Medstat Disease Staging™ Software

Version 5.22

Reference Guide

November 2004

DISEASE STAGING

DISEASE STAGING CLINICAL CRITERIA

> A disease can be effectively treated only when I as a doctor understand its causes in that particular patient, its site of origin, the internal havoc it creates, and the course which the process is likely to take whether treated or not. With that knowledge, I can make a diagnosis, prescribe a program of treatment, and predict an outcome.[1]

Where? Why? How serious? These are the basic questions that a clinician must attempt to answer when a patient presents with a medical problem. The same questions must be answered to make appropriate comparisons in studies of outcomes, quality, or costs of care. The "where" is the specific organ or system of the body; the "why" is the etiology of the problem; and the "how serious" is the pathophysiologic changes that have occurred and the ranking of the disease's complications.

Physicians use information from a patient's history, physical examination, laboratory findings, and other diagnostic tests to answer these questions in order to diagnose a disease, to estimate the patient's prognosis, and to prescribe appropriate treatment. Ideally, answers should be available before therapeutic intervention. Even in those cases when definitive answers may not be available and treatment must be given, it should be based on the presumptive answers to these questions.

Disease Staging is a classification system that uses diagnostic findings to produce clusters of patients who require similar treatment and have similar expected outcomes. It can serve as the basis for clustering of clinically homogeneous patients to assess quality of care, analyze clinical outcomes, review utilization of resources, assess efficacy of alternative treatments, and assign credentials for hospital privileges.

Ideally, a diagnostic label should have explicit data about the location of the health problem, the cause of the problem, and the severity of the problem. The majority of diagnostic labels identify the site of the disease (e.g., appendicitis, cholecystitis, diverticulitis, and peptic ulcer). Some provide information about the system involved and cause of the problem (e.g., pneumococcal pneumonia and urinary tract infection caused by E. coli). Other diagnostic labels are manifestations of problems (e.g., hypertension and anemia). A few, because of the body system involved, also convey a degree of severity (e.g., myocardial infarction or bacterial meningitis). And some may even be distinguished by the time of onset (e.g., congenital toxoplasmosis).

Only in the discipline of cancer has the medical profession developed a diagnostic classification that includes severity based on the understanding of the need to measure the efficacy of various treatments for similar clusters of patients. Now that society is challenging the medical profession to document quality of

care in a more objective manner, similar measurement instruments are needed for all medical problems.

DISEASE STAGING CRITERIA

The Disease Staging criteria define levels of biological severity for specific medical diseases, where severity is defined as the risk of organ failure or death. The classification is based on the severity of the pathophysiologic manifestations of the disease:

Stage 1	A disease with no complications
Stage 2	The disease has local complications
Stage 3	The disease involves multiple sites, or has systemic complications
Stage 4	Death

Subdivisions of these stage levels have been defined to allow more precise classification. The challenge is to include enough detail to allow for a rich description of each disease and yet not be so overwhelmingly complete that the staging is cumbersome.

In the definition of the Staging criteria, most of the diseases begin at Stage 1 and continue through Stage 4. There are several exceptions to this rule. Some self-limiting diseases, such as cataracts, do not include a Stage 3 or 4. Other criteria begin at either Stage 2 or 3 since they are often complications of other diseases (e.g., bacterial meningitis, which can be a complication of sinusitis, otitis media, or bacterial pneumonia). Stage 0 has also been included in the classification of diseases for patients with a history of a significant predisposing risk factor for the disease, but for whom there is currently no pathology (e.g., history of carcinoma or a newborn baby born to a mother suspected of having an infection at the time of delivery).

The Stage levels are ordinal in nature for each medical problem. Stage 1 of one disease may have different implications for resource use, treatment, and prognosis than a similar stage of another disease. For example, hyperglycemia (Stage 1 diabetes mellitus) is different than positive serological evidence of AIDS (Stage 1). Even when major pathophysiologic damage exists such as coma, which in all diseases is a Stage 3 complication, the prognosis may be different for each disease since for some there is treatment which may reverse the complication. Treatment, whether medical or surgical, has not, however, been introduced into the staging classification; staging is driven by the natural history of the disease. Nor has quality of life been taken into consideration in Disease Staging. Controlling for other factors (e.g., choice of treatment, age, and presence of co-morbid disease), risk of death is a function of etiology and stage of disease. While this risk generally increases with each higher Stage level, it may vary dramatically by Stage from one disease to another.

It is important to distinguish the etiology of a disease whenever possible. For example, "pneumonia" does not specify etiology. Designating that the pneumonia was bacterial in origin would be an improvement, (e.g., "bacterial pneumonia"), but optimally a physician should document the specific bacteria causing the pneumonia (e.g., pneumococcal pneumonia).

Health problems, such as congestive heart failure, and laboratory findings, such as anemia, that may result from a variety of causes, are not diagnoses. When such problems are recorded as the only evidence and stated as the patient's "diagnosis," the implication is that the physician did not know, or did not document, the disease process that produced the problem. Unfortunately, many users of medical information fail to distinguish between non-specific health problems (e.g., symptoms and laboratory findings) and diagnoses of specific diseases. As a result, patients may be inappropriately classified for the purposes of reimbursement, for the analysis of resource utilization, and for the assessment of quality of care.

For each Staging criteria set included in this volume, the most likely etiology is specified. Some diseases may have multiple etiologies (e.g., bacterial pneumonia). While the Staging classification is essentially the same for pneumonia due to Pneumococcus as it is for that due to Staphylococcus or Pseudomonas, each type of bacterial pneumonia should be analyzed separately when evaluating quality of care, clinical trials, and utilization of resources because of the varying prognosis associated with each.

There are a number of complications (for example, sepsis and congestive heart failure) that may result from many diseases. Generally, these complications have been assigned the same integer stage level across the different diseases, although not necessarily the same substage level. Different integer stage levels have been used when the complication may indicate different levels of severity depending upon the underlying disease. For example, pneumonia is classified as a Stage 2 complication when it occurs secondary to other problems. There are a few diseases, such as botulism, where aspiration pneumonia or bacterial pneumonia is a reflection of the systemic nature of the problem rather than just the involvement of the respiratory system. For these diseases, pneumonia is classified as a Stage 3 complication.

DIAGNOSTIC FINDINGS

In addition to the stages of the disease, each criteria set includes a specification of “diagnostic findings” that can be used to validate the presence of the disease and stage level. The diagnostic findings include physical findings, radiological and laboratory results, and pathological and operative reports.2

The present edition has addressed the validation issue more comprehensively than previous editions. Only the information that specifically documents a complication is included, with the understanding that physicians should first gather data from the history and physical examination to state a hypothesis (presumptive diagnosis) and use the laboratory judiciously to validate the diagnosis. Which laboratory data are collected will depend on available facilities and cost-benefits for the patients. For some diagnoses, both the patient and physician can accept uncertainty. However, if major treatment decisions are to be made, validation using objective data is essential. For instance, patients should not be treated for cancer on a presumptive diagnosis.

For some diagnostic testing (e.g., the use of the glucose tolerance test or fasting blood sugar for the diagnosis of diabetes mellitus), criteria have been recommended that are accepted by the medical community. Many laboratory tests, however, do not have nationally accepted values to delineate normal and abnormal results. In these situations, laboratory results have been defined as abnormal when they exceed three standard deviations from the mean value.3, 4

In summary, the physician's clinical judgment based on the history and physical examination should be used along with laboratory data to confirm or rule out the presence of a particular problem. In addition, laboratory values may need to be adjusted based on the calibration of the laboratory performing the test.

APPLICATIONS OF DISEASE STAGING

Disease Staging is a valuable tool in many clinical, research, management, and educational studies. Examples of how Disease Staging has been used to classify patients for a number of applications are highlighted below.

TIMING OF HOSPITALIZATION 5-8

Disease Staging may be used to document potential quality of care problems in ambulatory settings by providing data relating to patients' severity of illness at the time of hospitalization. Patients admitted to the hospital with advanced stages of illness represent possible failures of outpatient care. For example, an admission for cellulitis secondary to diabetes mellitus might have been preventable if the disease progression could have been averted with appropriate outpatient care.

For some diseases, such as appendicitis, hospitalization is clearly appropriate at the earliest stage of the disease. Other diseases, such as essential hypertension, rarely require hospitalization at the early stages; hospitalization is only required if the disease progresses to more advanced stages.

Because admitting patients to an acute care hospital involves incurring significant cost and potential risk, patients should be admitted to the hospital only if the expected benefits outweigh the costs and risks of the admission. Questions to address include:

Is inpatient diagnostic testing required? Do the symptoms suggest a serious illness which, if confirmed, may require immediate treatment? Does the patient require treatment that is most appropriately provided as an inpatient? Does the patient require the types of monitoring and nursing care available only in an acute care hospital?

Classification of severity of illness at the time of hospitalization is important for analysis of both inpatient and outpatient care. Comparisons of inpatient care outcomes can be accomplished only if one adjusts for patient risk at time of admission.

For patients admitted at earlier stages of illness, one may question whether an acceptable level of care could have been provided in an outpatient setting. A number of factors could make such an earlier stage admission appropriate. For example, a patient with acute symptoms (e.g., chest pain), but without a confirmed diagnosis, may be appropriately admitted to the hospital until a diagnosis and a decision can be made as to whether further inpatient care is necessary. A patient may have other co-morbid conditions (for example, poorly controlled diabetes mellitus) that make the admission advisable, or a patient may choose to undergo an elective surgical procedure that must be performed as an inpatient. A patient with osteoarthritis of the hip who decides to have a total hip replacement would clearly require hospitalization.

For patients hospitalized at more advanced stages, the issue is whether the patient has complications that could have been preventable with earlier inpatient care. For example, a patient admitted with acute cholecystitis and gangrene of

the gallbladder has a serious complication that may have been prevented with earlier hospitalization and treatment.

Timeliness of admission is, in part, a function of whether hospitalization is the first or subsequent admission for a particular complication of episode of care. For example, a first admission at advanced-stage cancer should raise questions about whether earlier detection was feasible. Subsequent scheduled admissions for the same patient to undergo chemotherapy would not, of course, raise the same question.

It is important to differentiate the concept of a timely admission from a preventable admission. For example, an admission at Stage 1 appendicitis is timely and, given current medical knowledge, not preventable. Such an admission does not raise issues of appropriateness of care. On the other hand, while an admission for Stage 2.5 diabetes mellitus and cellulitis is also timely, it may have been a preventable admission if the disease progression could have been averted with appropriate outpatient care.

CASE-MIX CLASSIFICATION FOR ANALYSIS OF RESOURCE UTILIZATION AND REIMBURSEMENT [9-19]

Disease Staging should be an integral part of systems designed to analyze resource utilization. Differences in length of stay and cost may result from differences in patient populations treated, as well as from differences in efficiency. Etiology and stage of disease are directly related to the use of resources and must be considered in these types of analyses, whether the focus is at the level of an individual physician, a hospital product line, or an entire institution.

In addition to the stage of the principal disease, other variables to be included in analysis of utilization include: presence of co-morbid, or co-existing, medical problems (e.g., presence of diabetes mellitus in a patient hospitalized for appendicitis – both the diabetes mellitus and appendicitis should be staged); reason for admission (e.g., for diagnostic purposes, therapeutic purposes, both diagnosis and therapy, chemotherapy, or observation); and the use of surgical procedures or special units (e.g., ICU, CCU), if such use is justified by the needs of the patient.

Use of resources depends on the clinical status of the patient, the reason for admission, and whether the latter is the first or one of many re-admissions. For instance, a woman with Stage 3 cancer of the breast will consume more resources during the first hospitalization, when more diagnostic and therapeutic interventions will be used, than on her third hospitalization, when for the same problem she may likely receive only chemotherapy or radiation therapy. In addition, the social support needs of the patient should be considered, although this variable would have a greater impact on timing of hospitalization and length of stay than on the diagnostic or therapeutic intervention.

By using Disease Staging, variations in resource use resulting from patient differences can be controlled, thereby allowing the manager or researcher to appropriately focus on the analysis of differences resulting from variation in physician and institutional practices. For similar reasons, reimbursement systems should be modified to account for differences in severity of illness.

QUALITY OF CARE ASSESSMENT [5, 20-30]

Whether the goal is assessment and improvement of the process of care or evaluation of clinical outcomes, there is a need for clinical specificity. The Centers for Medicare and Medicaid Services (CMS) and several statewide data organizations publish institution-specific, and in some cases physician-specific, information on outcome measures such as mortality. Without appropriate ways to account for differences in the severity of the patient mix treated, the relevance of these types of analyses is questionable. For example, analysis of data from the National Hospital Discharge Survey demonstrated a 5.6% mortality rate for patients hospitalized with Stage 1 bacterial pneumonia, 9.5% for those with Stage 2, and a 33.1% mortality rate for Stage 3.29 These estimates were further refined by considering the specific etiology (organism) of the pneumonia.

As a part of a quality improvement program, these types of advanced-stage admissions should be reviewed to evaluate whether they resulted from physician-related problems (e.g., delayed or incorrect diagnosis or treatment), patient-related problems (e.g., failure to seek timely care or comply with prescribed treatment), system problems (e.g., lack of access to care), or were not preventable (e.g., resulting from rapid disease progression in a particular patient).

Disease Staging can also be used as a direct measure of patient outcomes by studying changes in disease stage over time. For instance, severity at hospital admission can be compared with severity at discharge. Patient-based longitudinal data can be used in conjunction with Disease Staging to assess changes in severity of illness for defined populations and specific episodes of care.

Another valuable use of Disease Staging is the evaluation of processes as well as outcomes of medical care. A great deal of activity is currently being devoted to the development of clinical guidelines designed to reduce uncertainty and help guide the process of care. One of the difficulties faced in guidelines development is that the appropriateness of a specific diagnostic test or prescribed treatment varies by stage of disease. By defining stage-specific criteria, it is possible to improve the specificity of clinical guidelines and process review criteria and to make them more useful and acceptable to clinicians.

CLINICAL TRIALS 29

The primary objective of clinical trials is to test the efficacy of therapeutic interventions under highly controlled conditions. By using Disease Staging to help specify the study population, comparability of the treatment and control groups can be assessed. Staging allows the investigator to stratify patients more accurately, both for their principal diagnoses or problems and for any co-morbid conditions that they may have. Depending on the goals of the trial, it can be restricted to samples defined using specific stages of disease or designed to allow the assessment of efficacy across different levels of severity.

PROFESSIONAL STAFFING AND FACILITY PLANNING IN HEALTH CARE INSTITUTIONS [9-11, 31]

Severity of illness, as documented by Disease Staging, may be used to evaluate the appropriateness of current or planned staffing levels within hospitals or managed care institutions in relationship to patients' health care needs. Staging can provide severity-level data for specific patient groups that may justify

establishing or expanding special care units or securing special diagnostic equipment or other facilities.

SPECIALTY BOARD CERTIFICATION AND CLINICAL PRIVILEGES [32-34]

A major responsibility of medical specialty boards is the development and administration of procedures and examinations for board certification and recertification. Disease Staging has been used to classify the content of test items from the board certification/recertification examinations administered by the American Board of Family Practice32 and to analyze medical licensing examinations in Japan.33 Each item on the examination is classified by organ system, etiology, and stage of illness, along with other dimensions such as age group affected and whether the item focuses on diagnosis or management.

Use of this type of classification enables the specialty board to assess the current mix of items and begin to develop a "blueprint" to guide development of future examinations. For example, by using Disease Staging, one can refine the assessment of the physician's knowledge of diabetes mellitus management to assure that there is an appropriate mixture of items relevant to the early stages, as well as prevention and management of specific advanced-stage complications.

Disease Staging can be used in the assignment of hospital clinical privileges.34 Currently, the delineation of clinical privileges is primarily procedure-oriented, even in the medically-oriented specialties. For example, a general internist may be credentialed to perform procedures such as arterial puncture, thoracentesis, and lumbar puncture. However, the skills necessary to successfully perform an arterial puncture say very little about the physician's ability to diagnose or manage the complex patient with advanced-stage medical problems.

Disease Staging can be used to delineate disease-specific privileges that more appropriately reflect the clinical challenges of patient management. For example, a board certified general internist may have the appropriate education and experience to manage early stage diabetes mellitus, but not to manage a patient admitted for hyperosmolar coma. Potentially, the volume and outcomes of stage-specific experience could also be monitored, as is increasingly done for surgical volume and outcomes, to reassess the privileges assignment.

MEDICAL EDUCATION [35, 36, 37]

A significant part of both undergraduate and graduate medical education involves increasing levels of patient care responsibility as the experience of the student/physician increases. Disease Staging can be used as a part of systems designed to document these clinical experiences. For example, what is the mix of severity of illness of patients with diabetes mellitus seen by medical students? Does the student have adequate experience managing a patient with this disease to avoid, as well as in treating complications which may occur? Does this vary depending on the site where the students perform their clerkship? Is there significant variation from student to student?

Similarly, Disease Staging concepts can be used to evaluate the content of the curriculum. To what extent does the medical curriculum address Stage 1 illness and to what extent does it address Stage 3 illness? To what extent is attention devoted to problems associated with particular body organ systems or to problems of a particular etiological nature?

Use of Disease Staging can also help the student and resident become more effective diagnosticians. By understanding the evolution of a disease, the physician will use the laboratory more effectively and avoid delay in arriving at an accurate diagnosis.

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DISEASE STAGING CODED STAGING CRITERIA

The medical criteria can be applied on a manual basis to medical records to analyze diseases of patients within an institution or within a selected disease category. While this requires only a few minutes per patient, and may be acceptable for physicians in recording diagnoses on patient charts, it is too time-consuming and costly for use in large-scale research projects and utilization reviews. A computerized version of Disease Staging is required to facilitate analyses of large numbers of hospitalized patients.

A team of medical records professionals is employed to translate each stage and substage definition into diagnostic codes. Operationally, a procedure similar to that used for the medical (clinical) criteria is used for the coding process. Each medical staging criteria set is coded independently and then reviewed by a clinical data specialist to resolve discrepancies. When necessary, physician panel members are consulted to assist in making the final decision.

Two types of problems are addressed in translating the medical criteria into coded criteria: the specificity in the coding systems themselves and the availability of certain data on a typical discharge abstract. Code specificity can be a problem because coding systems do not always allow for the precision specified by the clinical criteria within substages. For example, the medical criteria for external hernia classify “irreducible external hernia and intestinal obstruction” as Stage 2.01 and “strangulated external hernia” as Stage 2.02. However, it is not possible to differentiate between obstruction and strangulation in the ICD-9-CM coding system.

This problem is resolved via a conservative strategy to understate stage of disease. For example, a patient with the diagnostic codes of femoral or ventral hernia with obstruction is classified as Stage 2.01 since it is unknown whether the hernia resulted in obstruction or strangulation. Of course, if this patient had other complications of an external hernia, such as septicemia, then the patient would be classified at the appropriate higher stage.

Detailed refinements were also necessary when translating the criteria to ICD-9-CM and ICD-10 diagnosis codes because of a lack of data (primarily physical findings, laboratory results and diagnostic imaging) in most discharge abstract data systems. It is not possible to specify a stage (or substage) that is defined solely on laboratory results by use of discharge abstract data. For example, the stages of aplastic anemia are defined in terms of hemoglobin levels, white blood cell counts, and platelet counts. Again, the coded criteria will understate the severity of the disease if the supporting evidence is not represented by a unique diagnosis code.

THE DISEASE STAGING SOFTWARE

Once the Staging criteria are coded, a software package is developed for assigning disease categories and stages to the diagnosis codes found on medical record abstracts or hospital insurance claim records. Every diagnosis code on the patient record is assigned a disease category and is staged. The staging algorithms are designed to be exhaustive so that the input of patient diagnosis code data always results in at least one disease category being defined. If additional diagnoses are included on the record, the patient may be assigned multiple disease categories.

Once each diagnosis has been staged, a Principal Disease Category (PDXCAT) and a Principal Stage value are assigned. There is only one PDXCAT for each

admission, and it is based on the principal diagnosis that appears on the inpatient record. A secondary diagnosis may be a complication of the PDXCAT. For example, when diabetes mellitus is present as the principal diagnosis and both retinopathy and neuropathy are secondary diagnoses, the latter are considered manifestations or complications of diabetes and are used by the software logic in establishing the stage for diabetes.

All the additional DXCATs that will appear on the record use secondary diagnoses to establish the DXCAT and are unrelated to the PDXCAT and to each other. A secondary diagnosis and associated DXCAT will fall into one of the following categories:

Unrelated Comorbidity - A secondary diagnosis that is not associated with the PDXCAT or other DXCATs is an unrelated comorbidity.

Symptoms - In many cases, codes for symptoms appear in the patient record in addition to the codes for disease. This type of combination is exemplified by a secondary diagnosis code for abdominal pain for which the principal diagnosis is appendicitis.

PATIENT LEVEL SEVERITY METHODOLOGY

Disease specificity has always been a key strength of Disease Staging. However, this characteristic also makes it difficult to quantify patient-level severity of illness especially if a patient has multiple diseases. Disease Stages are expressed as ordinal levels that cannot simply be averaged across diseases to describe a patient's overall severity of illness. Consequently, The MEDSTAT Group developed a number of patient level measures, or predictive scales, that combine the information about a patient's diseases and their severity and correlate this information with outcome measures.

RESOURCE SCALES

The MEDSTAT Group has developed separate predictive scales for hospital charges (resource demand) and length of stay (LOS). The reason for this is that while charge and LOS are highly correlated, they do not correlate in a linear fashion. While the shortening of length of stay has allowed many hospitals to lower their average charges, the decrease in length of stay does not correspond to a proportional decrease in charges. Many studies have demonstrated that treatment intensity is usually highest early in the hospital stay. Total charges therefore tend to decrease at a slower rate than the average LOS. For example, for certain diseases, such as cancers, the cost of treatment may decrease with severity because of the futility of any further active intervention, while at the same time the mortality rate goes up for each stage and substage.

To derive the various scales, The MEDSTAT Group conducts empirical analyses on a database containing approximately 15 million patient records. The predictions were derived from multiple regression models. An algorithm for combining multiple DXCATs to derive a single measure for the affect of comorbidities was developed and is applied.

For the Charge and LOS scales, regressions are run for each DRG and DXCAT combination separately. The independent variables consist of variables whose values tended to correlate with patient severity. Such variables include the

patient's DXCAT and stage, age, sex, comorbid conditions, and whether the patient was an emergency admission.

TOTAL RESOURCE DEMAND SCALE RDSCALE

The Overall Resource Demand Scale (RDSCALE) is a measure of resource consumption scaled to average 100 across all patients (regardless of DRG) in the development database. That is, RDSCALE is a patient's predicted charge as a percent of the average of predicted charges taken over all cases in the development database.

WITHIN DRG RESOURCE DEMAND SCALE - DRGSACLE

The DRG Resource Demand Scale (DRGSCALE) is a within-DRG measure of resource consumption scaled to average 100 in each DRG. That is, DRGSCALE is a patient's predicted charges as a percent of the average of predicted charges taken over all cases in that DRG. Thus, a DRGSCALE value of 120 indicates that a patient is expected to have a 20 percent greater average resource consumption than the average for patients in that DRG. It is important to keep in mind that an individual patient's actual resource utilization will likely vary from predicted resource utilization. As a result, DRGSCALE has greater precision as a predictor of average resource utilization for a group of patients than as a predictor for a single patient.

LENGTH OF STAY SCALE - LOSSCALE

The Length of Stay Scale (LOSSCALE) is an overall measure of likely length of stay scaled to average 100 across all patients, regardless of DRG, in the development database. Like RDSCALE, it represents a patient's predicted length of stay. It is described as a percent of the average length of stay in the development database.

LOS AND CHARGE LEVELS

A great deal of interest surrounds the predicted scales for individual patients. However, the variation in the prediction at the patient level is extremely high and for this reason drawing any conclusions at this level is extremely difficult. The reliability of the estimates improves as the predictions are aggregated into ranges.

To meet the interests of those desiring patient level statistics, LOS and RD and DRG Levels were devised and are included in the software output. The levels are explained in Table 3 below.

Table 3
Disease Staging Software
Patient Level
LOS, RD AND DRG Scale Definitions

LEVEL	PERCENTILES
+	> 95
High	75 - 95

Medium	25 - 75
Low	5 - 25
-	< 5

MORTALITY SCALE

The MEDSTAT Group's mortality scale was produced from the same development database described above. The first step in the process was accomplished by segregating surgical and medical DRGs. This is necessary as surgical procedures are an important predictor of in-hospital mortality.

The occurrence of an in-hospital death is an infrequent event. As a result reliable regression models could not be developed for all DRGs and/or DXCATs. As a result, the medical and surgical discharge groups were further divided on whether there were a sufficient number of discharges to run regressions. The data and expected mortality rates were calculated within the classes described below:

Class 1 - Medical Admissions – observed rates of death are calculated at the DXCAT and integer stage level where there were fewer than 300 discharges for a DXCAT. The observed death rates are used in the calculation of the mortality scale values for these DXCATs.

Class 2 – Medical Admissions – Prediction models analogous to the LOS and Charge models is developed where there were 300 or more discharges for a DXCAT:

Class 4 – Surgical Admissions – Observed rates are calculated at the DRG/DXCAT and integer stage level where there were fewer than 300 discharges for a DXCAT and used in the calculation of the mortality.

Class 5 – Surgical Admissions – Prediction models analogous to the LOS and Charge models are developed where there were 300 or more discharges for a DXCAT. The form of the models described for Class 2 were employed for this group of calculations with the difference being that the predictions were made at both the DRG and DXCAT level.

The Mortality Scale is calculated by dividing the predicted mortality, obtained from one of the four classes described above, by the overall rate of in-hospital mortality from the development database times 100.

MORTALITY LEVELS

Mortality levels are output for patients using the ranges and designations described for the LOS and Charge Levels (see Table 3). (Expected mortality of = .001 is considered near zero and not included in the calculation of the levels. The vast majority of the discharges in this group are normal deliveries.)

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COMPLICATIONS OF CARE

INTRODUCTION

The MEDSTAT Complications of Care (COC) methodology was first introduced in the early 1990s. It was designed as a screening tool to identify, from inpatient administrative data, records that have a high probability of detecting a complication of care in the patient hospital medical record. Then, as today, the identification of a claim record containing a potential complication did not necessarily indicate that a medical error had occurred.

In 2000, peer reviewed studies published in the 1990s were examined and compared to the COC Version 2.2 methodology. It was gratifying to find that a significant number of the original MEDSTAT COCs were validated, in whole or in part, by this independent research. Based on these studies, modifications to the design of the methodology and the software programs were made and implemented with the release of the Disease Staging version 4.10 software.

In 2001, COC v3.1 was released offering users the capability of excluding diagnoses that present at admission of the patient from use in the screening of potential complications. This functionality dramatically reduces the number of false-positive complications flagged by the software enabling users to more productively focus their efforts on the medical record reviews in the examination of medical errors.

The COC methodology is a powerful tool for in-hospital quality management activities. The computerized screening of administrative records for complications of medical care is a far more efficient means of identifying medical errors than the review of individual patient charts. It is not intended to be a complete and exhaustive list of hospital-based complications of care but a tool that identifies common potential complications from administrative data sources.

ENVIRONMENT AND FOCUS

The study of complications of care moved from the sole domain of health care professionals into the public forum in the 1990s. Interest piqued in 1999 with a report issued by the National Institute of Medicine*, To Error is Human: Building a Safer Health System*.[1] The report recommended a national focus on medical errors. Highlights of the report include:

> "Errors occur in all industries. To date…those involved in health care management and delivery have not had specific, clear, high-level incentives to apply what has been learned in other industries about the way to prevent error and reduce harm."2
>
> "Health care is decades behind other industries in terms of creating safer systems. Much of modern safety thinking grew out of military aviation [during World War II]. In the mid-1960s, the University of Southern California began its first advanced safety management programs…. By the 1970s, principles of system safety began to spread to other industries, including rapid rail and the oil industry."3

> "Preventable adverse events are the leading cause of death in the United States. …[A] t least 44,000 and perhaps as many as 98,000 Americans die in hospitals each year as a result of medical errors."4
>
> "Two studies of large samples of hospital admissions, one in New York using 1984 data and another in Colorado and Utah using 1992 data, found that the proportion of hospital admissions experiencing an adverse event, defined as injuries caused by medical management, were 3.7 and 2.9 percent, respectively. The proportion of adverse events that were attributable to errors (i.e., preventable adverse events) was 58 percent in New York, and 53 percent in Colorado and Utah."5
>
> "Total national costs (lost income, lost household production, disability, health care costs) are estimated to be between $37.6 billion and $50 billion for adverse events and between $17 billion and $29 billion for preventable adverse events."6
>
> "In terms of lives lost, patient safety is as important an issue as worker safety. Although more than 6,000 Americans die from workplace injuries every year, in 1993 medication errors are estimated to have accounted for about 7,000 deaths."7

The interest in patient safety is more than academic and is manifest in a number of real world reporting initiatives:

> The Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) found that at least one third of states have a mandatory adverse medical event reporting system.8
>
> A sentinel event reporting system was established by JCAHO for hospitals in 1996 as a requirement for accreditation. A sentinel event is defined as an "unexpected occurrence involving death of serious injury of psychological injury, or the risk thereof."9
>
> The JCAHO ORYX initiative specifies the collection of six certified performance measures. Analysis and remedial actions are required for continuing accreditation. (The MEDSTAT Group is a vendor of ORYX measures and several COC version 2.2 measures have been certified for ORYX reporting.)
>
> The National Committee for Quality Assurance (NCQA) – Healthcare Employee Data and Information Set (HEDIS) is used as a part of NCQA accreditation of health plans. HEDIS measures are also used by employers and employees to compare health plan performance.
>
> The Scope of Work activities of Professional Review Organizations (PROs) are designed to monitor the utilization and quality of care provided to Medicare beneficiaries by healthcare providers. Currently, the Sixth Scope of Work focuses on selected complications of care.
>
> MedWatch, the Food and Drug Administration's surveillance system, monitors adverse events related to medical products. Hospitals are required to report deaths to the FDA and the manufacturer of the related medical product. Severe injuries are reported to the manufacturer.

The investigation of complications of care and medical errors spans all sites of care and all medical interventions. The sole focus of the MEDSTAT Complications of Care software, however, is on hospital-based complications that are recorded in or inferred from claims or discharge abstract records. The

challenge of complications of care software algorithms is to identify patients experiencing untoward hospital-care events documented in the hospital medical record. In most cases, administrative data based on ICD-9-CM coding alone cannot prove the existence of a complication. Rather, algorithms are designed to identify administrative records that have a high probability of leading quality management personnel and physicians to charts that contain evidence of a complication.

DEFINITION: COMPLICATIONS OF CARE, MEDICAL ERRORS AND ADVERSE EVENTS

The definition of a complication of care offered by Fleming10 provides a useful context for this discussion: a complication is an "unexpected illness or injury caused by medical intervention or disease progression." Complications can be one of two types: the result of disease progression, (as modeled in the Disease Staging case mix severity adjustment methodology and software11) or the result of health care interventions.

Complications relating to health care interventions can further be divided. The Institute of Medicine adopted the following definitions of errors and adverse events:

> "An error is defined as the failure of a planned action to be completed as intended (i.e., error of execution) or the use of the wrong plan to achieve an aim (i.e., error of planning)."12

> "An adverse event is an injury caused by medical management rather than the underlying condition of the patient. An adverse event attributable to error is a 'preventable adverse event.'"13

EVIDENCE FOR USING COC V3.2 SOFTWARE

The following study analyzing the COC v 3.2 was presented at the 18th International Case Mix Conference, PCS/E 2002[14].

AUTOMATED SCREENING OF HOSPITAL COMPLICATIONS OF CARE

INTRODUCTION

In-hospital complications of medical care have long been the concern of clinicians and hospital managers. A principal source for information on complications of care and often a starting point for hospital quality improvement studies are computerized screening algorithms using health insurance claims or medical record abstracts. The challenge for these software algorithms is to identify patients experiencing untoward hospital-care events documented in the hospital medical record. In most cases, administrative data based on ICD-9-CM coding alone cannot prove the existence of a complication. Rather, algorithms are designed to identify administrative records that have a high probability of leading quality management personnel and physicians to medical records that contain evidence of a complication.

The weaknesses of the using these administrative data are well known[1]. Economic efficiency is the principal strength of using automated screening tools. Available evidence for using administrative data to screen discharge abstracts for complications of care is encouraging, notably the validation studies of Iezzoni and coworkers.[2] A significant obstacle, however, to the use of administrative records are standard diagnosis coding practices which do not require information on whether a condition was present at the time the patient was admitted to the hospital. This practice contributes to the high false-positive rates of flagged complications[3].

The focus of this study is the examination of an automated complications-of-care methodology from two perspectives. First, differences in average hospital charges and lengths of stay between groups of patients defined as being at risk of a defined complication and those identified as having a potential complication were studied. Differences between these groups would lend heuristic support for the use of automated methods using conventional diagnosis coding conventions as a component of hospital quality management processes. The second perspective examines the insight gained from knowing if a diagnosis was either present at admission or acquired during the hospital stay. This result would further recommend the value of automated screening protocols and importantly reinforce the value of collecting information relating to whether a condition was acquired during the hospital stay.

METHODS

The MEDSTAT Group is a vendor of a software tool comprised of 37 Complication of Care (COC) screening protocols based on published peer-reviewed validation studies. It is a fully documented and open methodology which identifies patient risk groups and administrative records containing potential complications. Each COC screen is comprised of definitions for determining whether: 1) a patient is at risk for a given complication and 2) if there is evidence contained in the hospital record to suggestive of the occurrence of a potential complication. Both the Risk and COC definitions are defined by using commonly abstracted data elements, i.e., ICD-9-CM diagnosis and procedure codes, patient age and sex variables and hospital length of stay.

For example, the COC 11, Postoperative Cerebral Infarction, screening definitions are displayed in Table 1. In this example, a surgery patient with a secondary diagnosis of "Occlusion of cerebral arteries with cerebral infarction: cerebral thrombosis" (ICD-9-CM diagnosis code 434.01) would be flagged for potentially experiencing a complication of medical care. The diagnosis code, 434.01, is said to have triggered the COC.

Over 3.6 million discharge records obtained from the California Office of State Planning and Development (OSPDA) from the year 1998 were used in the analysis. Along with standard data elements described above, a flag indicating whether a condition represented by a secondary diagnosis was present at the time of the admission of the patient is a required OSPDA data element.

OSHPD gives California hospitals the option to report a subset of External Cause of Injury codes (e-codes) pertaining to "misadventures and abnormal reactions." Many of these codes are used in the COC definitions of nine COCs. Due to the uncertainty surrounding the completeness of the data, these nine COCs were excluded for the study. In total, 26 COCs were analyzed.

Table 1 – Postoperative Cerebral Infarction Complication Screening Definitions

Risk Definition:	All inpatient surgical patients – various ICD-9-CM procedure codes
COC Definition:	Occlusion and stenosis of precerebral arteries with cerebral infarction:
	Basilar artery - sdx = 433.01
	Carotid artery - sdx = 433.11
	Vertebral artery - sdx = 432.21
	Multiple and bilateral - sdx = 433.31
	Other specified precerebral artery - sdx = 433.81
	Unspecified precerebral artery - sdx = 433.91
	Occlusion of cerebral arteries with cerebral infarction:
	Cerebral thrombosis - sdx = 434.01
	Cerebral embolism - sdx = 434.11
	Cerebral artery occlusion, unspecified - sdx = 434.91
	Acute, but ill-defined cerebrovascular disease - sdx = 436
	Iatrogenic cerebrovascular infarction or hemorrhage - sdx = 997.02

Within each of the study COCs differences in the average length of stay and average charge were examined. The first comparison sought to determine whether there were differences between average charges and lengths of stay for patients defined to be at risk and not flagged for a COC (Risk) and those flagged as potentially experiencing a medical complication (COC). The second analysis dissects the COC group into: 1) patients flagged for a COC based on secondary diagnoses that were present at admission (COC Present) and 2) patients whose triggering diagnoses were acquired during the hospital stay (COC Acquired). The natural logarithm of hospital charge and length of stay were calculated for each patient record and t-statistics on the differences between the log means were generated to test for the differences.

RESULTS

The results displayed in Table 2 show that there were statistical differences ($p < .001$) between the Risk patients and the COC patients in 23 of the 26 complications studied. In comparing the COC Present and COC Acquired groups, 12 of 26 average length of stay comparisons and 13 of 26 average charge significantly different. It should be noted that eight of the COC Present and COC Acquired complications which were not statistically different were associated with COCs related

to newborn deliveries. In these instances it seems likely that the secondary diagnosis codes related to deliveries would have been acquired during the hospital stay.

Table 2 - Differences in Average Length of Stay (ALOS) and Average Charge for Patients by COC vs. Risk, COC and COC Acquired vs. COC Present Groups.

	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig
COC03						
Postoperative Hemorrhage or Hematoma						
Risk	1,932,327	5.16		1,735,423	$24,030	
COC	25,498	9.69	*	22,681	$70,757	*
COC Present	3,940	9.14		3,608	$53,033	
COC Acquired	21,558	9.79		19,073	$74,110	*
COC04						
Postoperative Aspiration Pneumonia						
Risk	1,932,327	5.16		1,735,423	$24,030	
COC	14,344	20.30	*	13,346	$104,993	*
COC Present	7,588	17.51		7,145	$84,285	
COC Acquired	6,756	23.44	*	6,201	$128,853	*
	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig
COC05						
Postoperative Pneumonia (non-aspiration)						
Risk	1,932,327	5.16		1,735,423	$24,030	
COC	48,186	17.94	*	43,979	$92,170	*
COC Present	33,987	14.78		31,106	$68,097	
COC Acquired	14,199	25.49	*	12,873	$150,341	*

	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig
COC06						
Postoperative Urinary Tract Infection						
Risk	772,432	10.01		696,437	$45,238	
COC	64,506	16.28	*	59,079	$63,899	*
COC Present	50,267	13.70		46,178	$51,904	
COC Acquired	14,239	25.40	*	12,901	$106,834	*
COC07						
Postoperative Septicemia						
Risk	772,432	10.01		696,437	$45,238	
COC	29,231	22.73	*	26,617	$127,456	*
COC Present	20,411	18.60		18,653	$96,360	
COC Acquired	8,820	32.30	*	7,964	$200,288	*
COC09						
Postoperative Myocardial Infarction						
Risk	1,932,327	5.16		1,735,423	$24,030	
COC	11,903	10.27	*	10,654	$72,576	*
COC Present	7,294	8.62		6,595	$61,685	
COC Acquired	4,609	12.88	*	4,059	$90,271	*
COC10						
Postoperative Cardiopulmonary Complications Except AMI						
Risk	1,932,327	5.16		1,735,423	$24,030	
COC	189,142	11.49	*	174,008	$66,092	*
COC Present	123,517	10.02		113,988	$50,050	
COC Acquired	65,625	14.25	*	60,020	$96,560	*

	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig
COC11						
Postoperative Cerebral Infarction						
Risk	1,932,327	5.16		1,735,423	$24,030	
COC	8,612	16.56	*	7,953	$86,125	*
COC Present	4,496	16.03		4,186	$62,683	
COC Acquired	4,116	17.13	*	3,767	$112,175	*
COC12						
Postoperative or Postanesthetic Shock						
Risk	1,932,327	5.16		1,735,423	$24,030	
COC	12,931	13.77	*	12,920	$100,724	*
COC Present	8,645	11.89		8,913	$81,295	
COC Acquired	4,288	17.58	*	4,009	$143,963	*
	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig
COC13						
Postoperative Thrombophlebitis or Phlebitis						
Risk	1,932,327	5.16		1,735,423	$24,030	
COC	2,497	13.78	*	2,252	$79,834	*
COC Present	1,190	10.69		1,056	$48,724	
COC Acquired	1,307	16.61	*	1,196	$107,302	*
COC14						
Postoperative wound disruption						
Risk	1,932,327	5.16		1,735,423	$24,030	
COC	3,590	22.54	*	3,265	$126,152	*
COC Present	1,796	16.00		1,669	$70,321	
COC Acquired	1,794	29.10	*	1,596	$184,536	*

	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig
COC16						
Postoperative Complications affecting body systems						
Risk	19,445	34.56		18,318	$163,451	
COC	415	28.79		395	$144,170	
COC Present	175	30.67		171	$121,797	
COC Acquired	240	27.41		224	$161,249	
COC17						
Vascular or Infectious Complications Following Infusion or Transfusion						
Risk	547,076	8.15		506,003	$45,318	
COC	25,244	7.93		23,489	$40,666	
COC Present	6,268	9.87		5,931	$39,877	
COC Acquired	18,976	7.28		17,558	$40,932	
COC23						
Medication Reactions and Poisonings						
Risk	490,513	14.44		456,844	$50,023	
COC	12,699	22.14	*	11,831	$83,170	*
COC Present	10,665	18.99		9,973	$66,151	
COC Acquired	2,034	38.68	*	1,858	$174,520	*
COC25						
Rupture of uterus during or after labor						
Risk	3,627,688	5.28		3,351,918	$16,853	
COC	261	6.11	*	247	$35,826	*
COC Present	144	4.24		142	$20,184	
COC Acquired	117	8.41	*	105	$56,979	*

	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig
COC27						
Accidental Puncture or Laceration During Procedure						
Risk	553,236	2.26		497,664	$6,771	
COC	20,520	2.11		17,256	$6,190	
COC Present	2,541	2.27		2,226	$6,459	
COC Acquired	17,979	2.09		15,030	$6,150	
	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig
COC28						
Complication of Tracheostomy						
Risk	553,236	2.26		497,664	$6,771	
COC	366	4.65	*	313	$18,290	*
COC Present	96	4.69		83	$18,595	
COC Acquired	270	4.64		230	$18,180	
COC29						
Mechanical Complications of Implanted Device or Graft						
Risk	553,236	2.2646		497,664	$6,771	
COC	93	6.5161	*	93	$48,848	*
COC Present	41	6.41		42	$53,069	
COC Acquired	52	6.5962		51	$45,372	
COC30						
Cesarean Section with Anesthesia or Sedation Complications						
Risk	110,006	3.63		98,909	$11,415	
COC	366	4.34	*	320	$15,636	*
COC Present	57	4.09		53	$14,916	
COC Acquired	309	4.38		267	$15,779	

	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig
COC31						
Cesarean Section with Major Puerperal Infection						
Risk	110,006	3.63		98,909	$11,415	
COC	1,975	6.04	*	1,517	$19,524	*
COC Present	328	5.96		277	$21,295	
COC Acquired	1,647	6.05		1,240	$19,128	
COC32						
Vaginal Delivery with Anesthesia or Sedation Complications						
Risk	392,721	1.84		345,676	$5,454	
COC	376	2.45	*	325	$8,178	*
COC Present	47	2.53		45	$7,764	
COC Acquired	329	2.44		280	$8,244	
COC33						
Vaginal Delivery with Major Puerperal Infection						
Risk	392,721	1.84		345,676	$5,454	
COC	879	4.07	*	685	$12,844	*
COC Present	188	3.84		159	$12,755	
COC Acquired	691	4.14		526	$12,871	
COC34						
Delivery wound complications						
Risk	553,236	2.26		497,664	$6,771	
COC	2,092	4.72	*	1,817	$15,432	*
COC Present	322	4.99		272	$18,922	
COC Acquired	1,770	4.67		1,545	$14,817	
	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig

	ALOS Patients	ALOS	sig	Charge Patients	Ave Charge	sig
COC35						
Postpartum Deep Phlebothrombosis						
Risk	553,236	2.26		497,664	$6,771	
COC	203	8.64	*	175	$23,870	*
COC Present	32	6.97		30	$17,120	
COC Acquired	171	8.95		145	$25,267	
COC36						
Postpartum Pulmonary Embolism						
Risk	553,236	2.26		497,664	$6,771	
COC	55	6.53	*	52	$29,884	*
COC Present	14	6.93		12	$34,845	
COC Acquired	41	6.39		40	$28,395	
COC37						
Other obstetrical trauma						
Risk	553,236	2.26		497,664	$6,771	
COC	31,683	2.36	*	26,437	$7,708	*
COC Present	4,930	2.61		4,279	$8,687	
COC Acquired	26,753	2.31		22,158	$7,519	

- Differences significant at $p < .001$

DISCUSSION

Practical observations can be derived from these results. First, the COC screening protocols can identify distinctly different groups of patients from their at-risk counterparts. In many cases the differences are substantial. This information alone suggests that COC flagged patients warrant further investigation which may result in improvements to quality of care processes and reductions in patient care expenses. Next, knowing whether a condition was present at the time the patient was admitted to the hospital can eliminate the false positive identification of potential complication and in many cases dramatically reduce the size of the effort required to conduct medical record audits. Finally, comparing the COC Acquired and the Risk statistics offers valuable insight into the real effort and costs of in-hospital medical errors.

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CONSIDERATIONS IN USING ADMINISTRATIVE DATA TO IDENTIFY QUALITY OF CARE EVENTS

Iezzoni and colleagues have described a series of issues that should be considered in using medical record abstract data in this regard.15 These apply not only to the study of adverse events but more generally to the practical applications of researching discharge and claims-based databases.

HOSPITAL-ACQUIRED CONDITIONS

The most significant confounder in relating administrative data to quality outcomes deals with whether a secondary diagnosis was present at the admission of a patient. Standard ICD-9-CM coding practices specify that all relevant patient conditions be recorded. The principal diagnosis is defined to be the condition responsible for the hospitalization. The secondary diagnoses detail the remaining patient conditions, many of which may have been present at the time of admission. The secondary diagnosis is generally used as the trigger for software logic to designate whether a patient record contains a potential complication of hospital care. Not knowing whether a secondary diagnosis was present at admission has an enormous affect on the interpretation of the results.

The MEDSTAT Group strongly encourages hospitals to collect data indicating whether a complication was present at admission. Additional functionality has been added to the software to permit the submission and interpretation of this additional information. The use of this feature will greatly enhance the value of the software in discovering preventable complications in hospital medical records.

CLINICAL SPECIFICITY OF DIAGNOSIS CODES

A second concern in using administrative records to screen for complications of care regards the clinical specificity of diagnosis codes. For example, coding systems do not specify symptoms, signs, laboratory findings and diagnostic test results. It is then incumbent on medical record documentation and medical record coder interpretations to ensure the validity of the diagnosis codes.16, 17

CODING VARIABILITY ACROSS HOSPITALS

The thoroughness of coding can vary from one hospital to another,18 raising issues of coding bias at the hospital level. “We cannot say…whether the findings related to the rates of complications by hospital characteristics were biased by differences in coding styles or whether the patients were truly more complicated at a certain hospital.”19 Evidence of this is seen in a study of heart attack

patients in California.20 The authors showed that missing risk factors ranged from 45-87 percent across hospitals and that variation in coding explained a portion of the difference between "high" and "low" mortality hospitals.

PHYSICIAN REVIEWS OF MEDICAL RECORDS FLAGGED BY DIAGNOSIS CODES

Iezzoni and her colleagues have also studied complications from the physician perspective.21 In reviewing medical records flagged by a diagnosis code-based algorithm, trained physician reviewers found complications resulted from quality of care mishaps in 30.7 percent of surgical and 19.2 percent of medical cases. The probability of finding a medical error in an unflagged medical record was 2.1 percent.

Geraci and her collaborators22 approached the topic from the opposite perspective with equally disquieting results. Using confirmed complications found in medical records, they then examined administrative data for corresponding diagnosis codes. They found that fewer than 50 percent of patients with complications documented in the medical records were flagged using ICD-9-CM codes.

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PROCESS OF SELECTING AND DEFINING COMPLICATIONS FOR INCLUSION IN VERSION 3.2

Complications of Care, version 3.2, was the result of three interrelated processes:

Evidence-based Literature Review –Since the initial development of the method in the early 1990's, a number of research studies were conducted and published regarding the ability of ICD-9-CM codes and administrative data to identify medical errors in hospital medical records. A review of the peer-reviewed literature was conducted and many of the findings were incorporated into the software and documentation. See Section 6 for many of the studies surveyed.

Data Analysis – Data and analyses were shared with MEDSTAT by a prominent user of the COC algorithm. Washington and California all payer data and the MEDSTAT MarketScan database were also analyzed to design and test the algorithms. This core of information was used to supplement the literature review and consensus processes.

Market Research – Customers were surveyed and the results of these discussions, as well as overall impressions of the software and documentation, were shared with the design team. The above evidence, as well as marketplace and software considerations, were used by the design team in making recommendations for the set of COCs to be incorporated in the Version 3.0 release of the software.

OVERVIEW OF ALGORITHM

The COC algorithm determines whether a patient is at risk for a given complication and whether that complication is present in the patient administrative record. The software outputs the presence of complications, the probability of having complications and the associated prediction errors.

Complications: ICD-9-CM codes are used to define the 37 individual complications. (See Section 12)

Risk Pools: ICD-9-CM codes, patient demographics, hospital length of stay or DRGs define the risk pools. (See Section 13)

All principal and secondary diagnoses, as well as all procedure codes are considered in selecting risk pools and determining the presence of a complication. The associated probabilities and prediction errors are based on all secondary diagnoses in the development database. The findings obtained from this approach will overstate the rate of hospital incurred complications, as many of the secondary diagnoses will have been present at the admission of the patient.

If the user sets the "acquired flag" in the parameter file, only secondary diagnoses which were acquired during the hospital stay will be used in the screening of potential complications.

DESCRIPTION OF INPUT ELEMENTS

The Disease Staging Software contains MEDSTAT's COC methodology for identifying records with potential complications of care. The input variables that are required to identify the 37 different complications include:

Principal and Secondary ICD-9-CM diagnosis codes – The COC method will use up to 15 diagnosis codes.

ICD-9-CM procedure codes

Sex

Age

Discharge Status

Length of Stay

OUTPUT DATA ELEMENTS

The following data elements are output from the software:

Complications and Risk - For each of the 37 COCs, the software identifies whether the patient was at risk for a given complication and whether the complication was found in the patient record.

Expected Values - Predicted rates of occurrence based on the age and sex of the patients at risk for a complication are output.

Prediction Error Estimates – these estimates are output for each expected value. The prediction error is used in the calculation of statistical confidence intervals.

A patient will not be at risk of a complication and there will be no output for expected value and prediction error if an input element used to define a COC is missing from the patient record.

INTERPRETATION OF COC AND RISK GROUP DEFINITIONS

The following is a key to understanding the headings, wording and symbols found in the COC and Risk Groups definitions:

ICD-9-CM Code or DRG – Contained in this column is information that describes the type and name of ICD-9-CM codes used (i.e., principal and secondary diagnoses or procedures) or the DRG number and description.

Relation – the information contained in this column informs the user of the following:

Between – the ICD-9-CM codes fall between the codes listed in the next two columns, i.e., "From" and "To."

"=" - the ICD-9-CM codes equal the code displayed in "From"

">=" - this relation is used in the length of stay risk group definitions and states that the length of stay is greater than or equal to the number of days shown. For example, '>= 4' states that the length of stay either equals 4 days or is greater than 4 days.

From – This column is either that code the begins the range of codes in "Between" relations or is a specific code in the equals (=) relation.

To – these ICD-9-CM codes end the range of codes in Between relations.

Operand

Or – A logical "Or" is used to include additional relations. For example, the statement '9984 Or 9987' states that either of these diagnosis codes can be used to satisfy the definition.

And Not – This operand is used to modify statements so that the definition is satisfied if the given code is not found in the patient record.

Parentheses – "**(**" and "**)**" are used to combine codes and operands to make a single logical statement.

Example –the definition of COC 01 can be interpreted as follows.

A patient will be considered to have had complication COC 01 if any of the secondary diagnoses, 998.4 (foreign body accidentally left during a procedure), 998.7 (acute reaction to foreign substance accidentally left during procedure), 998.82 (Cataract fragments in eye following cataract surgery) or codes between E8710 (Foreign object left in body during procedure – surgical operation) and E8719 (Foreign object left in body during procedure – unspecified procedure) are found in the patient claims or abstract and the principal diagnosis is not 998.4, 998.7 or 998.82.

The statement “Between E8710 and E8719” includes the following diagnosis codes that are found in ICD-9-CM coding manuals, e.g., E871.0, E871.1, E871.2, E871.3, E871.4, E871.5, E871.6, E871.7, E871.8 and E871.9.

A principal diagnosis is defined as the main reason that a patient is admitted to a hospital. If a patient has been admitted to a hospital for a foreign body or substance left in the body during a procedure as principal diagnosis, it is inferred that these are complications of care of a previous hospitalization.

ICD-9-CM code or DRG	**Relation**	**From**	**To**	**Operand**
Any Secondary Diagnosis Code in List	=	9984		Or
- FB LEFT DURING PROCEDURE				
Any Secondary Diagnosis Code in List	=	9987		Or
- POSTOP FORGN SUBST REACT				
Any Secondary Diagnosis Code in List	=	99882		Or (
- CTRCT FRGMT FRM CTR SURG				
Any Secondary Diagnosis Code in List	Between	E8710	E8719	And Not
- POST-SURGICAL FORGN BODY				
- POST-OP FOREIGN BODY NOS				
Principal Diagnosis Code	=	9984		And Not
- FB LEFT DURING PROCEDURE				
Principal Diagnosis Code	=	9987		And Not
- POSTOP FORGN SUBST REACT				
Principal Diagnosis Code	=	99882		)
- CTRCT FRGMT FRM CTR SURG				

COC Definitions

COC Number: 01 Postoperative Retained Foreign Body or Other Substance

Risk Group:	RG-01	Procedural Patient	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	9984		Or
Any Secondary Diagnosis Code in List	=	9987		Or
Any Secondary Diagnosis Code in List	=	99882		Or (
Any Secondary Diagnosis Code in List	Between	E8710	E8719	And Not
Principal Diagnosis Code	=	9984		And Not
Principal Diagnosis Code	=	9987		And Not
Principal Diagnosis Code	=	99882		)

COC Number: 02 Reopening, Reclosure, or Revision of Procedure

Risk Group: RG-02 | All Patients

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Procedure Code in List	=	0123		Or
Any Procedure Code in List	=	0242		Or
Any Procedure Code in List	=	0302		Or
Any Procedure Code in List	=	0397		Or
Any Procedure Code in List	=	0475		Or
Any Procedure Code in List	=	0602		Or
Any Procedure Code in List	=	0837		Or
Any Procedure Code in List	=	1266		Or
Any Procedure Code in List	=	1283		Or
Any Procedure Code in List	=	156		Or
Any Procedure Code in List	Between	1662	1664	Or
Any Procedure Code in List	=	1666		Or
Any Procedure Code in List	=	1921		Or
Any Procedure Code in List	=	1929		Or
Any Procedure Code in List	=	196		Or
Any Procedure Code in List	=	2062		Or
Any Procedure Code in List	=	2092		Or
Any Procedure Code in List	=	3163		Or
Any Procedure Code in List	=	3174		Or
Any Procedure Code in List	=	3403		Or
Any Procedure Code in List	=	3595		Or
Any Procedure Code in List	=	3775		Or
Any Procedure Code in List	=	3779		Or
Any Procedure Code in List	=	3789		Or
Any Procedure Code in List	=	3942		Or
Any Procedure Code in List	=	3949		Or
Any Procedure Code in List	=	3994		Or
Any Procedure Code in List	=	445		Or
Any Procedure Code in List	Between	4640	4643	Or
Any Procedure Code in List	Between	4693	4694	Or
Any Procedure Code in List	=	5194		Or
Any Procedure Code in List	=	5412		Or
Any Procedure Code in List	=	5461		Or
Any Procedure Code in List	=	5652		Or
Any Procedure Code in List	=	5662		Or
Any Procedure Code in List	=	5672		Or

Any Procedure Code in List	=	5722		Or
Any Procedure Code in List	=	8153		Or
Any Procedure Code in List	=	8155		Or
Any Procedure Code in List	=	8159		Or
Any Procedure Code in List	=	8197		Or
Any Procedure Code in List	=	843		Or
Any Procedure Code in List	=	8675		Or
Any Procedure Code in List	Between	3751	3754	

COC Number: 03 Procedure Related Hemorrhage or Hematoma

Risk Group:	RG-01	Procedural Patient	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	=	99811		Or
Any Diagnosis Code in List	=	99812		Or
Any Secondary Procedure Code in List	=	287		Or
Any Secondary Procedure Code in List	=	3941		Or
Any Secondary Procedure Code in List	=	3998		Or
Any Secondary Procedure Code in List	=	4995		Or
Any Secondary Procedure Code in List	=	5793		Or
Any Secondary Procedure Code in List	=	6094		Or (
Any Secondary Procedure Code in List	Between	4440	4449	And Not
Principal Diagnosis Code	Between	53100	53491	)

COC Number: 04 Postoperative Aspiration Pneumonia

Risk Group:	RG-01	Procedural Patient	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	5070		

COC Number: 05 Postoperative Pneumonia (non-aspiration)

Risk Group:	RG-01	Procedural Patient	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	Between	4820	4838	Or
Any Secondary Diagnosis Code in List	Between	485	486	

COC Number: 06 Postoperative Urinary Tract Infection

Risk Group:			
	RG-01	Procedural Patient	And
	LOS-4	Length of Stay = 4 days or more	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	59010		Or
Any Secondary Diagnosis Code in List	=	5909		Or
Any Secondary Diagnosis Code in List	=	5950		Or
Any Secondary Diagnosis Code in List	=	5953		Or
Any Secondary Diagnosis Code in List	=	5959		Or
Any Secondary Diagnosis Code in List	=	5990		

COC Number: 07 Postoperative Septicemia

Risk Group:			
	RG-01	Procedural Patient	And
	LOS-4	Length of Stay = 4 days or more	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	Between	0380	0389	

COC Number: 08 Postoperative Infection, other

Risk Group:	RG-01	Procedural Patient	

Comments: Infections following transfusion, infusion, or injection are in COC 20. Obstetric wound infections are in COC 34.

Variable	**Relational Operand**	**(From) Value**	**(To) Value**	**Logical Operand**
				Not
Group	=	INF-1		And (
Group	=	INF-2		Or
Any Secondary Diagnosis Code in List	=	E8720		Or
Any Secondary Diagnosis Code in List	Between	E8724	E8726	Or
Any Secondary Diagnosis Code in List	Between	E8728	E8729	)
				Or
Any Diagnosis Code in List	=	53087		

COC Number: 09 Postoperative Myocardial Infarction

Risk Group:	RG-01	Procedural Patient	

Comments: Only the initial episode of care for an AMI is pertinent here. Risk Group includes all procedures and all surgery types, including cardiac.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	41001		Or
Any Secondary Diagnosis Code in List	=	41011		Or
Any Secondary Diagnosis Code in List	=	41021		Or
Any Secondary Diagnosis Code in List	=	41031		Or
Any Secondary Diagnosis Code in List	=	41041		Or
Any Secondary Diagnosis Code in List	=	41051		Or
Any Secondary Diagnosis Code in List	=	41061		Or
Any Secondary Diagnosis Code in List	=	41071		Or
Any Secondary Diagnosis Code in List	=	41081		Or
Any Secondary Diagnosis Code in List	=	41091		

COC Number: 10 Postoperative Cardiopulmonary Complications Except AMI

Risk Group:	RG-01	Procedural Patient	

Comments: Iatrogenic (postop) pneumothorax (512.1) is included here, but spontaneous pneumothorax (512.0 or 512.8) is not.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	41511		Or
Any Secondary Diagnosis Code in List	=	41519		Or
Any Secondary Diagnosis Code in List	=	4260		Or
Any Secondary Diagnosis Code in List	Between	42741	42742	Or
Any Secondary Diagnosis Code in List	=	4275		Or
Any Secondary Diagnosis Code in List	Between	4280	42843	Or
Any Secondary Diagnosis Code in List	=	4294		Or
Any Secondary Diagnosis Code in List	=	5121		Or
Any Secondary Diagnosis Code in List	=	5180		Or
Any Secondary Diagnosis Code in List	Between	5184	5185	Or
Any Secondary Diagnosis Code in List	Between	51881	51882	Or
Any Secondary Diagnosis Code in List	=	51884		Or
Any Secondary Diagnosis Code in List	=	7991		Or
Any Secondary Diagnosis Code in List	=	9971		Or
Any Secondary Diagnosis Code in List	=	9973		

COC Number: 11 Postoperative Cerebral Infarction

Risk Group:	RG-01	Procedural Patient	

Comments: Research by L. Iezzoni finds this to be a valid and reliable category to examine for complications of care. This definition is similar to Iezzoni's, but does not exclude patients in MDC 1 and adds code 436 for unspecified CVA.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	43301		Or
Any Secondary Diagnosis Code in List	=	43311		Or
Any Secondary Diagnosis Code in List	=	43321		Or
Any Secondary Diagnosis Code in List	=	43331		Or
Any Secondary Diagnosis Code in List	=	43381		Or
Any Secondary Diagnosis Code in List	=	43391		Or
Any Secondary Diagnosis Code in List	=	43401		Or
Any Secondary Diagnosis Code in List	=	43411		Or
Any Secondary Diagnosis Code in List	=	43491		Or
Any Secondary Diagnosis Code in List	=	436		Or
Any Secondary Diagnosis Code in List	=	99702		

COC Number: 12 Postoperative or Postanesthetic Shock

Risk Group:	RG-01	Procedural Patient	

Comments: This COC is qualified to exclude any patient with any diagnosis code for traumatic shock.

Variable	**Relational Operand**	**(From) Value**	**(To) Value**	**Logical Operand**
				Not
Any Diagnosis Code in List	=	9584		And (
Any Secondary Diagnosis Code in List	Between	78550	78552	Or
Any Secondary Diagnosis Code in List	=	78559		Or
Any Secondary Diagnosis Code in List	=	9954		Or
Any Secondary Diagnosis Code in List	=	9980		)

COC Number: 13 Postoperative Thrombophlebitis or Phlebitis

Risk Group:	RG-01	Procedural Patient	

Comments: Postpartum Deep Phlebothrombosis is in COC 35.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	Between	4510	45119	Or
Any Secondary Diagnosis Code in List	=	9972		

COC Number: 14 Postoperative Wound Disruption

Risk Group:	RG-01	Procedural Patient	

Comments: Obstetric wound disruptions are in COC 34.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	Between	9983	99832	

COC Number: 15 Accidental Puncture or Laceration During Procedure

Risk Group:	RG-01	Procedural Patient	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	9982		Or
Any Secondary Diagnosis Code in List	Between	E8701	E8709	

COC Number: 16 Complication of Tracheostomy

Risk Group:	RG-04	Tracheostomy Status or Procedure	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	Between	51900	51909	

COC Number: 17 Mechanical Complications of Implanted Device or Graft

Risk Group:	RG-05	Implanted Device or Graft	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	=	3491		Or
Any Diagnosis Code in List	=	53642		Or
Any Diagnosis Code in List	=	56962		Or
Any Diagnosis Code in List	Between	99600	99659	Or
Any Diagnosis Code in List	=	53086		

COC Number: 18 Abnormal Reaction and Late Complications of Procedures

Risk Group: RG-01 | Procedural Patient |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	3490		Or
Any Secondary Diagnosis Code in List	=	53640		Or
Any Secondary Diagnosis Code in List	=	53649		Or
Any Secondary Diagnosis Code in List	=	56960		Or
Any Secondary Diagnosis Code in List	=	99586		Or
Any Secondary Diagnosis Code in List	=	56969		Or
Any Secondary Diagnosis Code in List	=	99589		Or
Any Secondary Diagnosis Code in List	=	99813		Or
Any Secondary Diagnosis Code in List	=	9986		Or
Any Secondary Diagnosis Code in List	=	99881		Or
Any Secondary Diagnosis Code in List	=	99883		Or
Any Secondary Diagnosis Code in List	=	99889		Or
Any Secondary Diagnosis Code in List	=	9989		Or
Any Secondary Diagnosis Code in List	=	9990		Or
Any Secondary Diagnosis Code in List	=	9999		Or
Any Secondary Diagnosis Code in List	Between	E911	E912	Or
Any Secondary Diagnosis Code in List	Between	E8762	E8769	Or
Any Secondary Diagnosis Code in List	Between	E8780	E8789	

COC Number: 19 Postoperative Complications Affecting Body Systems

Risk Group: RG-01 | Procedural Patient |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	4294		Or
Any Secondary Diagnosis Code in List	=	5933		Or
Any Secondary Diagnosis Code in List	=	5934		Or
Any Secondary Diagnosis Code in List	=	5982		Or
Any Secondary Diagnosis Code in List	Between	99670	99689	Or
Any Secondary Diagnosis Code in List	=	99700		Or
Any Secondary Diagnosis Code in List	=	99701		Or
Any Secondary Diagnosis Code in List	=	99709		Or
Any Secondary Diagnosis Code in List	Between	9974	9975	Or
Any Secondary Diagnosis Code in List	Between	99760	99762	Or
Any Secondary Diagnosis Code in List	=	99769		Or
Any Secondary Diagnosis Code in List	=	99791		Or
Any Secondary Diagnosis Code in List	=	99799		Or
Any Secondary Diagnosis Code in List	Between	E8758	E8759	Or
Any Secondary Diagnosis Code in List	Between	99771	99779	

COC Number: 20 Vascular or Infectious Complications Following Infusion, Transfusion, Injection

Risk Group: RG-02 | All Patients

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	Between	6823	6824	Or
Any Secondary Diagnosis Code in List	Between	9991	9993	Or
Any Secondary Diagnosis Code in List	Between	E8721	E8723	Or
Any Secondary Diagnosis Code in List	Between	E8750	E8752	

COC Number: 21 Infusion or Transfusion Reactions

Risk Group:	RG-06	Infusion or Transfusion	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	Between	9994	9998	Or
Any Secondary Diagnosis Code in List	Between	E8760	E8761	

COC Number: 22 Fluid Overload Following Infusion or Transfusion

Risk Group:	RG-06	Infusion or Transfusion	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	2766		Or
Any Secondary Diagnosis Code in List	Between	E8730	E8731	

COC Number: 23 Decubitus Ulcer

Risk Group:			
	RG-02	All Patients	And
	LOS-7	Length of Stay = 7 days or more	And Not
	TRANS	Transfer from SNF or other facility	

Comments:

Variable	**Relational Operand**	**(From) Value**	**(To) Value**	**Logical Operand**
Any Secondary Diagnosis Code in List	Between	7070	70709	

COC Number: 24 Trauma to Hospitalized Patient

Risk Group:	RG-02	All Patients	

Comments: This COC may identify some cases of multiple trauma that can be further examined to see if the secondary trauma was present on admission or not. Included here are only fractures, head injuries, internal injuries, burns and injuries to nerves, spinal cord and blood vessels. Not included are sprains, strains, lacerations, contusions, foreign body in an orifice, and late effects of traumas.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
				Not
Group	=	TR-1		And (
Group	=	TR-2		Or
Any Secondary Diagnosis Code in List	Between	E8732	E8735	)

COC Number: 25 Anaphylactic Shock due to Medications

Risk Group:	RG-02	All Patients	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	=	9950		

COC Number: 26 Medication Reactions and Poisonings

Risk Group: RG-02 | All Patients

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Secondary Diagnosis Code in List	Between	9600	9799	Or
Any Secondary Diagnosis Code in List	Between	9951	9952	Or
Any Secondary Diagnosis Code in List	=	E8736		Or
Any Secondary Diagnosis Code in List	Between	E8738	E8739	Or (
				(
Any Secondary Diagnosis Code in List	Between	E8500	E8589	Or
Any Secondary Diagnosis Code in List	Between	E9300	E9499	)
				And Not
Principal Diagnosis Code	Between	9600	9799	)

COC Number: 27 Advanced Perineal Laceration

Risk Group:	RG-03	Obstetrical Patients	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	Between	66420	66421	Or
Any Diagnosis Code in List	=	66424		Or
Any Diagnosis Code in List	Between	66430	66431	Or
Any Diagnosis Code in List	=	66434		

COC Number: 28 Rupture of Uterus During or After Labor

Risk Group:	RG-03	Obstetrical Patients	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	Between	66510	66511	

COC Number: 29 Shock During or Following Labor and Delivery

Risk Group:	RG-03	Obstetrical Patients	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	Between	66910	66914	

COC Number: 30 Cesarean Section with Anesthesia or Sedation Complications

Risk Group:	RG-07	Cesarean Section	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	Between	66801	66802	Or
Any Diagnosis Code in List	Between	66811	66812	Or
Any Diagnosis Code in List	Between	66821	66822	Or
Any Diagnosis Code in List	Between	66881	66882	Or
Any Diagnosis Code in List	Between	66891	66892	

COC Number: 31 Cesarean Section with Major Puerperal Infection

Risk Group:	RG-07	Cesarean Section	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	=	67000		Or
Any Diagnosis Code in List	=	67002		Or
Any Diagnosis Code in List	=	67004		

COC Number: 32 Vaginal Delivery with Anesthesia or Sedation Complications

Risk Group: RG-08 | Vaginal Delivery |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	Between	66801	66802	Or
Any Diagnosis Code in List	Between	66811	66812	Or
Any Diagnosis Code in List	Between	66821	66822	Or
Any Diagnosis Code in List	Between	66881	66882	Or
Any Diagnosis Code in List	Between	66891	66892	

COC Number: 33 Vaginal Delivery with Major Puerperal Infection

Risk Group:	RG-08	Vaginal Delivery	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	=	67000		Or
Any Diagnosis Code in List	=	67002		Or
Any Diagnosis Code in List	=	67004		

COC Number: 34 Delivery Wound Complications

Risk Group:	RG-03	Obstetrical Patients	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	=	67410		Or
Any Diagnosis Code in List	=	67412		Or
Any Diagnosis Code in List	=	67414		Or
Any Diagnosis Code in List	=	67420		Or
Any Diagnosis Code in List	=	67422		Or
Any Diagnosis Code in List	=	67424		Or
Any Diagnosis Code in List	=	67430		Or
Any Diagnosis Code in List	=	67432		Or
Any Diagnosis Code in List	=	67434		

COC Number: 35 Postpartum Deep Phlebothrombosis

Risk Group: RG-03 | Obstetrical Patients

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	=	67140		Or
Any Diagnosis Code in List	=	67142		Or
Any Diagnosis Code in List	=	67144		Or
				(
				(
Group	=	RG-03		Or
Group	=	RG-07		Or
Group	=	RG-08		) And
Any Diagnosis Code in List	Between	45340	45342	)

COC Number: 36 Postpartum Pulmonary Embolism

Risk Group:	RG-03	Obstetrical Patients	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	=	67302		Or
Any Diagnosis Code in List	=	67304		Or
Any Diagnosis Code in List	=	67312		Or
Any Diagnosis Code in List	=	67314		Or
Any Diagnosis Code in List	=	67322		Or
Any Diagnosis Code in List	=	67324		Or
Any Diagnosis Code in List	=	67332		Or
Any Diagnosis Code in List	=	67334		Or
Any Diagnosis Code in List	=	67382		Or
Any Diagnosis Code in List	=	67384		

COC Number: 37 Other Obstetrical Trauma

Risk Group:	RG-03	Obstetrical Patients	

Comments: First and second degree lacerations, and other minor trauma, such as hematoma to vulva or perineum, are not included in this COC.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	Between	66530	66531	Or
Any Diagnosis Code in List	=	66534		Or
Any Diagnosis Code in List	Between	66540	66541	Or
Any Diagnosis Code in List	=	66544		Or
Any Diagnosis Code in List	Between	66550	66551	Or
Any Diagnosis Code in List	=	66554		Or
Any Diagnosis Code in List	Between	66560	66561	Or
Any Diagnosis Code in List	=	66564		Or
Any Diagnosis Code in List	Between	66570	66572	Or
Any Diagnosis Code in List	=	66574		Or
Any Diagnosis Code in List	Between	66580	66584	Or
Any Diagnosis Code in List	Between	66590	66594	Or
Any Diagnosis Code in List	=	66600		Or
Any Diagnosis Code in List	=	66602		Or
Any Diagnosis Code in List	=	66604		Or
Any Diagnosis Code in List	=	66610		Or
Any Diagnosis Code in List	=	66612		Or
Any Diagnosis Code in List	=	66614		Or
Any Diagnosis Code in List	=	66620		Or
Any Diagnosis Code in List	=	66622		Or
Any Diagnosis Code in List	=	66624		Or
Any Diagnosis Code in List	=	66630		Or
Any Diagnosis Code in List	=	66632		Or
Any Diagnosis Code in List	=	66634		Or
Any Diagnosis Code in List	=	66700		Or
Any Diagnosis Code in List	=	66702		Or
Any Diagnosis Code in List	=	66704		Or
Any Diagnosis Code in List	=	66710		Or
Any Diagnosis Code in List	=	66712		Or
Any Diagnosis Code in List	=	66714		

Readmission Definitions

Readmission Number: 01 All Patients

Index Admission Group:	G01	All Patients	

Comments: This general category identifies all readmissions, regardless of reason for either index or readmission. User has option to set time intervals between the two admissions.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	Is Present			

Readmission Number: 02 Post Procedure Complications

Index Admission Group: | G29 | Post-Procedure Complications |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
				(
				(
Principal Diagnosis Code	=	0400		Or
Principal Diagnosis Code	Between	04100	04105	Or
Principal Diagnosis Code	Between	04109	04111	Or
Principal Diagnosis Code	=	04119		Or
Principal Diagnosis Code	Between	0412	0417	Or
Principal Diagnosis Code	Between	04181	04186	Or
Principal Diagnosis Code	=	04189		Or
Principal Diagnosis Code	=	0419		Or
Principal Diagnosis Code	=	042		Or
Principal Diagnosis Code	Between	3200	3203	Or
Principal Diagnosis Code	=	3207		Or
Principal Diagnosis Code	Between	32081	32082	Or
Principal Diagnosis Code	=	32089		Or
Principal Diagnosis Code	Between	3209	3214	Or
Principal Diagnosis Code	=	3218		Or
Principal Diagnosis Code	Between	3220	3222	Or
Principal Diagnosis Code	Between	3229	3232	Or
Principal Diagnosis Code	Between	3234	3235	Or
Principal Diagnosis Code	Between	3240	3241	Or
Principal Diagnosis Code	=	3249		Or
Principal Diagnosis Code	=	3490		Or
Principal Diagnosis Code	Between	37200	37205	Or
Principal Diagnosis Code	=	41001		Or
Principal Diagnosis Code	=	41011		Or
Principal Diagnosis Code	=	41021		Or
Principal Diagnosis Code	=	41031		Or
Principal Diagnosis Code	=	41041		Or
Principal Diagnosis Code	=	41051		Or
Principal Diagnosis Code	=	41061		Or
Principal Diagnosis Code	=	41071		Or
Principal Diagnosis Code	=	41081		Or
Principal Diagnosis Code	=	41091		Or
Principal Diagnosis Code	=	41511		Or
Principal Diagnosis Code	=	41519		Or

Principal Diagnosis Code	=	4220		Or
Principal Diagnosis Code	=	42290		Or
Principal Diagnosis Code	=	42292		Or
Principal Diagnosis Code	=	4260		Or
Principal Diagnosis Code	Between	42741	42742	Or
Principal Diagnosis Code	=	4275		Or
Principal Diagnosis Code	Between	4280	4281	Or
Principal Diagnosis Code	=	4294		Or
Principal Diagnosis Code	=	43301		Or
Principal Diagnosis Code	=	43311		Or
Principal Diagnosis Code	=	43321		Or
Principal Diagnosis Code	=	43331		Or
Principal Diagnosis Code	=	43381		Or
Principal Diagnosis Code	=	43391		Or
Principal Diagnosis Code	=	43401		Or
Principal Diagnosis Code	=	43411		Or
Principal Diagnosis Code	=	43491		Or
Principal Diagnosis Code	=	436		Or
Principal Diagnosis Code	=	4510		Or
Principal Diagnosis Code	=	45111		Or
Principal Diagnosis Code	=	45119		Or
Principal Diagnosis Code	Between	4610	4613	Or
Principal Diagnosis Code	Between	4618	4619	Or
Principal Diagnosis Code	Between	462	463	Or
Principal Diagnosis Code	=	4640		Or
Principal Diagnosis Code	Between	46410	46411	Or
Principal Diagnosis Code	Between	46420	46421	Or
Principal Diagnosis Code	Between	46430	46431	Or
Principal Diagnosis Code	=	4660		Or
Principal Diagnosis Code	=	46611		Or
Principal Diagnosis Code	=	46619		Or
Principal Diagnosis Code	=	475		Or
Principal Diagnosis Code	=	47822		Or
Principal Diagnosis Code	=	47824		Or
Principal Diagnosis Code	Between	4820	4822	Or
Principal Diagnosis Code	Between	48230	48232	Or
Principal Diagnosis Code	Between	48239	48241	Or
Principal Diagnosis Code	=	48249		Or
Principal Diagnosis Code	Between	48281	48284	Or
Principal Diagnosis Code	=	48289		Or
Principal Diagnosis Code	Between	4830	4831	Or

Principal Diagnosis Code	=	4838		Or
Principal Diagnosis Code	Between	485	486	Or
Principal Diagnosis Code	Between	4870	4871	Or
Principal Diagnosis Code	=	4878		Or
Principal Diagnosis Code	=	490		Or
Principal Diagnosis Code	=	5070		Or
Principal Diagnosis Code	=	5121		Or
Principal Diagnosis Code	=	5131		Or
Principal Diagnosis Code	=	5180		Or
Principal Diagnosis Code	=	5184		Or
Principal Diagnosis Code	=	5185		Or
Principal Diagnosis Code	Between	51881	51882	Or
Principal Diagnosis Code	=	51884		Or
Principal Diagnosis Code	Between	51900	51902	Or
Principal Diagnosis Code	=	51909		Or
Principal Diagnosis Code	=	5273		Or
Principal Diagnosis Code	Between	53086	53087	Or
Principal Diagnosis Code	Between	53640	53642	Or
Principal Diagnosis Code	=	53649		Or
Principal Diagnosis Code	=	566		Or
Principal Diagnosis Code	Between	5670	5672	Or
Principal Diagnosis Code	Between	5678	5679	Or
Principal Diagnosis Code	Between	56960	56962	Or
Principal Diagnosis Code	=	56969		Or
Principal Diagnosis Code	Between	5933	5934	Or
Principal Diagnosis Code	=	5982		Or
Principal Diagnosis Code	=	6040		Or
Principal Diagnosis Code	=	6080		Or
Principal Diagnosis Code	=	6084		Or
Principal Diagnosis Code	=	6145		Or
Principal Diagnosis Code	Between	6163	6164	Or
Principal Diagnosis Code	Between	6800	6809	Or
Principal Diagnosis Code	Between	68100	68102	Or
Principal Diagnosis Code	Between	68110	68111	Or
Principal Diagnosis Code	Between	6819	6829	Or
Principal Diagnosis Code	Between	683	684	Or
Principal Diagnosis Code	=	6850		Or
Principal Diagnosis Code	Between	68600	68601	Or
Principal Diagnosis Code	=	68609		Or
Principal Diagnosis Code	=	6861		Or
Principal Diagnosis Code	Between	6868	6869	Or

Principal Diagnosis Code	=	6869		Or
Principal Diagnosis Code	=	7602		Or
Principal Diagnosis Code	Between	7712	7718	Or
Principal Diagnosis Code	Between	78550	78551	Or
Principal Diagnosis Code	=	78559		Or
Principal Diagnosis Code	=	7991		Or
Principal Diagnosis Code	Between	9583	9584	Or
Principal Diagnosis Code	=	9954		Or
Principal Diagnosis Code	=	99586		Or
Principal Diagnosis Code	=	99589		Or
Principal Diagnosis Code	Between	99600	99604	Or
Principal Diagnosis Code	=	99609		Or
Principal Diagnosis Code	Between	9961	9962	Or
Principal Diagnosis Code	Between	99630	99632	Or
Principal Diagnosis Code	=	99639		Or
Principal Diagnosis Code	=	9964		Or
Principal Diagnosis Code	Between	99651	99652	Or
Principal Diagnosis Code	Between	99654	99656	Or
Principal Diagnosis Code	Between	99657	99661	Or
Principal Diagnosis Code	Between	99670	99689	Or
Principal Diagnosis Code	Between	99700	99702	Or
Principal Diagnosis Code	=	99709		Or
Principal Diagnosis Code	Between	9971	9975	Or
Principal Diagnosis Code	Between	99760	99762	Or
Principal Diagnosis Code	=	99769		Or
Principal Diagnosis Code	Between	99771	99779	Or
Principal Diagnosis Code	=	99791		Or
Principal Diagnosis Code	=	99799		Or
Principal Diagnosis Code	=	9980		Or
Principal Diagnosis Code	Between	99811	99813	Or
Principal Diagnosis Code	Between	9982	9984	Or
Principal Diagnosis Code	=	99851		Or
Principal Diagnosis Code	=	99859		Or
Principal Diagnosis Code	Between	9986	9987	Or
Principal Diagnosis Code	Between	99881	99883	Or
Principal Diagnosis Code	=	99889		Or
Principal Diagnosis Code	=	9989		Or
Principal Diagnosis Code	=	9990		Or
Principal Diagnosis Code	=	9999		Or
Principal Procedure Code	=	0123		Or
Principal Procedure Code	=	0242		Or

Principal Procedure Code	=	0302		Or
Principal Procedure Code	=	0397		Or
Principal Procedure Code	=	0475		Or
Principal Procedure Code	=	0602		Or
Principal Procedure Code	=	0837		Or
Principal Procedure Code	=	1266		Or
Principal Procedure Code	=	1283		Or
Principal Procedure Code	=	156		Or
Principal Procedure Code	Between	1662	1664	Or
Principal Procedure Code	=	1666		Or
Principal Procedure Code	=	1921		Or
Principal Procedure Code	=	1929		Or
Principal Procedure Code	=	196		Or
Principal Procedure Code	=	2062		Or
Principal Procedure Code	=	2092		Or
Principal Procedure Code	=	287		Or
Principal Procedure Code	=	3163		Or
Principal Procedure Code	=	3174		Or
Principal Procedure Code	=	3403		Or
Principal Procedure Code	=	3595		Or
Principal Procedure Code	=	3775		Or
Principal Procedure Code	=	3779		Or
Principal Procedure Code	=	3789		Or
Principal Procedure Code	Between	3941	3942	Or
Principal Procedure Code	=	3949		Or
Principal Procedure Code	=	3994		Or
Principal Procedure Code	=	3998		Or
Principal Procedure Code	=	445		Or
Principal Procedure Code	Between	4640	4643	Or
Principal Procedure Code	Between	4693	4694	Or
Principal Procedure Code	=	4995		Or
Principal Procedure Code	=	5194		Or
Principal Procedure Code	=	5412		Or
Principal Procedure Code	=	5461		Or
Principal Procedure Code	=	5652		Or
Principal Procedure Code	=	5662		Or
Principal Procedure Code	=	5672		Or
Principal Procedure Code	=	5722		Or
Principal Procedure Code	=	5793		Or
Principal Procedure Code	=	6094		Or
Principal Procedure Code	=	8153		Or

Principal Procedure Code	=	8155		Or
Principal Procedure Code	=	8159		Or
Principal Procedure Code	=	8197		Or
Principal Procedure Code	=	843		Or
Principal Procedure Code	=	8675		) Or (
				(
Principal Procedure Code	Between	4443	4444	Or
Principal Procedure Code	=	4449		)
				And Not (
Principal Diagnosis Code	Between	53100	53101	Or
Principal Diagnosis Code	Between	53110	53111	Or
Principal Diagnosis Code	Between	53120	53121	Or
Principal Diagnosis Code	Between	53130	53131	Or
Principal Diagnosis Code	Between	53140	53141	Or
Principal Diagnosis Code	Between	53150	53151	Or
Principal Diagnosis Code	Between	53160	53161	Or
Principal Diagnosis Code	Between	53170	53171	Or
Principal Diagnosis Code	Between	53190	53191	Or
Principal Diagnosis Code	Between	53200	53201	Or
Principal Diagnosis Code	Between	53210	53211	Or
Principal Diagnosis Code	Between	53220	53221	Or
Principal Diagnosis Code	Between	53230	53231	Or
Principal Diagnosis Code	Between	53240	53241	Or
Principal Diagnosis Code	Between	53250	53251	Or
Principal Diagnosis Code	Between	53260	53261	Or
Principal Diagnosis Code	Between	53270	53271	Or
Principal Diagnosis Code	Between	53290	53291	Or
Principal Diagnosis Code	Between	53300	53301	Or
Principal Diagnosis Code	Between	53310	53311	Or
Principal Diagnosis Code	Between	53320	53321	Or
Principal Diagnosis Code	Between	53330	53331	Or
Principal Diagnosis Code	Between	53340	53341	Or
Principal Diagnosis Code	Between	53350	53351	Or
Principal Diagnosis Code	Between	53360	53361	Or
Principal Diagnosis Code	Between	53370	53371	Or
Principal Diagnosis Code	Between	53390	53391	Or
Principal Diagnosis Code	Between	53400	53401	Or
Principal Diagnosis Code	Between	53410	53411	Or
Principal Diagnosis Code	Between	53420	53421	Or
Principal Diagnosis Code	Between	53430	53431	Or
Principal Diagnosis Code	Between	53440	53441	Or

Principal Diagnosis Code	Between	53450	53451	Or
Principal Diagnosis Code	Between	53460	53461	Or
Principal Diagnosis Code	Between	53470	53471	Or
Principal Diagnosis Code	Between	53490	53491	)))

Readmission Number: 03 Diabetes Mellitus

Index Admission Group:	G03	Diabetes Mellitus	

Comments: This category excludes admissions for destruction of lesions of retina and choroid by any means. The procedure codes used include destruction of chorioretinopathy only, and no other retinal surgeries.

Variable	**Relational Operand**	**(From) Value**	**(To) Value**	**Logical Operand**
				(
Principal Diagnosis Code	Between	25000	25093	Or
Principal Diagnosis Code	=	2777		)
				And Not (
Any Procedure Code in List	Between	1421	1427	Or
Any Procedure Code in List	=	1429		)

Readmission Number: 04 COPD

Index Admission Group: | G04 | COPD |

Comments: Rules for this category are based on Aston reference, except for new codes added since that study, and excluding asthma, which is in a separate category.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	=	41511		Or
Group	=	G04		Or
Principal Diagnosis Code	=	41519		Or
Principal Diagnosis Code	Between	4168	4169	Or
Principal Diagnosis Code	=	4660		Or
Principal Diagnosis Code	=	46611		Or
Principal Diagnosis Code	=	46619		Or
Principal Diagnosis Code	Between	4800	4870	Or
Principal Diagnosis Code	Between	5120	5121	Or
Principal Diagnosis Code	=	5128		Or
Principal Diagnosis Code	=	5180		Or
Principal Diagnosis Code	Between	51881	51882	Or
Principal Diagnosis Code	=	51884		Or
Principal Diagnosis Code	Between	78600	78601	Or
Principal Diagnosis Code	Between	78603	78607	Or
Principal Diagnosis Code	=	78609		Or
Principal Diagnosis Code	=	7991		

Readmission Number: 05 Heart Failure

Index Admission Group:	G05	Heart Failure	

Comments: This category includes all codes used by Ashton except fluid overload (276.6), edema (782.3) and orthopnea (786.02). We used fluid overload only in category of transfusion and infusion complications.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	=	39891		Or
Principal Diagnosis Code	=	40201		Or
Principal Diagnosis Code	=	40211		Or
Principal Diagnosis Code	=	40291		Or
Principal Diagnosis Code	=	40401		Or
Principal Diagnosis Code	=	40403		Or
Principal Diagnosis Code	=	40411		Or
Principal Diagnosis Code	=	40413		Or
Principal Diagnosis Code	=	40491		Or
Principal Diagnosis Code	=	40493		Or
Principal Diagnosis Code	Between	4280	4289	

Readmission Number: 06 Pneumonia

Index Admission Group:	G06	Pneumonia	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Group	=	G06		

Readmission Number: 07 Acute Myocardial Infarction

Index Admission Group: | G07 | Acute Myocardial Infarction |

Comments: This category uses any AMI as principal or secondary diagnosis on index admission, but only principal diagnosis on readmit. Readmit also limits this to only unspecified or initial episode of care for the readmit. We also added other principal diagnoses on readmit based on complications of AMI listed in Disease Staging.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	Between	41000	41001	Or
Principal Diagnosis Code	Between	41010	41011	Or
Principal Diagnosis Code	Between	41020	41021	Or
Principal Diagnosis Code	Between	41030	41031	Or
Principal Diagnosis Code	Between	41040	41041	Or
Principal Diagnosis Code	Between	41050	41051	Or
Principal Diagnosis Code	Between	41060	41061	Or
Principal Diagnosis Code	Between	41070	41071	Or
Principal Diagnosis Code	Between	41080	41081	Or
Principal Diagnosis Code	Between	41090	41091	Or
Principal Diagnosis Code	=	4110		Or
Principal Diagnosis Code	=	41410		Or
Principal Diagnosis Code	=	41511		Or
Principal Diagnosis Code	=	41519		Or
Principal Diagnosis Code	Between	42090	42091	Or
Principal Diagnosis Code	=	42099		Or
Principal Diagnosis Code	=	4260		Or
Principal Diagnosis Code	Between	42610	42613	Or
Principal Diagnosis Code	Between	4262	4264	Or
Principal Diagnosis Code	Between	42650	42654	Or
Principal Diagnosis Code	=	4266		Or
Principal Diagnosis Code	=	4269		Or
Principal Diagnosis Code	Between	4270	4272	Or
Principal Diagnosis Code	Between	42731	42732	Or
Principal Diagnosis Code	Between	42741	42742	Or
Principal Diagnosis Code	=	4275		Or
Principal Diagnosis Code	=	42760		Or
Principal Diagnosis Code	=	42761		Or
Principal Diagnosis Code	=	42769		Or
Principal Diagnosis Code	=	42781		Or
Principal Diagnosis Code	=	42789		Or
Principal Diagnosis Code	=	4279		Or
Principal Diagnosis Code	=	4280		Or
Principal Diagnosis Code	=	4281		Or

Principal Diagnosis Code	=	4296	Or
Principal Diagnosis Code	=	42979	Or
Principal Diagnosis Code	=	43401	Or
Principal Diagnosis Code	=	43411	Or
Principal Diagnosis Code	=	43491	Or
Principal Diagnosis Code	=	436	Or
Principal Diagnosis Code	=	5184	Or
Principal Diagnosis Code	=	78551	

Readmission Number: 08 Asthma

Index Admission Group:	G08	Asthma	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Group	=	G08		

Readmission Number: 09 Atrial Fibrillation

Index Admission Group:	G09	Atrial Fibrillation	

Comments: Readmission uses any principal diagnosis of atrial fibrillation, as well as pulmonary embolism or embolic stroke.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	=	42731		Or
Principal Diagnosis Code	=	41511		Or
Principal Diagnosis Code	=	41519		Or
Principal Diagnosis Code	=	43301		Or
Principal Diagnosis Code	=	43311		Or
Principal Diagnosis Code	=	43321		Or
Principal Diagnosis Code	=	43331		Or
Principal Diagnosis Code	=	43381		Or
Principal Diagnosis Code	=	43391		Or
Principal Diagnosis Code	=	43401		Or
Principal Diagnosis Code	=	43411		Or
Principal Diagnosis Code	=	43491		Or
Principal Diagnosis Code	=	436		

Readmission Number: 10 Coronary Artery Disease With Angina

Index Admission Group:	G10	Coronary Artery Disease With Angina	

Comments: This uses any angina on index admission and any angina or acute myocardial infarction on the readmission.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	=	4111		Or
Any Diagnosis Code in List	=	4130		Or
Any Diagnosis Code in List	=	4131		Or
Any Diagnosis Code in List	=	4139		Or
Group	=	G10		

Readmission Number: 11 Depression

Index Admission Group:	G11	Depression	

Comments: This category includes any depression, including major depression, but excluding major depression with mention of psychotic behavior

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Group	=	G11		

Readmission Number: 12 Peptic Ulcer Disease

Index Admission Group:	G12	Peptic Ulcer Disease	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Group	=	G12		

Readmission Number: 13 Stroke or Transient Ischemic Attack

Index Admission Group:	G13	Stroke or Transient Ischemic Attack	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	=	43301		Or
Principal Diagnosis Code	=	43311		Or
Principal Diagnosis Code	=	43321		Or
Principal Diagnosis Code	=	43331		Or
Principal Diagnosis Code	=	43381		Or
Principal Diagnosis Code	=	43391		Or
Principal Diagnosis Code	=	43401		Or
Principal Diagnosis Code	=	43411		Or
Principal Diagnosis Code	=	43491		Or
Principal Diagnosis Code	Between	4350	4353	Or
Principal Diagnosis Code	Between	4358	4359	Or
Principal Diagnosis Code	=	436		

Readmission Number: 14 Decubitus Ulcers

Index Admission Group: G01 | All Patients |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	Between	7070	70709	

Readmission Number: 15 Dehydration

Index Admission Group:	G01	All Patients	

Comments: This category also includes readmissions for hypernatremia, acidosis, alkalosis, hyperpotassemia, mixed acid-base balance, and nonspecific electrolyte imbalances.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Any Diagnosis Code in List	=	2760		Or
Any Diagnosis Code in List	Between	2762	2765	Or
Any Diagnosis Code in List	=	2767		Or
Any Diagnosis Code in List	=	2769		

Readmission Number: 16 Drug Poisoning

Index Admission Group: G01 | All Patients |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	Between	9600	9635	Or
Principal Diagnosis Code	Between	9638	96502	Or
Principal Diagnosis Code	=	96509		Or
Principal Diagnosis Code	=	9651		Or
Principal Diagnosis Code	Between	9654	9655	Or
Principal Diagnosis Code	=	96561		Or
Principal Diagnosis Code	=	96569		Or
Principal Diagnosis Code	Between	9657	9664	Or
Principal Diagnosis Code	Between	9670	9676	Or
Principal Diagnosis Code	Between	9678	9687	Or
Principal Diagnosis Code	Between	9689	9701	Or
Principal Diagnosis Code	Between	9708	9713	Or
Principal Diagnosis Code	Between	9719	9736	Or
Principal Diagnosis Code	Between	9738	9747	Or
Principal Diagnosis Code	Between	E8509	9758	Or
Principal Diagnosis Code	Between	9760	9774	Or
Principal Diagnosis Code	Between	9778	9786	Or
Principal Diagnosis Code	Between	9788	9797	Or
Principal Diagnosis Code	=	9799		Or
Any Secondary Diagnosis Code in List	Between	E8500	E851	Or
Any Secondary Diagnosis Code in List	=	E851		Or
Any Secondary Diagnosis Code in List	Between	E8520	E8525	Or
Any Secondary Diagnosis Code in List	Between	E8528	E8532	Or
Any Secondary Diagnosis Code in List	Between	E8538	E8543	Or
Any Secondary Diagnosis Code in List	=	E8548		Or
Any Secondary Diagnosis Code in List	Between	E8550	E8556	Or
Any Secondary Diagnosis Code in List	Between	E8558	E8559	Or
Any Secondary Diagnosis Code in List	Between	E856	E8589	Or
Any Secondary Diagnosis Code in List	=	E8723		Or
Any Secondary Diagnosis Code in List	=	E8736		Or
Any Secondary Diagnosis Code in List	Between	E8738	E8739	Or
Any Secondary Diagnosis Code in List	Between	E8758	E8759	

Readmission Number: 17 Endocarditis

Index Admission Group: G01 | All Patients |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	Between	4210	4211	Or
Principal Diagnosis Code	=	4219		

Readmission Number: 18 Septicemia

Index Admission Group: G01 | All Patients |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	=	0380		Or
Principal Diagnosis Code	Between	03810	03811	Or
Principal Diagnosis Code	=	03819		Or
Principal Diagnosis Code	Between	0382	0383	Or
Principal Diagnosis Code	Between	03840	03844	Or
Principal Diagnosis Code	=	03849		Or
Principal Diagnosis Code	Between	0388	0389	Or
Principal Diagnosis Code	=	0031		Or
Principal Diagnosis Code	=	0202		Or
Principal Diagnosis Code	=	0223		Or
Principal Diagnosis Code	=	0362		Or
Principal Diagnosis Code	=	0545		

Readmission Number: 19 HIV or AIDS

Index Admission Group:	G19	HIV or AIDS	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Group	=	G19		

Readmission Number: 20 Hypertension

Index Admission Group:	G20	Hypertension	

Comments: This category excludes secondary hypertension and includes readmissions for either hypertension or hemorrhagic stroke.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Group	=	G20		Or
Principal Diagnosis Code	Between	430	431	Or
Principal Diagnosis Code	Between	4320	4321	Or
Principal Diagnosis Code	=	4329		Or
Principal Diagnosis Code	=	436		

Readmission Number: 21 Infections After Discharge for Infection

Index Admission Group: | G21 | Infections After Discharge for Infection |

Comments: This category excludes infections that have a separate readmission category (septicemia, endocarditis, kidney infection, pneumonia, UTI, osteomyelitis, septic arthritis, and HIV/AIDS).

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	=	0400		Or
Principal Diagnosis Code	=	04082		Or
Principal Diagnosis Code	Between	04100	04105	Or
Principal Diagnosis Code	Between	04109	04111	Or
Principal Diagnosis Code	=	04119		Or
Principal Diagnosis Code	Between	0412	0417	Or
Principal Diagnosis Code	Between	04181	04186	Or
Principal Diagnosis Code	=	04189		Or
Principal Diagnosis Code	=	0419		Or
Principal Diagnosis Code	=	0664		Or
Principal Diagnosis Code	=	07982		Or
Principal Diagnosis Code	Between	3200	3203	Or
Principal Diagnosis Code	=	3207		Or
Principal Diagnosis Code	Between	32081	32082	Or
Principal Diagnosis Code	=	32089		Or
Principal Diagnosis Code	Between	3209	3214	Or
Principal Diagnosis Code	=	3218		Or
Principal Diagnosis Code	Between	3220	3222	Or
Principal Diagnosis Code	Between	3229	3232	Or
Principal Diagnosis Code	Between	3234	3235	Or
Principal Diagnosis Code	Between	3240	3241	Or
Principal Diagnosis Code	=	3249		Or
Principal Diagnosis Code	Between	37200	37205	Or
Principal Diagnosis Code	=	4220		Or
Principal Diagnosis Code	=	42290		Or
Principal Diagnosis Code	=	42292		Or
Principal Diagnosis Code	Between	4610	4613	Or
Principal Diagnosis Code	Between	4618	4619	Or
Principal Diagnosis Code	Between	462	463	Or
Principal Diagnosis Code	=	4640		Or
Principal Diagnosis Code	Between	46410	46411	Or
Principal Diagnosis Code	Between	46420	46421	Or
Principal Diagnosis Code	Between	46430	46431	Or
Principal Diagnosis Code	=	4660		Or
Principal Diagnosis Code	=	46611		Or

Principal Diagnosis Code	=	46619		Or
Principal Diagnosis Code	=	475		Or
Principal Diagnosis Code	=	47822		Or
Principal Diagnosis Code	=	47824		Or
Principal Diagnosis Code	=	4871		Or
Principal Diagnosis Code	=	4878		Or
Principal Diagnosis Code	=	490		Or
Principal Diagnosis Code	=	5131		Or
Principal Diagnosis Code	=	5273		Or
Principal Diagnosis Code	=	53641		Or
Principal Diagnosis Code	=	566		Or
Principal Diagnosis Code	Between	5670	5672	Or
Principal Diagnosis Code	Between	5678	5679	Or
Principal Diagnosis Code	=	56961		Or
Principal Diagnosis Code	=	6040		Or
Principal Diagnosis Code	=	6080		Or
Principal Diagnosis Code	=	6084		Or
Principal Diagnosis Code	=	6145		Or
Principal Diagnosis Code	Between	6163	6164	Or
Principal Diagnosis Code	Between	6800	6809	Or
Principal Diagnosis Code	Between	68100	68102	Or
Principal Diagnosis Code	Between	68110	68111	Or
Principal Diagnosis Code	Between	6819	6829	Or
Principal Diagnosis Code	Between	683	684	Or
Principal Diagnosis Code	=	6850		Or
Principal Diagnosis Code	Between	68600	68601	Or
Principal Diagnosis Code	=	68609		Or
Principal Diagnosis Code	=	6861		Or
Principal Diagnosis Code	Between	6868	6869	Or
Principal Diagnosis Code	=	7602		Or
Principal Diagnosis Code	Between	7712	77189	Or
Principal Diagnosis Code	=	9583		Or
Principal Diagnosis Code	Between	99591	99592	Or
Principal Diagnosis Code	Between	99660	99661	Or
Principal Diagnosis Code	=	99762		Or
Principal Diagnosis Code	=	99851		Or
Principal Diagnosis Code	=	99859		

Readmission Number: 22 Infusion or Transfusion Complications

Index Admission Group:	G22	Infusion, Transfusion Complication	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	=	2766		Or
Principal Diagnosis Code	Between	6823	6824	Or
Principal Diagnosis Code	Between	9991	9998	Or
Principal Diagnosis Code	Between	E8721	E8722	Or
Principal Diagnosis Code	Between	E8730	E8731	Or
Principal Diagnosis Code	Between	E8750	E8752	Or
Principal Diagnosis Code	Between	E8760	E8761	

Readmission Number: 23 Kidney and Urinary Tract Infections

Index Admission Group: | G01 | All Patients |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	Between	59000	59001	Or
Principal Diagnosis Code	Between	59010	59011	Or
Principal Diagnosis Code	Between	5902	5903	Or
Principal Diagnosis Code	Between	59080	59081	Or
Principal Diagnosis Code	=	5909		Or
Principal Diagnosis Code	=	5950		Or
Principal Diagnosis Code	=	5959		Or
Principal Diagnosis Code	=	5970		Or
Principal Diagnosis Code	Between	59800	59801	Or
Principal Diagnosis Code	=	5990		

Readmission Number: 24 Osteomyelitis and Septic Arthritis

Index Admission Group: G01 | All Patients |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	Between	71100	71109	Or
Principal Diagnosis Code	Between	71140	71169	Or
Principal Diagnosis Code	Between	71180	71189	Or
Principal Diagnosis Code	Between	73000	73029	

Readmission Number: 25 Respiratory Complications

Index Admission Group: G01 | All Patients |

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Principal Diagnosis Code	Between	5120	5121	Or
Principal Diagnosis Code	=	5128		Or
Principal Diagnosis Code	=	5180		Or
Principal Diagnosis Code	Between	5184	5185	Or
Principal Diagnosis Code	Between	51881	51882	Or
Principal Diagnosis Code	=	51884		Or
Principal Diagnosis Code	Between	77081	77089	

Readmission Number: 26 Obstetric Complications

Index Admission Group:	G26	Obstetric Complications	

Comments: Testing on hold - will test in the future to determine if there are other ways to categorize OB complications.

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Group	=	G26		

Readmission Number: 27 Neonatal and Infant Conditions

Index Admission Group:	G28	Neonatal and Infant Conditions	

Comments:

Variable	Relational Operand	(From) Value	(To) Value	Logical Operand
Group	=	G28		