9
185	186.0	186.9	187.1	187.2	187.3	187.4	187.5	187.6
187.7	187.8	187.9	188.0	188.1	188.2	188.3	188.4	188.5
188.6	188.7	188.8	188.9	189.0	189.1	189.2	189.3	189.4
189.8	189.9	190.0	190.1	190.2	190.3	190.4	190.5	190.6
190.7	190.8	190.9	191.0	191.1	191.2	191.3	191.4	191.5
191.6	191.7	191.8	191.9	192.0	192.1	192.2	192.3	192.8
192.9	193	194.0	194.1	194.3	194.4	194.5	194.6	194.8
194.9	195.0	195.1	195.2	195.3	195.4	195.5	195.8	196.0
196.1	196.2	196.3	196.5	196.6	196.8	196.9	197.0	197.1
197.2	197.3	197.4	197.5	197.6	197.7	197.8	198.0	198.1
198.2	198.3	198.4	198.5	198.6	198.7	198.81	198.82	198.89
199.0	199.1	199.2	200.00	200.01	200.02	200.03	200.04	200.05
200.06	200.07	200.08	200.10	200.11	200.12	200.13	200.14	200.15
200.16	200.17	200.18	200.20	200.21	200.22	200.23	200.24	200.25
200.26	200.27	200.28	200.30	200.31	200.32	200.33	200.34	200.35
200.36	200.37	200.38	200.40	200.41	200.42	200.43	200.44	200.45
200.46	200.47	200.48	200.50	200.51	200.52	200.53	200.54	200.55
200.56	200.57	200.58	200.60	200.61	200.62	200.63	200.64	200.65
200.66	200.67	200.68	200.70	200.71	200.72	200.73	200.74	200.75
200.76	200.77	200.78	200.80	200.81	200.82	200.83	200.84	200.85

200.86	200.87	200.88	201.00	201.01	201.02	201.03	201.04	201.05
201.06	201.07	201.08	201.10	201.11	201.12	201.13	201.14	201.15
201.16	201.17	201.18	201.20	201.21	201.22	201.23	201.24	201.25
201.26	201.27	201.28	201.40	201.41	201.42	201.43	201.44	201.45
201.46	201.47	201.48	201.50	201.51	201.52	201.53	201.54	201.55
201.56	201.57	201.58	201.60	201.61	201.62	201.63	201.64	201.65
201.66	201.67	201.68	201.70	201.71	201.72	201.73	201.74	201.75
201.76	201.77	201.78	201.90	201.91	201.92	201.93	201.94	201.95
201.96	201.97	201.98	202.00	202.01	202.02	202.03	202.04	202.05
202.06	202.07	202.08	202.10	202.11	202.12	202.13	202.14	202.15
202.16	202.17	202.18	202.20	202.21	202.22	202.23	202.24	202.25
202.26	202.27	202.28	202.30	202.31	202.32	202.33	202.34	202.35
202.36	202.37	202.38	202.40	202.41	202.42	202.43	202.44	202.45
202.46	202.47	202.48	202.50	202.51	202.52	202.53	202.54	202.55
202.56	202.57	202.58	202.60	202.61	202.62	202.63	202.64	202.65
202.66	202.67	202.68	202.70	202.71	202.72	202.73	202.74	202.75
202.76	202.77	202.78	202.80	202.81	202.82	202.83	202.84	202.85
202.86	202.87	202.88	202.90	202.91	202.92	202.93	202.94	202.95
202.96	202.97	202.98	203.00	203.01	203.02	203.10	203.11	203.12
203.80	203.81	203.82	204.00	204.01	204.02	204.10	204.11	204.12
204.20	204.21	204.22	204.80	204.81	204.82	204.90	204.91	204.92
205.00	205.01	205.02	205.10	205.11	205.12	205.20	205.21	205.22
205.30	205.31	205.32	205.80	205.81	205.82	205.90	205.91	205.92
206.00	206.01	206.02	206.10	206.11	206.12	206.20	206.21	206.22
206.80	206.81	206.82	206.90	206.91	206.92	207.00	207.01	207.02
207.10	207.11	207.12	207.20	207.21	207.22	207.80	207.81	207.82
208.00	208.01	208.02	208.10	208.11	208.12	208.20	208.21	208.22
208.80	208.81	208.82	208.90	208.91	208.92	209.00	209.01	209.02
209.03	209.10	209.11	209.12	209.13	209.14	209.15	209.16	209.17
209.20	209.21	209.22	209.23	209.24	209.25	209.26	209.27	209.29
209.30	209.31	209.32	209.33	209.34	209.35	209.36	209.40	209.41
209.42	209.43	209.50	209.51	209.52	209.53	209.54	209.55	209.56
209.57	209.60	209.61	209.62	209.63	209.64	209.65	209.66	209.67
209.69	209.70	209.71	209.72	209.73	209.74	209.75	209.79	
ICD 10 Codes								
C00.0	C00.1	C00.2	C00.3	C00.4	C00.5	C00.6	C00.8	C00.9
C01	C02.0	C02.1	C02.2	C02.3	C02.4	C02.8	C02.9	C03.0
C03.1	C03.9	C04.0	C04.1	C04.8	C04.9	C05.0	C05.1	C05.2

C05.8	C05.9	C06.0	C06.1	C06.2	C06.80	C06.89	C06.9	C07
C08.0	C08.1	C08.9	C09.0	C09.1	C09.8	C09.9	C10.0	C10.1
C10.2	C10.3	C10.4	C10.8	C10.9	C11.0	C11.1	C11.2	C11.3
C11.8	C11.9	C12	C13.0	C13.1	C13.2	C13.8	C13.9	C14.0
C14.2	C14.8	C15.3	C15.4	C15.5	C15.8	C15.9	C16.0	C16.1
C16.2	C16.3	C16.4	C16.5	C16.6	C16.8	C16.9	C17.0	C17.1
C17.2	C17.3	C17.8	C17.9	C18.0	C18.1	C18.2	C18.3	C18.4
C18.5	C18.6	C18.7	C18.8	C18.9	C19	C20	C21.0	C21.1
C21.2	C21.8	C22.0	C22.1	C22.2	C22.3	C22.4	C22.7	C22.8
C22.9	C23	C24.0	C24.1	C24.8	C24.9	C25.0	C25.1	C25.2
C25.3	C25.4	C25.7	C25.8	C25.9	C26.0	C26.1	C26.9	C30.0
C30.1	C31.0	C31.1	C31.2	C31.3	C31.8	C31.9	C32.0	C32.1
C32.2	C32.3	C32.8	C32.9	C33	C34.00	C34.01	C34.02	C34.10
C34.11	C34.12	C34.2	C34.30	C34.31	C34.32	C34.80	C34.81	C34.82
C34.90	C34.91	C34.92	C37	C38.0	C38.1	C38.2	C38.3	C38.4
C38.8	C39.0	C39.9	C40.00	C40.01	C40.02	C40.10	C40.11	C40.12
C40.20	C40.21	C40.22	C40.30	C40.31	C40.32	C40.80	C40.81	C40.82
C40.90	C40.91	C40.92	C41.0	C41.1	C41.2	C41.3	C41.4	C41.9
C43.0	C43.10	C43.11	C43.12	C43.20	C43.21	C43.22	C43.30	C43.31
C43.39	C43.4	C43.51	C43.52	C43.59	C43.60	C43.61	C43.62	C43.70
C43.71	C43.72	C43.8	C43.9	C44.00	C44.01	C44.02	C44.09	C44.101
C44.102	C44.109	C44.111	C44.112	C44.119	C44.121	C44.122	C44.129	C44.191
C44.192	C44.199	C44.201	C44.202	C44.209	C44.211	C44.212	C44.219	C44.221
C44.222	C44.229	C44.291	C44.292	C44.299	C44.300	C44.301	C44.309	C44.310
C44.311	C44.319	C44.320	C44.321	C44.329	C44.390	C44.391	C44.399	C44.40
C44.41	C44.42	C44.49	C44.500	C44.501	C44.509	C44.510	C44.511	C44.519
C44.520	C44.521	C44.529	C44.590	C44.591	C44.599	C44.601	C44.602	C44.609
C44.611	C44.612	C44.619	C44.621	C44.622	C44.629	C44.691	C44.692	C44.699
C44.701	C44.702	C44.709	C44.711	C44.712	C44.719	C44.721	C44.722	C44.729
C44.791	C44.792	C44.799	C44.80	C44.81	C44.82	C44.89	C44.90	C44.91
C44.92	C44.99	C45.0	C45.1	C45.2	C45.7	C45.9	C46.0	C46.1
C46.2	C46.3	C46.4	C46.50	C46.51	C46.52	C46.7	C46.9	C47.0
C47.10	C47.11	C47.12	C47.20	C47.21	C47.22	C47.3	C47.4	C47.5
C47.6	C47.8	C47.9	C48.0	C48.1	C48.2	C48.8	C49.0	C49.10
C49.11	C49.12	C49.20	C49.21	C49.22	C49.3	C49.4	C49.5	C49.6
C49.8	C49.9	C4A.0	C4A.10	C4A.11	C4A.12	C4A.20	C4A.21	C4A.22
C4A.30	C4A.31	C4A.39	C4A.4	C4A.51	C4A.52	C4A.59	C4A.60	C4A.61
C4A.62	C4A.70	C4A.71	C4A.72	C4A.8	C4A.9	C50.011	C50.012	C50.019

C50.021	C50.022	C50.029	C50.111	C50.112	C50.119	C50.121	C50.122	C50.129
C50.211	C50.212	C50.219	C50.221	C50.222	C50.229	C50.311	C50.312	C50.319
C50.321	C50.322	C50.329	C50.411	C50.412	C50.419	C50.421	C50.422	C50.429
C50.511	C50.512	C50.519	C50.521	C50.522	C50.529	C50.611	C50.612	C50.619
C50.621	C50.622	C50.629	C50.811	C50.812	C50.819	C50.821	C50.822	C50.829
C50.911	C50.912	C50.919	C50.921	C50.922	C50.929	C51.0	C51.1	C51.2
C51.8	C51.9	C52	C53.0	C53.1	C53.8	C53.9	C54.0	C54.1
C54.2	C54.3	C54.8	C54.9	C55	C56.1	C56.2	C56.9	C57.00
C57.01	C57.02	C57.10	C57.11	C57.12	C57.20	C57.21	C57.22	C57.3
C57.4	C57.7	C57.8	C57.9	C58	C60.0	C60.1	C60.2	C60.8
C60.9	C61	C62.00	C62.01	C62.02	C62.10	C62.11	C62.12	C62.90
C62.91	C62.92	C63.00	C63.01	C63.02	C63.10	C63.11	C63.12	C63.2
C63.7	C63.8	C63.9	C64.1	C64.2	C64.9	C65.1	C65.2	C65.9
C66.1	C66.2	C66.9	C67.0	C67.1	C67.2	C67.3	C67.4	C67.5
C67.6	C67.7	C67.8	C67.9	C68.0	C68.1	C68.8	C68.9	C69.00
C69.01	C69.02	C69.10	C69.11	C69.12	C69.20	C69.21	C69.22	C69.30
C69.31	C69.32	C69.40	C69.41	C69.42	C69.50	C69.51	C69.52	C69.60
C69.61	C69.62	C69.80	C69.81	C69.82	C69.90	C69.91	C69.92	C70.0
C70.1	C70.9	C71.0	C71.1	C71.2	C71.3	C71.4	C71.5	C71.6
C71.7	C71.8	C71.9	C72.0	C72.1	C72.20	C72.21	C72.22	C72.30
C72.31	C72.32	C72.40	C72.41	C72.42	C72.50	C72.59	C72.9	C73
C74.00	C74.01	C74.02	C74.10	C74.11	C74.12	C74.90	C74.91	C74.92
C75.0	C75.1	C75.2	C75.3	C75.4	C75.5	C75.8	C75.9	C76.0
C76.1	C76.2	C76.3	C76.40	C76.41	C76.42	C76.50	C76.51	C76.52
C76.8	C77.0	C77.1	C77.2	C77.3	C77.4	C77.5	C77.8	C77.9
C78.00	C78.01	C78.02	C78.1	C78.2	C78.30	C78.39	C78.4	C78.5
C78.6	C78.7	C78.80	C78.89	C79.00	C79.01	C79.02	C79.10	C79.11
C79.19	C79.2	C79.31	C79.32	C79.40	C79.49	C79.51	C79.52	C79.60
C79.61	C79.62	C79.70	C79.71	C79.72	C79.81	C79.82	C79.89	C79.9
C7A.00	C7A.010	C7A.011	C7A.012	C7A.019	C7A.020	C7A.021	C7A.022	C7A.023
C7A.024	C7A.025	C7A.026	C7A.029	C7A.090	C7A.091	C7A.092	C7A.093	C7A.094
C7A.095	C7A.096	C7A.098	C7A.1	C7A.8	C7B.00	C7B.01	C7B.02	C7B.03
C7B.04	C7B.09	C7B.1	C7B.8	C80.0	C80.1	C80.2	C81.00	C81.01
C81.02	C81.03	C81.04	C81.05	C81.06	C81.07	C81.08	C81.09	C81.10
C81.11	C81.12	C81.13	C81.14	C81.15	C81.16	C81.17	C81.18	C81.19
C81.20	C81.21	C81.22	C81.23	C81.24	C81.25	C81.26	C81.27	C81.28
C81.29	C81.30	C81.31	C81.32	C81.33	C81.34	C81.35	C81.36	C81.37
C81.38	C81.39	C81.40	C81.41	C81.42	C81.43	C81.44	C81.45	C81.46

C81.47	C81.48	C81.49	C81.70	C81.71	C81.72	C81.73	C81.74	C81.75
C81.76	C81.77	C81.78	C81.79	C81.90	C81.91	C81.92	C81.93	C81.94
C81.95	C81.96	C81.97	C81.98	C81.99	C82.00	C82.01	C82.02	C82.03
C82.04	C82.05	C82.06	C82.07	C82.08	C82.09	C82.10	C82.11	C82.12
C82.13	C82.14	C82.15	C82.16	C82.17	C82.18	C82.19	C82.20	C82.21
C82.22	C82.23	C82.24	C82.25	C82.26	C82.27	C82.28	C82.29	C82.30
C82.31	C82.32	C82.33	C82.34	C82.35	C82.36	C82.37	C82.38	C82.39
C82.40	C82.41	C82.42	C82.43	C82.44	C82.45	C82.46	C82.47	C82.48
C82.49	C82.50	C82.51	C82.52	C82.53	C82.54	C82.55	C82.56	C82.57
C82.58	C82.59	C82.60	C82.61	C82.62	C82.63	C82.64	C82.65	C82.66
C82.67	C82.68	C82.69	C82.80	C82.81	C82.82	C82.83	C82.84	C82.85
C82.86	C82.87	C82.88	C82.89	C82.90	C82.91	C82.92	C82.93	C82.94
C82.95	C82.96	C82.97	C82.98	C82.99	C83.00	C83.01	C83.02	C83.03
C83.04	C83.05	C83.06	C83.07	C83.08	C83.09	C83.10	C83.11	C83.12
C83.13	C83.14	C83.15	C83.16	C83.17	C83.18	C83.19	C83.30	C83.31
C83.32	C83.33	C83.34	C83.35	C83.36	C83.37	C83.38	C83.39	C83.50
C83.51	C83.52	C83.53	C83.54	C83.55	C83.56	C83.57	C83.58	C83.59
C83.70	C83.71	C83.72	C83.73	C83.74	C83.75	C83.76	C83.77	C83.78
C83.79	C83.80	C83.81	C83.82	C83.83	C83.84	C83.85	C83.86	C83.87
C83.88	C83.89	C83.90	C83.91	C83.92	C83.93	C83.94	C83.95	C83.96
C83.97	C83.98	C83.99	C84.00	C84.01	C84.02	C84.03	C84.04	C84.05
C84.06	C84.07	C84.08	C84.09	C84.10	C84.11	C84.12	C84.13	C84.14
C84.15	C84.16	C84.17	C84.18	C84.19	C84.40	C84.41	C84.42	C84.43
C84.44	C84.45	C84.46	C84.47	C84.48	C84.49	C84.60	C84.61	C84.62
C84.63	C84.64	C84.65	C84.66	C84.67	C84.68	C84.69	C84.70	C84.71
C84.72	C84.73	C84.74	C84.75	C84.76	C84.77	C84.78	C84.79	C84.90
C84.91	C84.92	C84.93	C84.94	C84.95	C84.96	C84.97	C84.98	C84.99
C84.A0	C84.A1	C84.A2	C84.A3	C84.A4	C84.A5	C84.A6	C84.A7	C84.A8
C84.A9	C84.Z0	C84.Z1	C84.Z2	C84.Z3	C84.Z4	C84.Z5	C84.Z6	C84.Z7
C84.Z8	C84.Z9	C85.10	C85.11	C85.12	C85.13	C85.14	C85.15	C85.16
C85.17	C85.18	C85.19	C85.20	C85.21	C85.22	C85.23	C85.24	C85.25
C85.26	C85.27	C85.28	C85.29	C85.80	C85.81	C85.82	C85.83	C85.84
C85.85	C85.86	C85.87	C85.88	C85.89	C85.90	C85.91	C85.92	C85.93
C85.94	C85.95	C85.96	C85.97	C85.98	C85.99	C86.0	C86.1	C86.2
C86.3	C86.4	C86.5	C86.6	C88.0	C88.2	C88.3	C88.4	C88.8
C88.9	C90.00	C90.01	C90.02	C90.10	C90.11	C90.12	C90.20	C90.21
C90.22	C90.30	C90.31	C90.32	C91.00	C91.01	C91.02	C91.10	C91.11
C91.12	C91.30	C91.31	C91.32	C91.40	C91.41	C91.42	C91.50	C91.51

C91.52	C91.60	C91.61	C91.62	C91.90	C91.91	C91.92	C91.A0	C91.A1
C91.A2	C91.Z0	C91.Z1	C91.Z2	C92.00	C92.01	C92.02	C92.10	C92.11
C92.12	C92.20	C92.21	C92.22	C92.30	C92.31	C92.32	C92.40	C92.41
C92.42	C92.50	C92.51	C92.52	C92.60	C92.61	C92.62	C92.90	C92.91
C92.92	C92.A0	C92.A1	C92.A2	C92.Z0	C92.Z1	C92.Z2	C93.00	C93.01
C93.02	C93.10	C93.11	C93.12	C93.30	C93.31	C93.32	C93.90	C93.91
C93.92	C93.Z0	C93.Z1	C93.Z2	C94.00	C94.01	C94.02	C94.20	C94.21
C94.22	C94.30	C94.31	C94.32	C94.40	C94.41	C94.42	C94.6	C94.80
C94.81	C94.82	C95.00	C95.01	C95.02	C95.10	C95.11	C95.12	C95.90
C95.91	C95.92	C96.0	C96.2	C96.4	C96.5	C96.6	C96.9	C96.A
C96.Z								

Malignant Neoplasms Value Set								
ICD 9 Codes								
140.0	140.1	140.3	140.4	140.5	140.6	140.8	140.9	141.0
141.1	141.2	141.3	141.4	141.5	141.6	141.8	141.9	142.0
142.1	142.2	142.8	142.9	143.0	143.1	143.8	143.9	144.0
144.1	144.8	144.9	145.0	145.1	145.2	145.3	145.4	145.5
145.6	145.8	145.9	146.0	146.1	146.2	146.3	146.4	146.5
146.6	146.7	146.8	146.9	147.0	147.1	147.2	147.3	147.8
147.9	148.0	148.1	148.2	148.3	148.8	148.9	149.0	149.1
149.8	149.9	150.0	150.1	150.2	150.3	150.4	150.5	150.8
150.9	151.0	151.1	151.2	151.3	151.4	151.5	151.6	151.8
151.9	152.0	152.1	152.2	152.3	152.8	152.9	153.0	153.1
153.2	153.3	153.4	153.5	153.6	153.7	153.8	153.9	154.0
154.1	154.2	154.3	154.8	155.0	155.1	155.2	156.0	156.1
156.2	156.8	156.9	157.0	157.1	157.2	157.3	157.4	157.8
157.9	158.0	158.8	158.9	159.0	159.1	159.8	159.9	160.0
160.1	160.2	160.3	160.4	160.5	160.8	160.9	161.0	161.1
161.2	161.3	161.8	161.9	162.0	162.2	162.3	162.4	162.5
162.8	162.9	163.0	163.1	163.8	163.9	164.0	164.1	164.2
164.3	164.8	164.9	165.0	165.8	165.9	170.0	170.1	170.2
170.3	170.4	170.5	170.6	170.7	170.8	170.9	171.0	171.2
171.3	171.4	171.5	171.6	171.7	171.8	171.9	172.0	172.1
172.2	172.3	172.4	172.5	172.6	172.7	172.8	172.9	173.00
173.01	173.02	173.09	173.10	173.11	173.12	173.19	173.20	173.21
173.22	173.29	173.30	173.31	173.32	173.39	173.40	173.41	173.42
173.49	173.50	173.51	173.52	173.59	173.60	173.61	173.62	173.69

173.70	173.71	173.72	173.79	173.80	173.81	173.82	173.89	173.90
173.91	173.92	173.99	174.0	174.1	174.2	174.3	174.4	174.5
174.6	174.8	174.9	175.0	175.9	176.0	176.1	176.2	176.3
176.4	176.5	176.8	176.9	179	180.0	180.1	180.8	180.9
181	182.0	182.1	182.8	183.0	183.2	183.3	183.4	183.5
183.8	183.9	184.0	184.1	184.2	184.3	184.4	184.8	184.9
185	186.0	186.9	187.1	187.2	187.3	187.4	187.5	187.6
187.7	187.8	187.9	188.0	188.1	188.2	188.3	188.4	188.5
188.6	188.7	188.8	188.9	189.0	189.1	189.2	189.3	189.4
189.8	189.9	190.0	190.1	190.2	190.3	190.4	190.5	190.6
190.7	190.8	190.9	191.0	191.1	191.2	191.3	191.4	191.5
191.6	191.7	191.8	191.9	192.0	192.1	192.2	192.3	192.8
192.9	193	194.0	194.1	194.3	194.4	194.5	194.6	194.8
194.9	195.0	195.1	195.2	195.3	195.4	195.5	195.8	196.0
196.1	196.2	196.3	196.5	196.6	196.8	196.9	197.0	197.1
197.2	197.3	197.4	197.5	197.6	197.7	197.8	198.0	198.1
198.2	198.3	198.4	198.5	198.6	198.7	198.81	198.82	198.89
199.0	199.1	199.2	200.00	200.01	200.02	200.03	200.04	200.05
200.06	200.07	200.08	200.10	200.11	200.12	200.13	200.14	200.15
200.16	200.17	200.18	200.20	200.21	200.22	200.23	200.24	200.25
200.26	200.27	200.28	200.30	200.31	200.32	200.33	200.34	200.35
200.36	200.37	200.38	200.40	200.41	200.42	200.43	200.44	200.45
200.46	200.47	200.48	200.50	200.51	200.52	200.53	200.54	200.55
200.56	200.57	200.58	200.60	200.61	200.62	200.63	200.64	200.65
200.66	200.67	200.68	200.70	200.71	200.72	200.73	200.74	200.75
200.76	200.77	200.78	200.80	200.81	200.82	200.83	200.84	200.85
200.86	200.87	200.88	201.00	201.01	201.02	201.03	201.04	201.05
201.06	201.07	201.08	201.10	201.11	201.12	201.13	201.14	201.15
201.16	201.17	201.18	201.20	201.21	201.22	201.23	201.24	201.25
201.26	201.27	201.28	201.40	201.41	201.42	201.43	201.44	201.45
201.46	201.47	201.48	201.50	201.51	201.52	201.53	201.54	201.55
201.56	201.57	201.58	201.60	201.61	201.62	201.63	201.64	201.65
201.66	201.67	201.68	201.70	201.71	201.72	201.73	201.74	201.75
201.76	201.77	201.78	201.90	201.91	201.92	201.93	201.94	201.95
201.96	201.97	201.98	202.00	202.01	202.02	202.03	202.04	202.05
202.06	202.07	202.08	202.10	202.11	202.12	202.13	202.14	202.15
202.16	202.17	202.18	202.20	202.21	202.22	202.23	202.24	202.25
202.26	202.27	202.28	202.30	202.31	202.32	202.33	202.34	202.35

202.36	202.37	202.38	202.40	202.41	202.42	202.43	202.44	202.45
202.46	202.47	202.48	202.50	202.51	202.52	202.53	202.54	202.55
202.56	202.57	202.58	202.60	202.61	202.62	202.63	202.64	202.65
202.66	202.67	202.68	202.70	202.71	202.72	202.73	202.74	202.75
202.76	202.77	202.78	202.80	202.81	202.82	202.83	202.84	202.85
202.86	202.87	202.88	202.90	202.91	202.92	202.93	202.94	202.95
202.96	202.97	202.98	203.00	203.01	203.02	203.10	203.11	203.12
203.80	203.81	203.82	204.00	204.01	204.02	204.10	204.11	204.12
204.20	204.21	204.22	204.80	204.81	204.82	204.90	204.91	204.92
205.00	205.01	205.02	205.10	205.11	205.12	205.20	205.21	205.22
205.30	205.31	205.32	205.80	205.81	205.82	205.90	205.91	205.92
206.00	206.01	206.02	206.10	206.11	206.12	206.20	206.21	206.22
206.80	206.81	206.82	206.90	206.91	206.92	207.00	207.01	207.02
207.10	207.11	207.12	207.20	207.21	207.22	207.80	207.81	207.82
208.00	208.01	208.02	208.10	208.11	208.12	208.20	208.21	208.22
208.80	208.81	208.82	208.90	208.91	208.92	209.00	209.01	209.02
209.03	209.10	209.11	209.12	209.13	209.14	209.15	209.16	209.17
209.20	209.21	209.22	209.23	209.24	209.25	209.26	209.27	209.29
209.30	209.31	209.32	209.33	209.34	209.35	209.36	209.40	209.41
209.42	209.43	209.50	209.51	209.52	209.53	209.54	209.55	209.56
209.57	209.60	209.61	209.62	209.63	209.64	209.65	209.66	209.67
209.69	209.70	209.71	209.72	209.73	209.74	209.75	209.79	
ICD 10 Codes								
C00.0	C00.1	C00.2	C00.3	C00.4	C00.5	C00.6	C00.8	C00.9
C01	C02.0	C02.1	C02.2	C02.3	C02.4	C02.8	C02.9	C03.0
C03.1	C03.9	C04.0	C04.1	C04.8	C04.9	C05.0	C05.1	C05.2
C05.8	C05.9	C06.0	C06.1	C06.2	C06.80	C06.89	C06.9	C07
C08.0	C08.1	C08.9	C09.0	C09.1	C09.8	C09.9	C10.0	C10.1
C10.2	C10.3	C10.4	C10.8	C10.9	C11.0	C11.1	C11.2	C11.3
C11.8	C11.9	C12	C13.0	C13.1	C13.2	C13.8	C13.9	C14.0
C14.2	C14.8	C15.3	C15.4	C15.5	C15.8	C15.9	C16.0	C16.1
C16.2	C16.3	C16.4	C16.5	C16.6	C16.8	C16.9	C17.0	C17.1
C17.2	C17.3	C17.8	C17.9	C18.0	C18.1	C18.2	C18.3	C18.4
C18.5	C18.6	C18.7	C18.8	C18.9	C19	C20	C21.0	C21.1
C21.2	C21.8	C22.0	C22.1	C22.2	C22.3	C22.4	C22.7	C22.8
C22.9	C23	C24.0	C24.1	C24.8	C24.9	C25.0	C25.1	C25.2
C25.3	C25.4	C25.7	C25.8	C25.9	C26.0	C26.1	C26.9	C30.0
C30.1	C31.0	C31.1	C31.2	C31.3	C31.8	C31.9	C32.0	C32.1

C32.2	C32.3	C32.8	C32.9	C33	C34.00	C34.01	C34.02	C34.10
C34.11	C34.12	C34.2	C34.30	C34.31	C34.32	C34.80	C34.81	C34.82
C34.90	C34.91	C34.92	C37	C38.0	C38.1	C38.2	C38.3	C38.4
C38.8	C39.0	C39.9	C40.00	C40.01	C40.02	C40.10	C40.11	C40.12
C40.20	C40.21	C40.22	C40.30	C40.31	C40.32	C40.80	C40.81	C40.82
C40.90	C40.91	C40.92	C41.0	C41.1	C41.2	C41.3	C41.4	C41.9
C43.0	C43.10	C43.11	C43.12	C43.20	C43.21	C43.22	C43.30	C43.31
C43.39	C43.4	C43.51	C43.52	C43.59	C43.60	C43.61	C43.62	C43.70
C43.71	C43.72	C43.8	C43.9	C44.00	C44.01	C44.02	C44.09	C44.101
C44.102	C44.109	C44.111	C44.112	C44.119	C44.121	C44.122	C44.129	C44.191
C44.192	C44.199	C44.201	C44.202	C44.209	C44.211	C44.212	C44.219	C44.221
C44.222	C44.229	C44.291	C44.292	C44.299	C44.300	C44.301	C44.309	C44.310
C44.311	C44.319	C44.320	C44.321	C44.329	C44.390	C44.391	C44.399	C44.40
C44.41	C44.42	C44.49	C44.500	C44.501	C44.509	C44.510	C44.511	C44.519
C44.520	C44.521	C44.529	C44.590	C44.591	C44.599	C44.601	C44.602	C44.609
C44.611	C44.612	C44.619	C44.621	C44.622	C44.629	C44.691	C44.692	C44.699
C44.701	C44.702	C44.709	C44.711	C44.712	C44.719	C44.721	C44.722	C44.729
C44.791	C44.792	C44.799	C44.80	C44.81	C44.82	C44.89	C44.90	C44.91
C44.92	C44.99	C45.0	C45.1	C45.2	C45.7	C45.9	C46.0	C46.1
C46.2	C46.3	C46.4	C46.50	C46.51	C46.52	C46.7	C46.9	C47.0
C47.10	C47.11	C47.12	C47.20	C47.21	C47.22	C47.3	C47.4	C47.5
C47.6	C47.8	C47.9	C48.0	C48.1	C48.2	C48.8	C49.0	C49.10
C49.11	C49.12	C49.20	C49.21	C49.22	C49.3	C49.4	C49.5	C49.6
C49.8	C49.9	C4A.0	C4A.10	C4A.11	C4A.12	C4A.20	C4A.21	C4A.22
C4A.30	C4A.31	C4A.39	C4A.4	C4A.51	C4A.52	C4A.59	C4A.60	C4A.61
C4A.62	C4A.70	C4A.71	C4A.72	C4A.8	C4A.9	C50.011	C50.012	C50.019
C50.021	C50.022	C50.029	C50.111	C50.112	C50.119	C50.121	C50.122	C50.129
C50.211	C50.212	C50.219	C50.221	C50.222	C50.229	C50.311	C50.312	C50.319
C50.321	C50.322	C50.329	C50.411	C50.412	C50.419	C50.421	C50.422	C50.429
C50.511	C50.512	C50.519	C50.521	C50.522	C50.529	C50.611	C50.612	C50.619
C50.621	C50.622	C50.629	C50.811	C50.812	C50.819	C50.821	C50.822	C50.829
C50.911	C50.912	C50.919	C50.921	C50.922	C50.929	C51.0	C51.1	C51.2
C51.8	C51.9	C52	C53.0	C53.1	C53.8	C53.9	C54.0	C54.1
C54.2	C54.3	C54.8	C54.9	C55	C56.1	C56.2	C56.9	C57.00
C57.01	C57.02	C57.10	C57.11	C57.12	C57.20	C57.21	C57.22	C57.3
C57.4	C57.7	C57.8	C57.9	C58	C60.0	C60.1	C60.2	C60.8
C60.9	C61	C62.00	C62.01	C62.02	C62.10	C62.11	C62.12	C62.90
C62.91	C62.92	C63.00	C63.01	C63.02	C63.10	C63.11	C63.12	C63.2

C63.7	C63.8	C63.9	C64.1	C64.2	C64.9	C65.1	C65.2	C65.9
C66.1	C66.2	C66.9	C67.0	C67.1	C67.2	C67.3	C67.4	C67.5
C67.6	C67.7	C67.8	C67.9	C68.0	C68.1	C68.8	C68.9	C69.00
C69.01	C69.02	C69.10	C69.11	C69.12	C69.20	C69.21	C69.22	C69.30
C69.31	C69.32	C69.40	C69.41	C69.42	C69.50	C69.51	C69.52	C69.60
C69.61	C69.62	C69.80	C69.81	C69.82	C69.90	C69.91	C69.92	C70.0
C70.1	C70.9	C71.0	C71.1	C71.2	C71.3	C71.4	C71.5	C71.6
C71.7	C71.8	C71.9	C72.0	C72.1	C72.20	C72.21	C72.22	C72.30
C72.31	C72.32	C72.40	C72.41	C72.42	C72.50	C72.59	C72.9	C73
C74.00	C74.01	C74.02	C74.10	C74.11	C74.12	C74.90	C74.91	C74.92
C75.0	C75.1	C75.2	C75.3	C75.4	C75.5	C75.8	C75.9	C76.0
C76.1	C76.2	C76.3	C76.40	C76.41	C76.42	C76.50	C76.51	C76.52
C76.8	C77.0	C77.1	C77.2	C77.3	C77.4	C77.5	C77.8	C77.9
C78.00	C78.01	C78.02	C78.1	C78.2	C78.30	C78.39	C78.4	C78.5
C78.6	C78.7	C78.80	C78.89	C79.00	C79.01	C79.02	C79.10	C79.11
C79.19	C79.2	C79.31	C79.32	C79.40	C79.49	C79.51	C79.52	C79.60
C79.61	C79.62	C79.70	C79.71	C79.72	C79.81	C79.82	C79.89	C79.9
C7A.00	C7A.010	C7A.011	C7A.012	C7A.019	C7A.020	C7A.021	C7A.022	C7A.023
C7A.024	C7A.025	C7A.026	C7A.029	C7A.090	C7A.091	C7A.092	C7A.093	C7A.094
C7A.095	C7A.096	C7A.098	C7A.1	C7A.8	C7B.00	C7B.01	C7B.02	C7B.03
C7B.04	C7B.09	C7B.1	C7B.8	C80.0	C80.1	C80.2	C81.00	C81.01
C81.02	C81.03	C81.04	C81.05	C81.06	C81.07	C81.08	C81.09	C81.10
C81.11	C81.12	C81.13	C81.14	C81.15	C81.16	C81.17	C81.18	C81.19
C81.20	C81.21	C81.22	C81.23	C81.24	C81.25	C81.26	C81.27	C81.28
C81.29	C81.30	C81.31	C81.32	C81.33	C81.34	C81.35	C81.36	C81.37
C81.38	C81.39	C81.40	C81.41	C81.42	C81.43	C81.44	C81.45	C81.46
C81.47	C81.48	C81.49	C81.70	C81.71	C81.72	C81.73	C81.74	C81.75
C81.76	C81.77	C81.78	C81.79	C81.90	C81.91	C81.92	C81.93	C81.94
C81.95	C81.96	C81.97	C81.98	C81.99	C82.00	C82.01	C82.02	C82.03
C82.04	C82.05	C82.06	C82.07	C82.08	C82.09	C82.10	C82.11	C82.12
C82.13	C82.14	C82.15	C82.16	C82.17	C82.18	C82.19	C82.20	C82.21
C82.22	C82.23	C82.24	C82.25	C82.26	C82.27	C82.28	C82.29	C82.30
C82.31	C82.32	C82.33	C82.34	C82.35	C82.36	C82.37	C82.38	C82.39
C82.40	C82.41	C82.42	C82.43	C82.44	C82.45	C82.46	C82.47	C82.48
C82.49	C82.50	C82.51	C82.52	C82.53	C82.54	C82.55	C82.56	C82.57
C82.58	C82.59	C82.60	C82.61	C82.62	C82.63	C82.64	C82.65	C82.66
C82.67	C82.68	C82.69	C82.80	C82.81	C82.82	C82.83	C82.84	C82.85
C82.86	C82.87	C82.88	C82.89	C82.90	C82.91	C82.92	C82.93	C82.94

C82.95	C82.96	C82.97	C82.98	C82.99	C83.00	C83.01	C83.02	C83.03
C83.04	C83.05	C83.06	C83.07	C83.08	C83.09	C83.10	C83.11	C83.12
C83.13	C83.14	C83.15	C83.16	C83.17	C83.18	C83.19	C83.30	C83.31
C83.32	C83.33	C83.34	C83.35	C83.36	C83.37	C83.38	C83.39	C83.50
C83.51	C83.52	C83.53	C83.54	C83.55	C83.56	C83.57	C83.58	C83.59
C83.70	C83.71	C83.72	C83.73	C83.74	C83.75	C83.76	C83.77	C83.78
C83.79	C83.80	C83.81	C83.82	C83.83	C83.84	C83.85	C83.86	C83.87
C83.88	C83.89	C83.90	C83.91	C83.92	C83.93	C83.94	C83.95	C83.96
C83.97	C83.98	C83.99	C84.00	C84.01	C84.02	C84.03	C84.04	C84.05
C84.06	C84.07	C84.08	C84.09	C84.10	C84.11	C84.12	C84.13	C84.14
C84.15	C84.16	C84.17	C84.18	C84.19	C84.40	C84.41	C84.42	C84.43
C84.44	C84.45	C84.46	C84.47	C84.48	C84.49	C84.60	C84.61	C84.62
C84.63	C84.64	C84.65	C84.66	C84.67	C84.68	C84.69	C84.70	C84.71
C84.72	C84.73	C84.74	C84.75	C84.76	C84.77	C84.78	C84.79	C84.90
C84.91	C84.92	C84.93	C84.94	C84.95	C84.96	C84.97	C84.98	C84.99
C84.A0	C84.A1	C84.A2	C84.A3	C84.A4	C84.A5	C84.A6	C84.A7	C84.A8
C84.A9	C84.Z0	C84.Z1	C84.Z2	C84.Z3	C84.Z4	C84.Z5	C84.Z6	C84.Z7
C84.Z8	C84.Z9	C85.10	C85.11	C85.12	C85.13	C85.14	C85.15	C85.16
C85.17	C85.18	C85.19	C85.20	C85.21	C85.22	C85.23	C85.24	C85.25
C85.26	C85.27	C85.28	C85.29	C85.80	C85.81	C85.82	C85.83	C85.84
C85.85	C85.86	C85.87	C85.88	C85.89	C85.90	C85.91	C85.92	C85.93
C85.94	C85.95	C85.96	C85.97	C85.98	C85.99	C86.0	C86.1	C86.2
C86.3	C86.4	C86.5	C86.6	C88.0	C88.2	C88.3	C88.4	C88.8
C88.9	C90.00	C90.01	C90.02	C90.10	C90.11	C90.12	C90.20	C90.21
C90.22	C90.30	C90.31	C90.32	C91.00	C91.01	C91.02	C91.10	C91.11
C91.12	C91.30	C91.31	C91.32	C91.40	C91.41	C91.42	C91.50	C91.51
C91.52	C91.60	C91.61	C91.62	C91.90	C91.91	C91.92	C91.A0	C91.A1
C91.A2	C91.Z0	C91.Z1	C91.Z2	C92.00	C92.01	C92.02	C92.10	C92.11
C92.12	C92.20	C92.21	C92.22	C92.30	C92.31	C92.32	C92.40	C92.41
C92.42	C92.50	C92.51	C92.52	C92.60	C92.61	C92.62	C92.90	C92.91
C92.92	C92.A0	C92.A1	C92.A2	C92.Z0	C92.Z1	C92.Z2	C93.00	C93.01
C93.02	C93.10	C93.11	C93.12	C93.30	C93.31	C93.32	C93.90	C93.91
C93.92	C93.Z0	C93.Z1	C93.Z2	C94.00	C94.01	C94.02	C94.20	C94.21
C94.22	C94.30	C94.31	C94.32	C94.40	C94.41	C94.42	C94.6	C94.80
C94.81	C94.82	C95.00	C95.01	C95.02	C95.10	C95.11	C95.12	C95.90
C95.91	C95.92	C96.0	C96.2	C96.4	C96.5	C96.6	C96.9	C96.A
C96.Z								

COPD Value Set								
ICD 9 Codes								
493.20	493.21	493.22	496					
ICD 10 Codes								
J44.0	J44.1	J44.9						

Cystic Fibrosis Value Set								
ICD 9 Codes								
277.00	277.01	277.02	277.03	277.09				
ICD 10 Codes								
E84.0	E84.11	E84.19	E84.8	E84.9				

Comorbid Conditions Value Set								
ICD 9 Codes								
010.00	010.01	010.02	010.03	010.04	010.05	010.06	010.10	010.11
010.12	010.13	010.14	010.15	010.16	010.80	010.81	010.82	010.83
010.84	010.85	010.86	010.90	010.91	010.92	010.93	010.94	010.95
010.96	011.00	011.01	011.02	011.03	011.04	011.05	011.06	011.10
011.11	011.12	011.13	011.14	011.15	011.16	011.20	011.21	011.22
011.23	011.24	011.25	011.26	011.30	011.31	011.32	011.33	011.34
011.35	011.36	011.40	011.41	011.42	011.43	011.44	011.45	011.46
011.50	011.51	011.52	011.53	011.54	011.55	011.56	011.60	011.61
011.62	011.63	011.64	011.65	011.66	011.70	011.71	011.72	011.73
011.74	011.75	011.76	011.80	011.81	011.82	011.83	011.84	011.85
011.86	011.90	011.91	011.92	011.93	011.94	011.95	011.96	012.00
012.01	012.02	012.03	012.04	012.05	012.06	012.10	012.11	012.12
012.13	012.14	012.15	012.16	012.20	012.21	012.22	012.23	012.24
012.25	012.26	012.30	012.31	012.32	012.33	012.34	012.35	012.36
012.80	012.81	012.82	012.83	012.84	012.85	012.86	013.00	013.01
013.02	013.03	013.04	013.05	013.06	013.10	013.11	013.12	013.13
013.14	013.15	013.16	013.20	013.21	013.22	013.23	013.24	013.25
013.26	013.30	013.31	013.32	013.33	013.34	013.35	013.36	013.40
013.41	013.42	013.43	013.44	013.45	013.46	013.50	013.51	013.52
013.53	013.54	013.55	013.56	013.60	013.61	013.62	013.63	013.64
013.65	013.66	013.80	013.81	013.82	013.83	013.84	013.85	013.86
013.90	013.91	013.92	013.93	013.94	013.95	013.96	014.00	014.01
014.02	014.03	014.04	014.05	014.06	014.80	014.81	014.82	014.83
014.84	014.85	014.86	015.00	015.01	015.02	015.03	015.04	015.05

015.06	015.10	015.11	015.12	015.13	015.14	015.15	015.16	015.20
015.21	015.22	015.23	015.24	015.25	015.26	015.50	015.51	015.52
015.53	015.54	015.55	015.56	015.60	015.61	015.62	015.63	015.64
015.65	015.66	015.70	015.71	015.72	015.73	015.74	015.75	015.76
015.80	015.81	015.82	015.83	015.84	015.85	015.86	015.90	015.91
015.92	015.93	015.94	015.95	015.96	016.00	016.01	016.02	016.03
016.04	016.05	016.06	016.10	016.11	016.12	016.13	016.14	016.15
016.16	016.20	016.21	016.22	016.23	016.24	016.25	016.26	016.30
016.31	016.32	016.33	016.34	016.35	016.36	016.40	016.41	016.42
016.43	016.44	016.45	016.46	016.50	016.51	016.52	016.53	016.54
016.55	016.56	016.60	016.61	016.62	016.63	016.64	016.65	016.66
016.70	016.71	016.72	016.73	016.74	016.75	016.76	016.90	016.91
016.92	016.93	016.94	016.95	016.96	017.00	017.01	017.02	017.03
017.04	017.05	017.06	017.10	017.11	017.12	017.13	017.14	017.15
017.16	017.20	017.21	017.22	017.23	017.24	017.25	017.26	017.30
017.31	017.32	017.33	017.34	017.35	017.36	017.40	017.41	017.42
017.43	017.44	017.45	017.46	017.50	017.51	017.52	017.53	017.54
017.55	017.56	017.60	017.61	017.62	017.63	017.64	017.65	017.66
017.70	017.71	017.72	017.73	017.74	017.75	017.76	017.80	017.81
017.82	017.83	017.84	017.85	017.86	017.90	017.91	017.92	017.93
017.94	017.95	017.96	018.00	018.01	018.02	018.03	018.04	018.05
018.06	018.80	018.81	018.82	018.83	018.84	018.85	018.86	018.90
018.91	018.92	018.93	018.94	018.95	018.96	279.00	279.01	279.02
279.03	279.04	279.05	279.06	279.09	279.10	279.11	279.12	279.13
279.19	279.2	279.3	279.41	279.49	279.50	279.51	279.52	279.53
279.8	279.9	491.0	491.1	491.20	491.21	491.22	491.8	491.9
494.0	494.1	495.0	495.1	495.2	495.3	495.4	495.5	495.6
495.7	495.8	495.9	500	501	502	503	504	505
506.0	506.1	506.2	506.3	506.4	506.9	507.0	507.1	507.8
508.0	508.1	508.2	508.8	508.9	510.0	510.9	511.0	511.1
511.81	511.89	511.9	512.0	512.1	512.2	512.81	512.82	512.83
512.84	512.89	513.0	513.1	514	515	516.0	516.1	516.2
516.30	516.31	516.32	516.33	516.34	516.35	516.36	516.37	516.4
516.5	516.61	516.62	516.63	516.64	516.69	516.8	516.9	517.1
517.2	517.3	517.8	518.0	518.1	518.2	518.3	518.4	518.51
518.52	518.53	518.6	518.7	518.81	518.82	518.83	518.84	518.89
519.00	519.01	519.02	519.09	519.11	519.19	519.2	519.3	519.4
519.8	519.9							

ICD 10 Codes								
A15.0	A15.4	A15.5	A15.6	A15.7	A15.8	A15.9	A17.0	A17.1
A17.81	A17.82	A17.83	A17.89	A17.9	A18.01	A18.02	A18.03	A18.09
A18.10	A18.11	A18.12	A18.13	A18.14	A18.15	A18.16	A18.17	A18.18
A18.2	A18.31	A18.32	A18.39	A18.4	A18.50	A18.51	A18.52	A18.53
A18.54	A18.59	A18.6	A18.7	A18.81	A18.82	A18.83	A18.84	A18.85
A18.89	A19.0	A19.1	A19.2	A19.8	A19.9	B44.81	D57.01	D57.211
D57.411	D57.811	J22	J41.0	J41.1	J41.8	J42	J47.0	J47.1
J47.9	J60	J61	J62.0	J62.8	J63.0	J63.1	J63.2	J63.3
J63.4	J63.5	J63.6	J64	J65	J66.0	J66.1	J66.2	J66.8
J67.0	J67.1	J67.2	J67.3	J67.4	J67.5	J67.6	J67.7	J67.8
J67.9	J68.0	J68.1	J68.2	J68.3	J68.9	J69.0	J69.1	J69.8
J70.0	J70.1	J70.2	J70.3	J70.4	J70.5	J70.8	J70.9	J80
J81.0	J81.1	J82	J84.01	J84.02	J84.03	J84.09	J84.10	J84.111
J84.112	J84.113	J84.114	J84.115	J84.116	J84.117	J84.17	J84.2	J84.81
J84.82	J84.83	J84.841	J84.842	J84.843	J84.848	J84.89	J84.9	J85.0
J85.1	J85.2	J85.3	J86.0	J86.9	J90	J91.0	J91.8	J92.0
J92.9	J93.0	J93.11	J93.12	J93.81	J93.82	J93.83	J93.9	J94.0
J94.1	J94.2	J94.8	J94.9	J95.00	J95.01	J95.02	J95.03	J95.04
J95.09	J95.1	J95.2	J95.3	J95.4	J95.5	J95.61	J95.62	J95.71
J95.72	J95.811	J95.812	J95.821	J95.822	J95.830	J95.831	J95.84	J95.850
J95.851	J95.859	J95.88	J95.89	J96.00	J96.01	J96.02	J96.10	J96.11
J96.12	J96.20	J96.21	J96.22	J96.90	J96.91	J96.92	J99	M30.1
M32.13	M33.01	M33.11	M33.21	M33.91	M34.81	M35.02	O98.011	O98.012
O98.013	O98.019	O98.02	O98.03					

Pharyngitis Value Set								
ICD 9 Codes								
034.0	462	463						
ICD 10 Codes								
J02.0	J02.8	J02.9	J03.00	J03.01	J03.80	J03.81	J03.90	J03.91

Competing diagnosis Value Set								
ICD 9 Codes								
001.0	001.1	001.9	002.0	002.1	002.2	002.3	002.9	003.0
003.1	003.20	003.21	003.22	003.23	003.24	003.29	003.8	003.9
004.0	004.1	004.2	004.3	004.8	004.9	005.0	005.1	005.2
005.3	005.4	005.81	005.89	005.9	006.0	006.1	006.2	006.3

006.4	006.5	006.6	006.8	006.9	007.0	007.1	007.2	007.3
007.4	007.5	007.8	007.9	008.00	008.01	008.02	008.03	008.04
008.09	008.1	008.2	008.3	008.41	008.42	008.43	008.44	008.45
008.46	008.47	008.49	008.5	008.61	008.62	008.63	008.64	008.65
008.66	008.67	008.69	008.8	009.0	009.1	009.2	009.3	033.0
033.1	033.8	033.9	041.9	078.88	079.88	079.98	088.0	088.81
088.82	088.89	088.9	090.0	090.1	090.2	090.3	090.40	090.41
090.42	090.49	090.5	090.6	090.7	090.9	091.0	091.1	091.2
091.3	091.4	091.50	091.51	091.52	091.61	091.62	091.69	091.7
091.81	091.82	091.89	091.9	092.0	092.9	093.0	093.1	093.20
093.21	093.22	093.23	093.24	093.81	093.82	093.89	093.9	094.0
094.1	094.2	094.3	094.81	094.82	094.83	094.84	094.85	094.86
094.87	094.89	094.9	095.0	095.1	095.2	095.3	095.4	095.5
095.6	095.7	095.8	095.9	096	097.0	097.1	097.9	098.0
098.10	098.11	098.12	098.13	098.14	098.15	098.16	098.17	098.19
098.2	098.30	098.31	098.32	098.33	098.34	098.35	098.36	098.37
098.39	098.40	098.41	098.42	098.43	098.49	098.50	098.51	098.52
098.53	098.59	098.6	098.7	098.81	098.82	098.83	098.84	098.85
098.86	098.89	099.0	099.1	099.2	099.3	099.40	099.41	099.49
099.50	099.51	099.52	099.53	099.54	099.55	099.56	099.59	099.8
099.9	131.00	131.01	131.02	131.03	131.09	131.8	131.9	382.00
382.01	382.02	382.1	382.2	382.3	382.4	382.9	383.00	383.01
383.02	383.1	383.20	383.21	383.22	383.30	383.31	383.32	383.33
383.81	383.89	383.9	461.0	461.1	461.2	461.3	461.8	461.9
464.10	464.11	464.20	464.21	464.30	464.31	473.0	473.1	473.2
473.3	473.8	473.9	474.00	474.01	474.02	474.10	474.11	474.12
474.2	474.8	474.9	478.21	478.22	478.24	478.29	478.71	478.79
478.9	481	482.0	482.1	482.2	482.30	482.31	482.32	482.39
482.40	482.41	482.42	482.49	482.81	482.82	482.83	482.84	482.89
482.9	483.0	483.1	483.8	484.1	484.3	484.5	484.6	484.7
484.8	485	486	590.00	590.01	590.10	590.11	590.2	590.3
590.80	590.81	590.9	595.0	595.1	595.2	595.3	595.4	595.81
595.82	595.89	595.9	599.0	601.0	601.1	601.2	601.3	601.4
601.8	601.9	614.0	614.1	614.2	614.3	614.4	614.5	614.6
614.7	614.8	614.9	615.0	615.1	615.9	616.0	616.10	616.11
616.2	616.3	616.4	616.50	616.51	616.81	616.89	616.9	681.00
681.01	681.02	681.10	681.11	681.9	682.0	682.1	682.2	682.3
682.4	682.5	682.6	682.7	682.8	682.9	683	684	686.00

686.01	686.09	686.1	686.8	686.9	706.0	706.1	730.00	730.01
730.02	730.03	730.04	730.05	730.06	730.07	730.08	730.09	730.10
730.11	730.12	730.13	730.14	730.15	730.16	730.17	730.18	730.19
730.20	730.21	730.22	730.23	730.24	730.25	730.26	730.27	730.28
730.29	730.30	730.31	730.32	730.33	730.34	730.35	730.36	730.37
730.38	730.39	730.70	730.71	730.72	730.73	730.74	730.75	730.76
730.77	730.78	730.79	730.80	730.81	730.82	730.83	730.84	730.85
730.86	730.87	730.88	730.89	730.90	730.91	730.92	730.93	730.94
730.95	730.96	730.97	730.98	730.99	V01.6	V02.7	V02.8	
ICD 10 Codes								
A00.0	A00.1	A00.9	A01.00	A01.01	A01.02	A01.03	A01.04	A01.05
A01.09	A01.1	A01.2	A01.3	A01.4	A02.0	A02.1	A02.20	A02.21
A02.22	A02.23	A02.24	A02.25	A02.29	A02.8	A02.9	A03.0	A03.1
A03.2	A03.3	A03.8	A03.9	A04.0	A04.1	A04.2	A04.3	A04.4
A04.5	A04.6	A04.7	A04.8	A04.9	A05.0	A05.1	A05.2	A05.3
A05.4	A05.5	A05.8	A05.9	A06.0	A06.1	A06.2	A06.3	A06.4
A06.5	A06.6	A06.7	A06.81	A06.82	A06.89	A06.9	A07.0	A07.1
A07.2	A07.3	A07.4	A07.8	A07.9	A08.0	A08.11	A08.19	A08.2
A08.31	A08.32	A08.39	A08.4	A08.8	A09	A37.00	A37.01	A37.10
A37.11	A37.80	A37.81	A37.90	A37.91	A44.0	A44.1	A44.8	A44.9
A49.9	A50.01	A50.02	A50.03	A50.04	A50.05	A50.06	A50.07	A50.08
A50.09	A50.1	A50.2	A50.30	A50.31	A50.32	A50.39	A50.40	A50.41
A50.42	A50.43	A50.44	A50.45	A50.49	A50.51	A50.52	A50.53	A50.54
A50.55	A50.56	A50.57	A50.59	A50.6	A50.7	A50.9	A51.0	A51.1
A51.2	A51.31	A51.32	A51.39	A51.41	A51.42	A51.43	A51.44	A51.45
A51.46	A51.49	A51.5	A51.9	A52.00	A52.01	A52.02	A52.03	A52.04
A52.05	A52.06	A52.09	A52.10	A52.11	A52.12	A52.13	A52.14	A52.15
A52.16	A52.17	A52.19	A52.2	A52.3	A52.71	A52.72	A52.73	A52.74
A52.75	A52.76	A52.77	A52.78	A52.79	A52.8	A52.9	A53.0	A53.9
A54.00	A54.01	A54.02	A54.03	A54.09	A54.1	A54.21	A54.22	A54.23
A54.24	A54.29	A54.30	A54.31	A54.32	A54.33	A54.39	A54.40	A54.41
A54.42	A54.43	A54.49	A54.5	A54.6	A54.81	A54.82	A54.83	A54.84
A54.85	A54.86	A54.89	A54.9	A55	A56.00	A56.01	A56.02	A56.09
A56.11	A56.19	A56.2	A56.3	A56.4	A56.8	A57	A58	A59.00
A59.01	A59.02	A59.03	A59.09	A59.8	A59.9	A63.0	A63.8	A64
A69.0	A69.1	A69.20	A69.21	A69.22	A69.23	A69.29	A69.8	A69.9
B60.0	B60.10	B60.11	B60.12	B60.13	B60.19	B60.2	B60.8	B64
B78.1	B96.89	E83.2	H66.001	H66.002	H66.003	H66.004	H66.005	H66.006

H66.007	H66.009	H66.011	H66.012	H66.013	H66.014	H66.015	H66.016	H66.017
H66.019	H66.10	H66.11	H66.12	H66.13	H66.20	H66.21	H66.22	H66.23
H66.3X1	H66.3X2	H66.3X3	H66.3X9	H66.40	H66.41	H66.42	H66.43	H66.90
H66.91	H66.92	H66.93	H67.1	H67.2	H67.3	H67.9	H70.001	H70.002
H70.003	H70.009	H70.011	H70.012	H70.013	H70.019	H70.091	H70.092	H70.093
H70.099	H70.10	H70.11	H70.12	H70.13	H70.201	H70.202	H70.203	H70.209
H70.211	H70.212	H70.213	H70.219	H70.221	H70.222	H70.223	H70.229	H70.811
H70.812	H70.813	H70.819	H70.891	H70.892	H70.893	H70.899	H70.90	H70.91
H70.92	H70.93	H95.00	H95.01	H95.02	H95.03	H95.111	H95.112	H95.113
H95.119	H95.121	H95.122	H95.123	H95.129	H95.131	H95.132	H95.133	H95.139
H95.191	H95.192	H95.193	H95.199	H95.21	H95.22	H95.31	H95.32	H95.41
H95.42	H95.811	H95.812	H95.813	H95.819	H95.88	H95.89	J01.00	J01.01
J01.10	J01.11	J01.20	J01.21	J01.30	J01.31	J01.40	J01.41	J01.80
J01.81	J01.90	J01.91	J02.0	J02.8	J02.9	J03.00	J03.01	J03.80
J03.81	J03.90	J03.91	J04.10	J04.11	J04.2	J05.0	J05.10	J05.11
J13	J14	J15.0	J15.1	J15.20	J15.211	J15.212	J15.29	J15.3
J15.4	J15.5	J15.6	J15.7	J15.8	J15.9	J16.0	J16.8	J17
J18.0	J18.1	J18.8	J18.9	J20.0	J20.1	J20.2	J32.0	J32.1
J32.2	J32.3	J32.4	J32.8	J32.9	J35.01	J35.02	J35.03	J35.1
J35.2	J35.3	J35.8	J35.9	J38.7	J39.0	J39.1	J39.2	J39.8
J39.9	K12.2	L01.00	L01.01	L01.02	L01.03	L01.09	L01.1	L03.011
L03.012	L03.019	L03.021	L03.022	L03.029	L03.031	L03.032	L03.039	L03.041
L03.042	L03.049	L03.111	L03.112	L03.113	L03.114	L03.115	L03.116	L03.119
L03.121	L03.122	L03.123	L03.124	L03.125	L03.126	L03.129	L03.211	L03.212
L03.221	L03.222	L03.311	L03.312	L03.313	L03.314	L03.315	L03.316	L03.317
L03.319	L03.321	L03.322	L03.323	L03.324	L03.325	L03.326	L03.327	L03.329
L03.811	L03.818	L03.891	L03.898	L03.90	L03.91	L04.0	L04.1	L04.2
L04.3	L04.8	L04.9	L08.1	L08.81	L08.82	L08.89	L08.9	L88
L92.8	L98.0	L98.3	M46.20	M46.21	M46.22	M46.23	M46.24	M46.25
M46.26	M46.27	M46.28	M46.30	M46.31	M46.32	M46.33	M46.34	M46.35
M46.36	M46.37	M46.38	M46.39	M89.00	M89.011	M89.012	M89.019	M89.021
M89.022	M89.029	M89.031	M89.032	M89.039	M89.041	M89.042	M89.049	M89.051
M89.052	M89.059	M89.061	M89.062	M89.069	M89.071	M89.072	M89.079	M89.08
M89.09	M89.121	M89.122	M89.123	M89.124	M89.125	M89.126	M89.127	M89.128
M89.129	M89.131	M89.132	M89.133	M89.134	M89.138	M89.139	M89.151	M89.152
M89.153	M89.154	M89.155	M89.156	M89.157	M89.158	M89.159	M89.160	M89.161
M89.162	M89.163	M89.164	M89.165	M89.166	M89.167	M89.168	M89.169	M89.18
M89.20	M89.211	M89.212	M89.219	M89.221	M89.222	M89.229	M89.231	M89.232

M89.233	M89.234	M89.239	M89.241	M89.242	M89.249	M89.251	M89.252	M89.259
M89.261	M89.262	M89.263	M89.264	M89.269	M89.271	M89.272	M89.279	M89.28
M89.29	M89.30	M89.311	M89.312	M89.319	M89.321	M89.322	M89.329	M89.331
M89.332	M89.333	M89.334	M89.339	M89.341	M89.342	M89.349	M89.351	M89.352
M89.359	M89.361	M89.362	M89.363	M89.364	M89.369	M89.371	M89.372	M89.379
M89.38	M89.39	M89.40	M89.411	M89.412	M89.419	M89.421	M89.422	M89.429
M89.431	M89.432	M89.439	M89.441	M89.442	M89.449	M89.451	M89.452	M89.459
M89.461	M89.462	M89.469	M89.471	M89.472	M89.479	M89.48	M89.49	M89.50
M89.511	M89.512	M89.519	M89.521	M89.522	M89.529	M89.531	M89.532	M89.539
M89.541	M89.542	M89.549	M89.551	M89.552	M89.559	M89.561	M89.562	M89.569
M89.571	M89.572	M89.579	M89.58	M89.59	M89.60	M89.611	M89.612	M89.619
M89.621	M89.622	M89.629	M89.631	M89.632	M89.639	M89.641	M89.642	M89.649
M89.651	M89.652	M89.659	M89.661	M89.662	M89.669	M89.671	M89.672	M89.679
M89.68	M89.69	M89.70	M89.711	M89.712	M89.719	M89.721	M89.722	M89.729
M89.731	M89.732	M89.739	M89.741	M89.742	M89.749	M89.751	M89.752	M89.759
M89.761	M89.762	M89.769	M89.771	M89.772	M89.779	M89.78	M89.79	M89.8X0
M89.8X1	M89.8X2	M89.8X3	M89.8X4	M89.8X5	M89.8X6	M89.8X7	M89.8X8	M89.8X9
M89.9	M90.80	M90.811	M90.812	M90.819	M90.821	M90.822	M90.829	M90.831
M90.832	M90.839	M90.841	M90.842	M90.849	M90.851	M90.852	M90.859	M90.861
M90.862	M90.869	M90.871	M90.872	M90.879	M90.88	M90.89	N10	N11.0
N11.1	N11.8	N11.9	N12	N13.6	N15.1	N16	N28.84	N28.85
N28.86	N30.00	N30.01	N30.10	N30.11	N30.20	N30.21	N30.30	N30.31
N30.40	N30.41	N30.80	N30.81	N30.90	N30.91	N39.0	N41.0	N41.1
N41.2	N41.3	N41.4	N41.8	N41.9	N70.01	N70.02	N70.03	N70.11
N70.12	N70.13	N70.91	N70.92	N70.93	N71.0	N71.1	N71.9	N72
N73.0	N73.1	N73.2	N73.3	N73.4	N73.5	N73.6	N73.8	N73.9
N74	N75.0	N75.1	N75.8	N75.9	N76.0	N76.1	N76.2	N76.3
N76.4	N76.5	N76.6	N76.81	N76.89	N77.0	N77.1	Z20.2	Z22.4

Appendix C: Statistical Output

Table C.1: Missing data output from SAS PROC MI to explore missing data patterns

pt_age	sexn	racen	ethn	insmin	prov_spec	elixs	prov_age	s_cg25	s_cp1	s_cp2	s_cp3	s_cp4	s_cp8	s_n1	s_n2	s_a14	s_v60	s_i60	s_cg26	s_o15	s_o2	s_aco03	s_aco04	Freq	Percent
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	11	0.31
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	7	0.2
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	153	4.3
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	125	3.52
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	44	1.24
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	.	1190	33.46
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	.	1	0.03
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	X	X	6	0.17
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	X	.	2	0.06
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	.	.	41	1.15
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	.	.	5	0.14
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	.	.	4	0.11
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	.	X	1	0.03
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	.	.	.	10	0.28
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	X	X	X	7	0.2
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	X	X	.	4	0.11
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	X	.	.	135	3.8
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	.	X	X	6	0.17
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	.	X	.	4	0.11
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	.	.	.	56	1.57
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	X	.	.	2	0.06
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	X	.	.	.	1	0.03
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	1	0.03
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	.	12	0.34
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	X	.	X	X	3	0.08
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	.	X	2	0.06
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	.	.	21	0.59
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	X	.	.	.	1	0.03
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	X	.	.	.	1	0.03
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	X	.	X	.	10	0.28

```
X X X X X X  X X  X X  X X  X X  X X  .  X  .  X  .  .  X  X    14   0.39
X X X X X X  X X  X X  X X  X X  X X  .  X  .  X  .  .  X  .     3   0.08
X X X X X X  X X  X X  X X  X X  X X  .  X  .  X  .  .  .  .    86   2.42
X X X X X X  X X  X X  X X  X X  X  .  X X X X X  .  X  X    82   2.31
X X X X X X  X X  X X  X X  X X  X  .  X X X X X  .  X  .    22   0.62
X X X X X X  X X  X X  X X  X X  X  .  X X X X X  .  .  .   698  19.63
X X X X X X  X X  X X  X X  X X  X  .  X X X X  .  .  .  .     4   0.11
X X X X X X  X X  X X  X X  X X  X  .  X X X  .  X  .  .  .     2   0.06
X X X X X X  X X  X X  X X  X X  X  .  X X  .  X X  .  X  X     1   0.03
X X X X X X  X X  X X  X X  X X  X  .  X X  .  X X  .  .  .     6   0.17
X X X X X X  X X  X X  X X  X X  X  .  X X  .  .  X  .  .  .     1   0.03
X X X X X X  X X  X X  X X  X X  X  .  X  .  X X X  .  X  X     1   0.03
X X X X X X  X X  X X  X X  X X  X  .  X  .  X X X  .  .  .     1   0.03
X X X X X X  X X  X X  X X  X X  X  .  .  X X X X  .  X  X     2   0.06
X X X X X X  X X  X X  X X  X X  X  .  .  X X X X  .  X  .     1   0.03
X X X X X X  X X  X X  X X  X X  X  .  .  X X X X  .  .  .    17   0.48
X X X X X X  X X  X X  X X  X X  X  .  .  X X  .  X  .  .  .     1   0.03
X X X X X X  X X  X X  X X  X X  X  .  .  X  .  X  .  .  .  .     1   0.03
X X X X X X  X X  X X  X X  X X  X  .  X X X X X X  .  X  X     1   0.03
X X X X X X  X X  X X  X X  X X  X  .  .  X X X X X  .  .  .     1   0.03
X X X X X X  X X  X X  X X  X X  .  X X X X X X X  .  .  .     2   0.06
X X X X X X  X X  X X  X X  X X  .  X X X X X X X  .  .  .     2   0.06
X X X X X X  X X  X X  X X  X X  .  X X X X X  .  X X  .  X X     1   0.03
X X X X X X  X X  X X  X X  X X  .  X X X X X  .  X  .  .  .  .     1   0.03
X X X X X X  X X  X X  X X  X X  .  X X X X X  .  .  X  .  .  .     1   0.03
X X X X X X  X X  X X  X X  X X  .  X X  .  X X X X X  .  .  .     1   0.03
X X X X X X  X X  X X  X X  X X  .  .  X  .  X X  .  .  X  .  .  .    17   0.48
X X X X X X  X X  X X  X X  X X  .  .  X  .  .  .  .  .  X  .  .  .     3   0.08
X X X X X X  X X  X X  X X  X  .  .  X  .  .  .  .  .  X  .  .  .     1   0.03
X X X X X X  X X  X X  X X  X  .  X X X X X X X X X X X  .     1   0.03
X X X X X X  X X  X X  X X  X  .  X X  .  X X  .  X X X  .  .  .     1   0.03
X X X X X X  X X  X X  X  .  X X X X X X X X X  .  .  .  .     1   0.03
X X X X X X  X X  X X  X  .  X X X X X X X X  .  X X X  .  .     1   0.03
X X X X X X  X X  X X  X  .  X X X X  .  X X X X  .  .  .     1   0.03
X X X X X X  X X  X X  X  .  X X X X  .  .  X X X X  .  .  .     1   0.03
X X X X X X  X X  X X  X  .  X  .  .  X  .  X X  .  X  .  .  .  .     1   0.03
X X X X X X  X X  X  .  X X X X X X X X X X  .  .  .  .     2   0.06
X X X X X X  X X  X  .  X X X X X X  .  X  .  X  .  .  .  .     1   0.03
X X X X X X  X X  X  .  X X X X X  .  X X X X X  .  .  .     1   0.03
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X X X X X X  X X  X  .  .  .  .  .  .  .  .  .  .  .  X  .  .  .  .  .   3   0.08
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  X  X  X  .  .     17  0.48
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  X  X  .  X  X    12  0.34
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  X  X  .  X  .     8   0.22
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  X  X  .  .  .    300  8.44
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  X  X  .  .  X  X  1   0.03
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  X  X  .  .  X  .  3   0.08
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  X  .  .  .  .  9   0.25
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  .  X  X  .  X  X  1   0.03
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  .  X  X  .  .  3   0.08
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  .  X  .  .  X  .  1   0.03
X X X X X X  X .  X  X  X  X  X  X  X  X  X  X  .  X  .  .  .  13  0.37
X X X X X X  X .  X  X  X  X  X  X  X  X  X  .  X  X  X  .  .  1   0.03
X X X X X X  X .  X  X  X  X  X  X  X  X  X  .  X  X  X  .  .  5   0.14
X X X X X X  X .  X  X  X  X  X  X  X  X  X  .  X  X  X  .  .  1   0.03
X X X X X X  X .  X  X  X  X  X  X  X  X  X  .  X  .  X  .  .  X  .  2   0.06
X X X X X X  X .  X  X  X  X  X  X  X  X  X  .  X  .  X  .  .  11  0.31
X X X X X X  X .  X  X  X  X  X  X  X  .  X  X  X  X  X  .  X  X  3   0.08
X X X X X X  X .  X  X  X  X  X  X  X  .  X  X  X  X  X  .  X  .  5   0.14
X X X X X X  X .  X  X  X  X  X  X  X  .  X  X  X  X  X  .  .  182 5.12
X X X X X X  X .  X  X  X  X  X  X  X  .  X  X  X  X  .  .  .  1   0.03
X X X X X X  X .  X  X  X  X  X  X  X  .  X  X  X  .  X  .  .  1   0.03
X X X X X X  X .  X  X  X  X  X  X  X  .  X  X  .  X  X  .  X  X  1   0.03
X X X X X X  X .  X  X  X  X  X  X  X  .  X  X  .  X  X  .  X  .  1   0.03
X X X X X X  X .  X  X  X  X  X  X  X  .  X  X  .  X  X  .  .  2   0.06
X X X X X X  X .  X  X  X  X  X  X  X  .  .  X  X  X  X  .  .  2   0.06
X X X X X X  X .  X  X  X  X  X  X  X  .  .  X  .  X  X  .  .  1   0.03
X X X X X X  X .  X  X  X  X  X  X  .  X  X  X  .  X  .  .  .  1   0.03
X X X X X X  X .  X  X  X  X  X  X  .  .  X  X  X  X  X  .  .  1   0.03
X X X X X X  X .  X  X  X  X  X  .  X  X  X  X  X  X  X  .  X  X  1   0.03
X X X X X X  X .  X  X  X  X  X  .  X  .  X  X  X  X  X  .  .  1   0.03
X X X X X X  X .  X  X  X  X  .  X  X  X  X  X  X  X  .  .  .  1   0.03
X X X X X X  X .  X  X  X  X  .  X  X  X  .  X  .  X  .  .  .  1   0.03
X X X X X X  X .  X  X  X  X  .  .  X  .  X  X  .  .  X  .  .  12  0.34
X X X X X X  X .  X  X  X  .  X  X  X  X  X  X  X  X  .  .  .  1   0.03
X X X X X X  X .  X  X  X  .  X  X  X  .  X  X  X  X  X  .  .  2   0.06
X X X X X X  X .  X  X  .  X  X  X  X  X  X  X  X  X  .  .  .  2   0.06
X X X X X X  X .  X  .  .  .  .  .  .  .  .  .  X  .  .  .  .  2   0.06
X X X X X X  X .  X  .  .  .  .  .  .  .  .  .  .  .  .  .  .  1   0.03
```

X	X	X	X	X	.	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	.	5	0.14
X	X	X	X	X	.	X	.	X	X	X	X	X	X	X	.	X	X	X	X	X	.	.	.	2	0.06
X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	1	0.03
X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	2	0.06
X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	.	29	0.82
X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	.	1	0.03
X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	X	.	.	2	0.06
X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	.	.	.	1	0.03
X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	.	X	X	1	0.03
X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	.	.	.	20	0.56
X	X	X	X	.	X	X	X	X	X	X	X	X	X	X	.	.	X	X	X	X	.	.	.	1	0.03
X	X	X	X	.	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	1	0.03
X	X	X	X	.	X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	.	6	0.17
X	X	X	X	.	X	X	.	X	X	X	X	X	X	X	X	X	.	X	.	.	.	.	.	1	0.03
X	X	X	X	.	X	X	.	X	X	X	X	X	X	X	.	X	X	X	X	X	.	X	X	1	0.03
X	X	X	X	.	X	X	.	X	X	X	X	X	X	X	.	X	X	X	X	X	.	X	.	1	0.03
X	X	X	X	.	X	X	.	X	X	X	X	X	X	X	.	X	X	X	X	X	.	.	.	10	0.28
X	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	.	1	0.03
X	.	.	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	.	1	0.03
X	.	.	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	.	.	.	1	0.03
X	.	.	.	X	X	X	X	X	X	X	X	X	X	X	.	X	X	X	X	X	.	X	X	1	0.03

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