



3M™ Clinical Risk Grouping Software

## Definitions Manual

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v1.12



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# About this document

This document describes the 3M™ Clinical Risk Groups (CRG) logic and the development of the CRG classification system. It also includes a Microsoft® Excel® file attachment, CRG\_Tables\_v1.12, which contains detailed lists of codes and CRGs.

## Electronic content delivery format

As with the previous CRG release, the manual for the July 2014 v1.12 release is in PDF format with the code list spreadsheet attached to the PDF file.

The table below is a quick guide to navigating through a PDF manual.

For this view...	Do this...
Show bookmarks	In the left panel, click the ribbon icon. When bookmarks are displayed, every bookmark is a link.
Show attachments	In the left panel, click the paper clip icon.
See previous view	Press Alt+Left arrow.
Page up	At the left of the tool bar, press the up arrow.
Page down	At the left of the tool bar, press the down arrow.

The attached spreadsheet contains all the codes used in the CRG logic for v1.12. The content of the spreadsheet is cumulative and reflects the code additions, deletions, and modifications for all CRG releases, including the initial v1.0 release.

## Opening an attached file

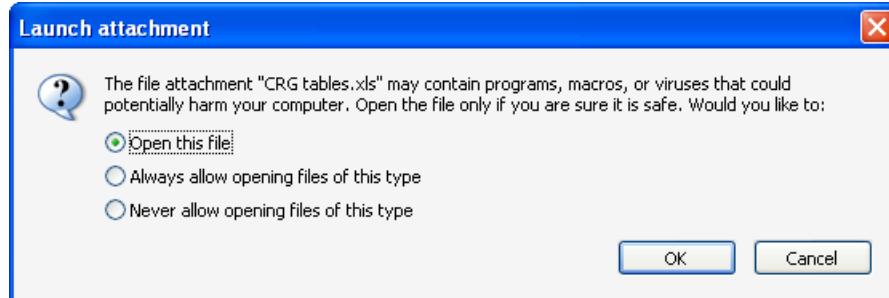
This manual delivers all the codes used in the CRG logic in a Microsoft® Excel spreadsheet attached to the pdf file. The spreadsheet file is approximately 13 MB in size, so it may take a while to open.

### ***To open an attached file***

1. On the left side of the pdf window, in the Bookmarks pane, click the paper clip icon.
2. In the attachments list, double-click the file you want to open.

## About this document

3. If you see the following dialog box when the spreadsheet opens, select Open this file, then click OK.



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  - The document that opens is a read-only version. To ensure that you always have one original version of each document, 3M recommends that you use the original as your definitive sources of reference.
4. To create a working copy of the file, select File > Save As, and save a copy with a new name indicating that it is not the original from 3M.

## Navigating the CRG tables

The CRG tables attachment is an Excel spreadsheet consisting of multiple appendix worksheets. Each appendix contains a different code list. To make the navigation easier, all the appendixes are linked to a "clickable" Table of Contents (TOC) on the first tab. The TOC lists all appendices in the file. You can return to the TOC at any time by either clicking the blue link in the top left corner of the worksheet or by clicking the left arrow below the row numbers for the current worksheet.

	A	B	C	D	E	F	G	H	I	J
1	<a href="#">Click to return to Table of Contents</a>									
2	Drug and Drug Combinations Used to Create Diagnoses and Procedures									
3	EDC or EPC	EDC / EPC	Description	Type	DRUG1	Rule1	DRUG2	Rule2	DRUG3	Rule3
4	EDC	1	Progressive Neurological Diagnoses	DC	Interferon Beta-1a	2				
5	EDC	1	Progressive Neurological Diagnoses	DC	Interferon Beta-1b	2				
6	EDC	1	Progressive Neurological Diagnoses	DC	Ms_	2				
7	EDC	2	Extrapyramidal Diagnoses	DC	Amantadine	50				
8	EDC	2	Extrapyramidal Diagnoses	DC	Amantadine	41				
9	EDC	2	Extrapyramidal Diagnoses	DC	Amantadine Hydrochloride	50				
10	EDC	2	Extrapyramidal Diagnoses	DC	Amantadine Hydrochloride	41				
11	EDC	2	Extrapyramidal Diagnoses	DC	Benztropine Mesylate	41				
12	EDC	2	Extrapyramidal Diagnoses	DC	Bromocriptine	50				
13	EDC	2	Extrapyramidal Diagnoses	DC	Bromocriptine	41				
14	EDC	2	Extrapyramidal Diagnoses	DC	Bromocriptine Mesylate	50				
15	EDC	2	Extrapyramidal Diagnoses	DC	Bromocriptine Mesylate	41				
16	EDC	2	Extrapyramidal Diagnoses	DC	Parkinson_	50				
17	EDC	2	Extrapyramidal Diagnoses	DC	Parkinson_	41				
18	EDC	6	Alzheimer's Disease and Other Dementias	DC	Alzheimer_	2				
19	EDC	6	Alzheimer's Disease and Other Dementias	DC	Dihydro-Alpha-Ergocryptine Mesylate	13				
20	EDC	6	Alzheimer's Disease and Other Dementias	DC	Dihydro-Beta-Ergocryptine Mesylate	13				
21	EDC	6	Alzheimer's disease	DC	Rivastigmine	2				
22	EDC	6	Alzheimer's disease	DC	Rivastigmine Tartrate	2				
23	EDC	7	Cerebral Palsy NOS	DC	Baclofen	53	Anticonvulsants_	2		
24	EDC	7	Cerebral Palsy NOS	DC	Glycopyrrolate	53	Anticonvulsants_	2		
25	EDC	11	Chronic Neuromuscular/Other Neurological Diagnoses - Moderate	MC	Abenonium Chloride	2				
26	EDC	11	Chronic Neuromuscular/Other Neurological Diagnoses - Moderate	MC	Baclofen	25				
27	EDC	11	Chronic Neuromuscular/Other Neurological Diagnoses - Moderate	MC	Edrophonium Chloride	2				
28	EDC	11	Chronic Neuromuscular/Other	MC	Neostigmine Bromide	2				

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- Use one of the following methods:
  - Click the appropriate tab.
  - From the TOC tab, click the blue link for that appendix.

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- Names of other programs or memory-resident programs running on the workstation when the problem occurred
- Exact wording of any messages on your monitor
- What you were doing when the problem occurred and whether you can reproduce the problem
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# Chapter 1: Introduction to CRGs

This chapter introduces the 3M™ Clinical Risk Groups (CRGs) classification system, provides the background for the creation of the CRG methodology, and describes the development process for the CRG system.

## Initial and continuing development and evaluation of CRGs

Throughout the world healthcare costs are growing faster than the economies which sustain them. This is untenable. The problem may be most significant for the United States where healthcare costs expressed as percentage of Gross Domestic Product (GDP) is the highest in the world. More importantly the share of the GDP dedicated to healthcare has been increasing for the last fifty years and given current health care finance and delivery systems will likely do so for the foreseeable future.

Other countries despite spending, as a percentage of their GDP, less than the United States, are also experiencing significant growth in the healthcare expenditures. These are likely to continue if only due to the aging of their populations.

Health Care Trends Since 1980 - Selected Countries <sup>1</sup>						
	1980	1990	2000	2007	2008	2009
Australia	6.1	6.7	8.0	8.5	8.7	
Austria	7.4	8.3	9.9	10.3	10.4	11.0
Canada	7.0	8.9	8.8	10.0	10.3	11.4
Chile			6.6	6.9	7.5	8.4
Czech Republic		4.7	6.5	6.8	7.1	8.2
Denmark	8.9	8.3	8.7	10.0	10.3	11.5
Finland	6.3	7.7	7.2	8.1	8.4	9.2
France	7.0	8.4	10.1	11.0	11.1	11.8
Germany	8.4	8.3	10.3	10.5	10.7	11.6
Hungary			7.0	7.5	7.2	7.4
Iceland	6.3	7.8	9.5	9.1	9.1	9.7
Ireland	8.2	6.1	6.1	7.7	8.8	9.5
Israel	7.7	7.1	7.5	7.6	7.7	7.9
Italy		7.7	8.1	8.7	9.0	9.5
Japan	6.4	5.9	7.7	8.2	8.5	
Korea	4.0	4.2	4.8	6.3	6.5	6.9

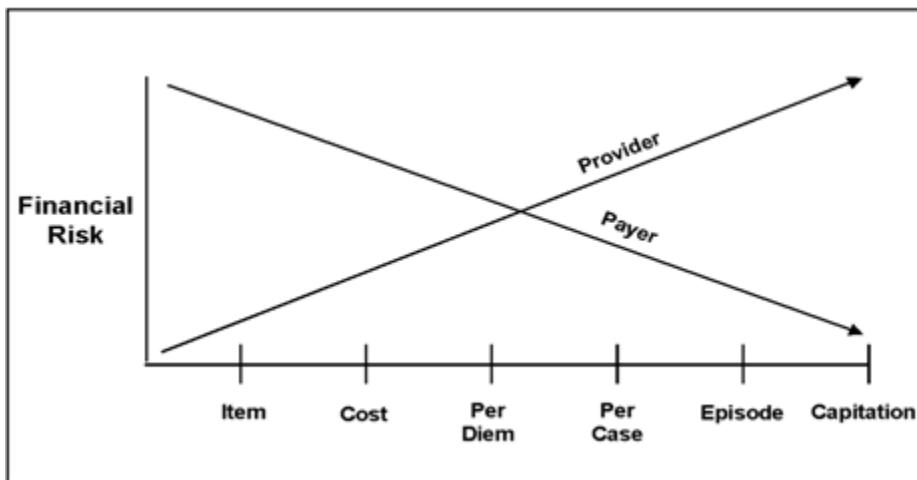
<b>Health Care Trends Since 1980 - Selected Countries<sup>1</sup></b>						
	1980	1990	2000	2007	2008	2009
Mexico		4.4	5.1	5.8	5.8	6.4
New Zealand	5.8	6.8	7.6	8.8	9.6	10.3
Norway	7.0	7.6	8.4	8.9	8.6	9.6
Poland		4.8	5.5	6.4	7.0	7.4
Portugal	5.1	5.7	9.3	10.0	10.1	
Spain	5.3	6.5	7.2	8.5	9.0	9.5
Sweden	8.9	8.2	8.2	8.9	9.2	10.0
Switzerland	7.4	8.2	10.2	10.6	10.7	11.4
United Kingdom	5.6	5.9	7.0	8.4	8.8	9.8
United States	9.0	12.4	13.7	16.0	16.4	17.4
OECD average	6.6	6.9	7.8	8.6	8.8	9.5

As high healthcare costs pose a significant burden for all nations and their citizens, there is a clear need to control the growth of expenditures while at the same time maintaining health care quality.

Attempts to control healthcare expenditures in the U.S. have utilized three primary strategies:

1. Shift financial risk from payers to providers
2. Provide financial incentives for providers to deliver care efficiently
3. Create competition among providers based on price, scope, and quality of services

During the past three decades, there has been an evolution of the basic unit of payment upon which healthcare services are paid. The unit of payment has evolved through items, cost, per diems, per case, episodes and capitation. Various payers have utilized some or all of these units of payment. Each of the successive evolutions of the unit of payment has aggregated more services into the unit of payment. Per diem payment aggregates all hospital services provided in a day. Per case payment aggregates all hospital services provided for a hospital admission. Episode payment aggregates all healthcare services for a particular illness over a period of time. Capitated payment aggregates all healthcare services for an individual over a period of time. As illustrated in the following figure, this evolution of the unit of payment into larger and larger units of payment shifts the financial risk from payer to provider. The inherent assumption underlying the transfer of financial risk from payer to provider is that since providers control the provision of services, they can also control the overall cost of services.



The shift of financial risk from payer to provider also creates the incentive for providers to control costs since providers will benefit financially if their costs are low and suffer financially if their costs are high. Thus, the evolution of healthcare cost containment strategies has focused on the shift of risk from payer to provider which creates incentives for providers to deliver care efficiently. More recently, with the advent of managed care, the process of establishing the price for each unit of service has evolved from a negotiation between provider and payer to a competition among providers in which payers limit the number of providers with whom they do business, based in part on the price offered by the provider. In one form or another, the basis of many managed care arrangements is the payment of a capitated rate that has been competitively established. The long-term success of such arrangements depends on the establishment of capitated rates that are fair and realistic such that providers are able to respond to the incentive to control cost in a way that is effective for all population groups.

The adoption of managed care has expanded rapidly. Managed care enrollment for Medicare in 1998 was 18.3 percent of beneficiaries,<sup>2</sup> and for Medicaid in 1997 was over 40 percent of beneficiaries.<sup>3</sup>

Major problems have arisen in the managed care approach. This can be seen in the experience of the United States Medicare program. Although pilot programs existed previously, Medicare Managed Care was offered as an option following the 1982 passage of the Tax Equity and Fiscal Responsibility Act (TEFRA). Under this program managed care plans agreed to accept payments that averaged 95% of the standard Medicare fee for services payments. It was assumed that they

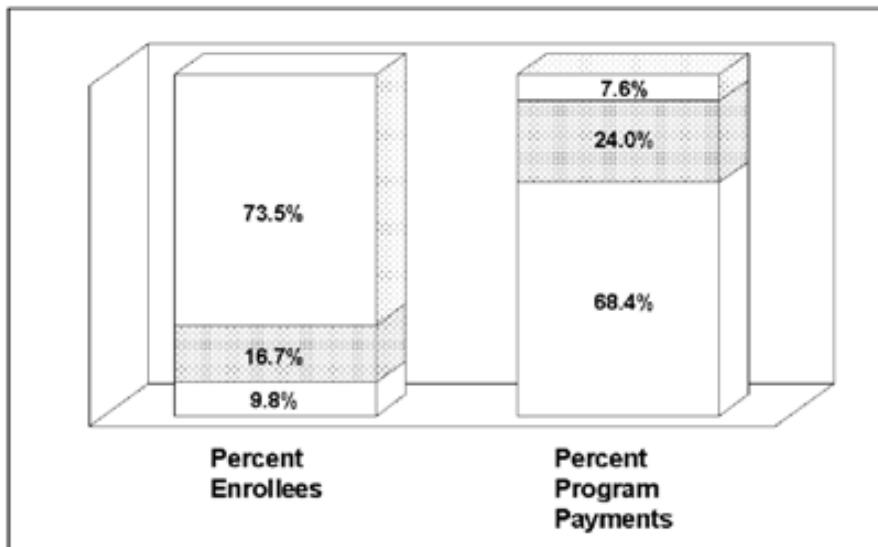
would make up the difference through better quality, provider contracting, etc. Medicare managed care initially expanded rapidly. Enrollments, however, peaked in the late 1990s and declined as payers withdrew from the market citing significant losses. This decline continued until 2004 when enrollments began to increase<sup>4</sup> in the aftermath of the passage of the Medicare Modernization Act of 2003. Medicare managed care was renamed the Medicare Advantage Program. Since then enrollments have more than doubled.<sup>5</sup> This growth in enrollment reflects a change in plan reimbursement more than the successful implementation of the original program. Whereas the program was initially designed to be cheaper than traditional Medicare fee for service, Medicare Advantage typically reimburses plans about 110% of fee for service though it varies by region. In return the plans offer better coverage most commonly the reduction of cost sharing. Not surprisingly, beneficiaries have responded to the financial incentives.

The problems experienced by the plans can be linked to problems in their initial design. A study by the Medicare Payment Advisory Commission (MedPAC) showed a significant bias in enrollment and disenrollment patterns in managed care organizations (MCOs) contracting with Medicare.<sup>6</sup> The Medicare program offers recipients the option to voluntarily enroll in a MCO or remain in the fee-for-service delivery system. New enrollees in Medicare MCOs appear to be relatively healthy, with expenditures that are about 35 percent below the Medicare fee-for-service average in the six months before enrollment. By contrast, Medicare beneficiaries disenrolling from MCOs had expenditures 60 percent higher than the Medicare fee-for-service average in the six months following disenrollment. Thus, healthy beneficiaries tend to enroll in Medicare MCOs and sick beneficiaries tend to disenroll from Medicare MCOs.<sup>7</sup> In an effort to keep costs low, some MCOs have targeted their marketing efforts toward healthy individuals.<sup>8</sup> Unfortunately, it is easier to attract healthy beneficiaries and avoid enrolling sick beneficiaries than it is to learn to deliver cost effective care. The advertising policy, facility location and types of services offered (e.g., sports medicine) can easily be used to create a bias selection of healthy enrollees. As a result of biased enrollment and disenrollment Medicare is overpaying capitated MCOs by 5–20 percent.<sup>9</sup>

"Thus failure to adjust compensation for patient's health status reinforces two of the more worrisome trends in the present healthcare system. First, it rewards plans for a business strategy of 'risk selection' in which they deliberately market their services to relatively healthy populations and avoid relatively sick ones. This strategy, in turn, punishes plans and physicians that do a good job of treating the sick, thus reinforcing the incentive to stint on care that is already present in a system that increasingly relies on payment by means of capitation rather than on fee-for-service reimbursement. Second, as risks are shifted to the individual physician, doctors with sicker patients must work longer hours or receive a reduced income or make unethical or clinically dangerous decisions to withhold necessary care."<sup>10</sup>

The incentive to enroll the healthy individuals is dramatic. The following figure shows the distribution of Medicare beneficiaries and program payments. While 73.5 percent of Medicare beneficiaries consume 7.6 percent of program expenditures, 9.8 percent of beneficiaries consume 68.4 percent of program expenditures.<sup>11</sup> Thus, there is an enormous concentration of expenditures in relatively few individuals. With such a concentration, a strategy for financial success under a capitated payment system with inadequate risk adjustment is clear: enroll the 73.5 percent of beneficiaries that consume 7.6 percent of the expenditures and avoid enrolling the 9.8 percent of beneficiaries that consume 68.4 percent of the expenditures. A financially successful strategy toward disenrollment is also clear. Enrollee expenditures from the previous year are a relatively good predictor of the next year's expenditures.<sup>12</sup> Thus, managed care organizations can easily identify the enrollees who are likely to be high cost in the future. The failure to have adequate risk adjustment creates a perverse set of incentives. For example, an MCO recognized as providing high quality care to individuals with HIV could be financially penalized if it enrolled too many HIV infected individuals. The failure to include adequate risk

adjustment in capitated payment arrangements is jeopardizing the potential success of managed care. In particular, inadequate payment for the sickest individuals may lead to access problems. Thus, there is a critical need for a comprehensive and accurate method for risk adjusting capitation payments.



The objective of this research was to develop a classification system for accurately describing the health status of individuals. The challenges associated with the development of a classification system for risk adjustment are substantial. The enormous concentration of expenditures in relatively few individuals makes the identification and classification of these individuals crucial to the effectiveness of risk adjustment. Since individuals with severe disease in multiple organ systems are likely to be a substantial proportion of the high expenditure individuals, the classification system needs to include a detailed clinical specification of individuals with multiple comorbid diseases including a determination of their relative severity of illness.

The initial motivation for developing the classification system was for risk adjustment of capitated payments. However, the research focused on developing a management tool for MCOs, since the success of a capitated payment system is dependent on MCOs being able to respond to the incentives in the system and deliver care efficiently and effectively. The classification system that resulted is not only a management tool but can also be used as a basis for risk adjusting capitated payments. Risk adjustment, incentives for efficiency and management's response are all interrelated in a capitated payment system. An effective solution to the problem of risk adjustment must address these interrelated issues simultaneously. Further, risk adjustment is only one part of a capitated payment system. The classification system for risk adjustment cannot be developed in isolation from the other components of the full payment system (e.g., stop loss, annual updates, etc.). The development of the classification system for risk adjustment must, therefore, explicitly address the full design of a capitated payment system and address how risk adjustment is integrated into each component of the payment system. Finally, the classification system must be viewed as part of an overall system for monitoring and evaluating MCO performance. The classification system is not only key to the capitated payment methodology but is also key to the methodology for tracking the populations served by each MCO and monitoring MCO performance as measured through patient satisfaction surveys, disenrollment rates and other outcome measures. It is essential for the classification system to be able to differentiate

MCO performance for healthy populations who require relatively few services from MCO performance for sicker populations who require more extensive services.

The classification system for risk adjustment developed during this research is named Clinical Risk Groups (CRGs). As the name implies, CRGs are risk groups that can be used as the basis of risk adjustment in a capitated payment system and are also clinically precise so as to be usable as a management tool for MCOs.

The design and development of CRGs was greatly influenced by the success of the Medicare inpatient Prospective Payment System (PPS). The Medicare PPS was the first large scale implementation of a payment system that incorporated the clinical characteristics of a patient into the determination of the payment amount for the patient. The Medicare PPS is a per case payment system that uses the Diagnosis Related Groups (DRGs) as the basic unit of payment. Based on the patient's diagnoses, procedures, age, and sex, the DRGs assign each patient to a single, mutually exclusive and clinically coherent group of patients that are expected to consume similar amounts and types of hospital resources. In the Medicare PPS, a prospective payment amount is established for each DRG. The Medicare PPS has been an extremely effective payment system. The Brookings Institute has estimated that as a result of the PPS, Medicare expenditures for inpatient care have been reduced by \$17 billion per year.<sup>13</sup> Further, these savings have been achieved with no apparent impact on quality of care.<sup>14</sup> In addition to the Medicare program, there are a number of state Medicaid programs, private sector payers, and foreign countries that have implemented DRG-based payment systems.<sup>15</sup>

Like DRGs, CRGs provide a means of incorporating the clinical characteristics of individuals into the determination of the payment amount. While the role of DRGs and CRGs in a payment system are similar, there are some fundamental differences between the two classification systems. One is the difference between casemix adjustment and risk adjustment. DRGs are assigned after the services are rendered while CRGs must be assigned before the services are rendered. Thus, DRGs explain past resource use while CRGs must predict future resource use. A second fundamental difference is that DRGs classify a single encounter at a point in time, (i.e., a hospitalization), while CRGs classify the individual and all medical care services for an extended period of time. Despite these differences, many of the fundamental lessons learned from the successful implementation of the Medicare PPS still apply to the problems associated with the establishment of capitated payment rates.

## Lessons learned from the Medicare PPS

There are two key attributes of the Medicare PPS that were critical to its success. These attributes were also key to the success of efforts by Medicaid programs and other payers to implement an inpatient PPS system.

### Payment based on a categorical clinical model

Since the DRGs were developed as groups of clinically similar patients, a language was created that linked the clinical and financial aspects of care. The importance of the communication value of DRGs cannot be emphasized enough. The language of DRGs provided administrators and physicians a meaningful basis for evaluating both the processes of care and the associated

financial impacts. Indeed, DRGs were originally developed to be a management tool. The availability of a DRG definitions manual, in which the clinical characteristics of each DRG were clearly specified, was essential for creating a basis of communications (nearly 100,000 copies of the DRG definitions manual have been distributed). DRGs revolutionized hospital management. Development of care pathways by DRG and profit and loss reports by DRG product lines became commonplace. With the adoption of these new management methods, length of stay and the use of ancillary services dropped dramatically.<sup>16</sup> The simple categorical nature of DRGs created a powerful communications tool. The Medicare PPS did not by itself reduce Medicare inpatient expenditures. What it did was to create the foundation for a new approach to hospital management which resulted in increased efficiency which in turn permitted Medicare payment levels to be reduced without creating a financial crisis for hospitals.

DRGs not only provided a communications tool for hospital management, but they also provided an effective means for hospitals and Medicare to communicate. Instead of accountants and lawyers arguing the fine points of cost accounting, the focus of payment deliberations became the determination of a fair payment rate for patients with specific clinical problems. The vast majority of modifications to the DRGs since the inception of the Medicare PPS have resulted from recommendations from hospitals. The recommendations have almost always been the result of clinicians identifying specific types of patients with unique needs that were not adequately addressed in the DRGs. A recent example of such a clinical dialogue is the DRGs related to burns.<sup>17</sup> The fiscal year 1999 update to the DRGs included a major restructuring of the DRGs for burns. This restructuring was the direct result of detailed and specific recommendations provided to Medicare by burn specialists.

### **Separate methodology for computation of payment weights**

The Medicare PPS establishes a relative payment weight for each DRG which is the basis for setting the actual payment amount. The process of establishing the relative DRG payment weight is straightforward and basically involves estimating the average cost of patients in each DRG. The categorical nature of DRGs permits a separation of the computation of the relative payment weights and the definition of the DRG categories. Such a separation is an inherent by-product of the categorical nature of DRGs and cannot be readily implemented in non-categorical systems. For example, payment rates could be computed based on linear or logistic regression techniques. In a regression model, the presence of certain clinical factors are used as variables in the regression. The coefficients in the regression equation would be equivalent to the relative payment weights in the DRG system. However, in a regression model, the clinical model and payment coefficients are inextricably intertwined. There is no independent definition of the clinical model and the payment coefficients. Thus, with a regression model, the clinical model needs to be completely revalidated with different groups of patients. In a categorical model, the clinical model remains stable. The payment weights change when the patient type (e.g., Medicare vs. Medicaid) changes.

The separation of the methodologies for developing the clinical model and the payment weights was a critical factor in the success and widespread adoption of the DRG system. An example of the importance of the separation of the clinical and payment weight methodologies is illustrated by the first set of DRG payment weights used in the Medicare PPS.<sup>18</sup> In this initial set of DRG payment weights there were five pairs of DRGs in which patients with a complication or comorbidity, which would clinically be expected to result in a higher payment weight, actually had a lower payment weight than patients without a complication or comorbidity. This anomaly reflected limitations in the database used to compute the initial set of DRG payment weights. The

important point is that the clinical definition of the DRGs was not altered based on the anomaly. In a regression model the anomaly in the data would implicitly be reflected in the coefficients in the regression equation. In the third year of the Medicare PPS the DRG payment weights were recomputed with more accurate data and the anomalies in the DRG payment weights were eliminated without any change to the clinical definition of the DRGs. Thus, the separation of the clinical and payment weight methodologies allowed a stable clinical methodology to be maintained while the payment weights evolved in response to more accurate and complete data.

The independence of the clinical model and payment weights plus the straightforward method for computing the DRG payment weights (i.e., a simple average) facilitated the widespread use of the DRGs by other payers and foreign countries. The clinical definition of the DRGs reflects the type of patient while the DRG payment weights reflect the treatment processes and methods. Since new diseases (e.g., HIV) are rare, the clinical definition of the DRGs is relatively stable. However, since treatment processes and methods are constantly changing, the DRG payment weights often undergo substantial change. Most non-Medicare payers (e.g., Medicaid programs) that have used DRGs, compute their own DRG payment weights while leaving the standard DRG definitions unchanged.<sup>19</sup>

## Characteristics of a CRG-classification system

The lessons learned in the implementation of the Medicare PPS and the PPS systems implemented by other payers are relevant to the problem of establishing a risk adjusted classification system. The design and development of the CRGs and their use in a payment system reflects many of the key decisions made in the implementation of the Medicare PPS. The CRG-based classification system was designed to have the following characteristics:

- CRGs are a categorical clinical model.
- CRGs are severity adjusted.
- CRGs use standard claims data.
- CRGs can be readily aggregated.
- CRGs support internal management systems.

### CRGs are a categorical clinical model

The CRGs are a categorical clinical model in which each individual is assigned to a single mutually exclusive risk group which relates the historical clinical and demographic characteristics of the individual to the amount and type of healthcare resources that individual will consume in the future. Since the CRGs are clinically based, they create a language that links the clinical and financial aspects of care. Thus, CRGs are designed to serve as the foundation of management systems which support care pathways, product line management, and case management. The CRG Definitions Manual contains a complete specification of the CRG logic, permitting physicians to independently assess the clinical validity of CRGs.

## **CRGs are severity adjusted**

While the DRGs initially used by Medicare do not explicitly adjust for severity of illness, the most recent version of Medicare DRGs and other advanced versions of DRGs contain severity of illness subclasses within each DRG. These more advanced versions of DRGs not only improve the clinical accuracy of the DRGs and their applicability to patients in all age categories, but also allow the applications of DRGs to be expanded to include outcomes analysis. Indeed, many states use severity of illness adjusted DRGs to disseminate provider performance reports to the public.<sup>20</sup> The addition of severity of illness subclasses to the DRGs further improved the value of DRGs as a communication and management tool. The CRGs were developed to include explicit severity of illness subclasses that describe the extent and progression of an individual's condition.

## **CRGs use standard claims data**

The data used in the clinical definition of the CRGs are routinely collected by standard claims processing systems. These data include age, sex, diagnoses, procedures, pharmaceuticals, site of service, date of service (or fill date), and provider type. By using widely available data, CRGs can be easily assigned. As more data (e.g., laboratory findings) become available they may be included in the CRGs if their inclusion leads to enhanced clinical and statistical precision.

## **CRGs can be readily aggregated**

The number of individuals covered by payers can vary considerably. While payment weights are available with CRGs, most payers will compute their own payment weights. In order to facilitate CRG use, CRGs are consolidated into three tiers of aggregation. Each successive tier of aggregation has fewer CRGs. Payers who wish to compute their own payment weights but have relatively few covered individuals can use a highly consolidated tier of CRG aggregation in order to have a sufficient number of covered individuals to compute a payment weight. In addition, payers can develop their own consolidation algorithm. The key to consolidating CRGs is for each successive aggregation of CRGs to maintain distinct severity of illness levels. The severity of illness of an individual is an essential part of description of the individual's condition. Not only are the multiple tiers of aggregation important for flexibility in establishing payment weights, but they are also essential for developing an effective management information system based on CRGs. Since the successive consolidations of CRGs are formed in a hierarchical manner, upper management can receive highly aggregated reports while clinicians can receive a corresponding set of reports that contain more detail. CRGs contain the flexibility to provide the payer or provider the level of detail that corresponds to their needs.

## **CRGs support internal management systems**

Capitated payment arrangements place the majority of financial risk on the providers of care. The underlying assumption is that since providers are responsible for the delivery of care, they can respond to the incentives to control costs inherent in a capitated payment system. The success of any payment system that is predicated on providing incentives for cost control is almost totally

dependent on the effectiveness with which the incentives are communicated to providers. Payers need to express the payment arrangements in a form that communicates the incentives in the system in a manner and at a level of detail that promotes effective management responses. Given the impact that the method of payment can have on patient care, it is not only in the best interest of payers to promote effective management. It is their obligation. CRGs were explicitly designed to be a tool for management. Indeed, CRGs are really a management tool that can also be used as the basis of establishing capitated payment rates. The key distinction between a management tool and payment method relates to the ability of the provider to use the information to take action in response to the incentives in the system. Thus, a management tool communicates information in a form and at a level of detail that can lead to specific positive actions. As the Medicare PPS clearly demonstrated, the effectiveness of any incentive-based payment system is greatly enhanced if the payment method is simultaneously a management tool. To illustrate the difference, suppose for individuals with diabetes the capitated payments are 25 percent lower than the provider's expenditures. While this is obviously useful information for identifying a problem, it does not give the provider any real information on the precise source of the problem or the actions that can be taken to correct the problem. In contrast, suppose the payment system also provided the following information:

The higher costs for diabetic individuals are due to unusually high expenditures for inpatient care combined with uncommonly low expenditures for pharmacy and outpatient laboratory services for Severity of Illness Level 1 and 2 diabetic individuals. Further, a higher than expected percentage of Severity of Illness Level 1 and 2 diabetic individuals who, over time, become Severity Level 3 or 4.

Clearly, the above information raises specific questions concerning the monitoring and preventive care being provided to low severity diabetic individuals. A capitated payment system that communicates information similar to the information illustrated above, gives providers a basis for management action and an effective response to the incentives in the system.

## Data used in the initial development of CRGs

Databases from a Medicare, Medicaid, and privately insured population were used in the initial development of the CRGs. The data from all three populations met the following conditions:

- Eligibility information was available
- Claims data from all care settings was available
- The claims data could be linked from each eligible individual
- There were multiple years of claims data available
- Diagnostic, procedure, and expenditure information was available on each claim.

The availability of eligibility information was essential in order to identify individuals who had continuous eligibility over the period of time covered in the analysis. For example, suppose two years of data were available and the data from the first year is used to assign the CRGs for predicting expenditures in the second year. An individual who was only eligible in the first year could not have any reported expenditures in the second year and would need to be excluded from the analysis. Conversely, an individual who was eligible in both years, but had no claims in the first year, would still need to be assigned a CRG (i.e., healthy) for the purpose of predicting

second year expenditures. Indeed, individuals who had no claims for the entire analysis time period, but who were eligible during the entire analysis period, must be included in the database. In all three databases, identifiers for individuals and providers were encrypted to ensure confidentiality.

### Medicare database

Data for the Medicare component of the analysis came from the Medicare Standard Analytical Files (SAF), which is a five percent sample of Medicare beneficiaries. The SAF contains all claims for the institutional components of inpatient care, outpatient care, hospice care, skilled nursing facility (SNF) and hospital outpatient care, as well as professional and ancillary claims. Eligibility information was available from a separate beneficiary file. All data were linkable at the beneficiary and provider level. Data from 1991 to 1994 were included in the analysis database. The criteria for inclusion in the analysis database were:

- Non-institutionalized
- Continuous Part A and Part B eligibility for the analysis period
- No HMO enrollment for the analysis period
- No indication of another primary or payer

Beneficiaries who are long-term institutionalized can exceed their lifetime Medicare benefits and therefore all their claims data may not be available. Continuous Part A and Part B coverage was required in order to insure that claims from all care settings were available. Beneficiaries enrolled in an HMO or with another primary payer may not have all their claims data available and were therefore excluded from the analysis. Beneficiaries who met the eligibility criteria but had no claims for the entire analysis period were included in the analysis.

The first three years of data were used in the development of the CRGs (i.e., 1991-1993) and the last three years of data (i.e., 1992-1994) were used to validate the CRGs. The criteria used for inclusion in the analysis were applied separately to each of the three year periods. In addition, in each of the three year periods, beneficiaries who died in the first two years of the period or were born in the last year of the period were excluded from the analysis. A total of 1,330,458 beneficiaries were included in the analysis database for the 1991-1993 period and 1,325,568 beneficiaries were included in the analysis database for the 1992-1994 period.

Submitted and paid charges were included in the Medicare database. Submitted charges are the actual charges submitted to Medicare by the provider. Paid charges are the charges actually paid by Medicare and exclude deductibles and coinsurance paid by the beneficiary. Medicare-paid charges also reflect geographic and other adjustments.

### Privately insured population data

Data for the privately insured population component of the analysis came from a commercial insurance database which included working individuals, retirees not yet Medicare eligible, and the dependents of both. The commercial insurance coverage included a full range of benefits which

were paid on a fee-for-service basis subject to network requirements. Complete eligibility information was available and all data was linkable for each eligible individual.

Data from 1992 to 1995 were included in the analysis database. The criteria used for inclusion in the analysis database were:

- Continuous eligibility for the analysis period
- No HMO enrollment for the analysis period
- No indication of another primary payer
- Age less than 65 years old for the analysis period

Individuals who met eligibility criteria but had no claims for the entire analysis period were included in the analysis. The first three years of data (i.e., 1992-1994) were used in the development of the CRGs and the last three years of data (i.e., 1993-1995) were available to validate the CRGs. The criteria used for inclusion in the analyses were applied separately to each of the three year periods. In addition, in each of the three year periods, individuals who died in the first two years of the period or were born in the last year of the period, were excluded from the analysis. A total of 253,116 individuals were included in the analysis database for the 1992-1994 period and 246,186 individuals were included in the analysis database for the 1993-1995 period. Both submitted and allowed charges were included in the database. Allowed charges are the charges approved for payment by the insurance carrier. Paid charges were not included in the database because they reflected negotiated discounts that were considered proprietary information.

### *Medicaid data*

The state of Washington Medicaid claims database was used for the Medicaid component of the analysis. Data from fiscal years 1992 and 1993 were included in the analysis database. Complete eligibility information was available and all data was linkable for each beneficiary. The Medicaid database presented a problem not encountered in either the Medicare or privately insured population database. Medicaid beneficiaries change eligibility status frequently. Thus, it was not feasible to restrict the criteria for inclusion in the analysis database to those beneficiaries who were continuously eligible for the entire two years. The criteria used for inclusion in the analysis database were:

- Non-institutionalized
- Not Medicare-Medicaid dually eligible
- Non-HMO enrollee
- Valid age for newborn and obstetric diagnoses to avoid co-mingling of claims for mothers and newborns at time of birth
- In addition, criteria were established to insure that only beneficiaries that had sufficient claims experience were included in the analysis database:
- Minimum eligibility for at least six months in both 1992 and 1993 except for newborns in 1992
- Newborns in 1992 were required to have at least two months eligibility in 1992

Medicare-Medicaid dually eligible individuals were excluded because all their claims data would not be included in the Medicaid database. A problem encountered in the Medicaid data related to the claims for newborns being reported with the identification number of the mother. Therefore, edits relating to diagnosis consistency with age were used to exclude beneficiaries with obstetrical care who potentially had co-mingled newborn claims. These exclusion criteria resulted in a somewhat higher proportion of female Medicaid beneficiaries being excluded from the analysis. Beneficiaries were required to have at least six months of eligibility in both 1992 and 1993. The one exception was newborns who were only required to have two months of eligibility in 1992 and six months in 1993 in order to be included in the analysis database. There were 242,816 Medicaid beneficiaries who were included in the analysis database. Two-thirds of the Medicaid beneficiaries were children and one-sixth were disabled. The measure of expenditures for analysis of the Washington Medicaid data was submitted charges. For recipients with less than 12 months of eligibility in 1993, the submitted charges were annualized based upon the beneficiaries' months of eligibility. An indication of whether an individual died was not present in the Medicaid database.

### *Continuing development of CRGs*

Since its development and initial release, the CRG software has been maintained and enhanced, including

- Adjustments to the clinical logic such as the reassignment of codes, changes in the assignment of severity of illness levels, the addition and deletion of groups, and other needed logic changes
- Addition of new diagnosis, procedure, and pharmacy/drug codes
- Addition of new features including the use of pharmacy data, alternative group assignments, and the ability to use selected international code sets

These changes have improved both clinical precision and statistical performance as well as CRG functionality. They have not altered the basic structure of the CRG algorithm and the philosophy inherent in its design.

## Development process

The development of the clinical logic of the CRGs was accomplished in four phases.

### **Phase 1: Development of Overall CRG Algorithm**

In Phase 1, the overall architecture of the CRGs was designed. Design decisions were formulated into an algorithm that constitutes the steps associated with the assignment of a CRG. The criteria for the design of the algorithm for assigning a CRG were strictly clinical. The focus was to create an algorithm that would permit conditional and complex clinical characteristics to be specified. The premise was that clinical characterization should be dependent on the nature and extent of an individual's underlying diseases. In particular, the ability to identify individuals with disease in multiple organ systems, along with an explicit specification of severity of illness was emphasized.

In essence, the CRG algorithm provides a means of combining detailed clinical distinctions into a meaningful overall clinical description. The diversity and complexity of the clinical issues required an algorithm that could reflect the unique clinical characteristics of each disease and each combination of diseases.

## Phase 2: Specification of the Clinical Parameters of the CRG Algorithm

Once the overall CRG algorithm was developed, the next step was to specify the actual clinical parameters by classifying diagnoses and procedures. For example, ICD-9 and ICD-10 disease codes were assigned to Major Diagnostic Categories (MDCs) and within each MDC to Episode Diagnostic Categories (EDC)s. Two separate clinical groups independently established the initial parameters for the CRG algorithm. The clinical research team at 3M Health Information Systems (3M HIS) focused primarily on the adult and elderly populations. The clinical team at the Childrens' Hospital Association (formerly known as NACHRI) focused on the pediatric population with a secondary focus on the Medicaid disabled population. The Childrens' Hospital Association group used a previously developed classification of congenital and chronic health as the starting point for their work.<sup>21</sup> Both groups made frequent use of additional clinical consultants. While there was ongoing communication between the two clinical groups and both clinical groups worked within the structure of the CRG algorithm, the development of clinical parameters was done relatively independently which provided cross-validation to the process. All decisions on code assignments were made on a clinical basis initially, without review of historical expenditure data. The assignment of diagnoses and procedures was based on their expected impact on an individual's future need for medical care, and their likelihood of debility and death.

## Phase 3: Review Clinical Parameterization of the CRG Algorithm with Historical Data

Based on the initial clinical parameterization of the CRG algorithm, the initial CRGs were assigned to the three analysis databases which covered three very distinct population groups. For Medicare and the employed population databases, the initial CRGs were assigned based on the first two years of data. Expenditures in the third year of data were used as a measure of the impact of specific clinical characteristics on the future healthcare needs of an individual. Since, in general, individuals with high healthcare expenditures have significant disease, third year expenditures were used as a proxy for the individual's clinical condition. The third year expenditures were for review purposes only. Final decisions were always clinical. For the Medicaid database, CRGs were assigned based on the first year of data, and expenditures in the second year were used as the measure of future healthcare needs.

Detailed CRG analysis reports were produced which examined the impact of a wide range of clinical characteristics on individuals with specific diseases and combinations of diseases. For example, the reports examined the impact on subsequent expenditures of the occurrence of pneumonia in an individual with emphysema. The impact of pneumonia was examined under various conditions, such as having occurred in the most recent six months, or having been reported multiple times over an extended period. The impact of pneumonia in an individual with both emphysema and congestive heart failure was examined separately. Thus, the reports were extremely detailed and examined almost every conceivable combination of diseases and disease conditions (e.g., occurring within most recent six months). Based on the initial review of the data,

the clinical parameterization of the CRG algorithm was modified, the CRGs were reassigned to the data, the CRG analysis reports were reproduced, and the CRG analysis reports were reviewed again. Thus, the process of finalizing the parameterization of the CRG algorithm was highly iterative. The complete process was repeated multiple times.

The review of the subsequent expenditures for specific clinical characteristics sometimes produced statistical results for which there was no clinical rationale. Statistical results that were clinically unreasonable were not used as a basis for modifying the parameterization of the CRG algorithm. If clinically unreasonable statistical results occurred with high frequency, additional confirmation was obtained from outside clinical experts in the specialty area. The 3M HIS clinical staff utilized data from the Medicare and employed population data, while the Childrens' Hospital Association clinical staff utilized data from the Medicaid and employed population data. The end result of the process was a clinical model that had been extensively reviewed with historical data.

#### **Phase 4: Integration of Parameterization of the CRG Algorithm**

Since 3M HIS and the Childrens' Hospital Association clinical staffs had parameterized the CRG algorithm relatively independently, there were differences between the two parameterizations (e.g., the severity level to which a particular clinical characteristic is assigned.) In Phase 4, a final unified parameterization of the CRG algorithm was developed through a consensus process between the two clinical staffs.

The final parameterization of the CRG algorithm that resulted from the four-phase process constitutes the full clinical logic of the CRGs. The four-phase process took 42 months to complete. Phase 1 required six months, Phase 2 required twelve months, Phase 3 required eighteen months and Phase 4 required six months. The iterative process of successive clinical evaluations of historical data was patterned after the process that was used in the original development of the DRGs.

## **Conclusion**

CRGs are risk groups that can be used as the basis of risk adjustment in a capitated payment system and also are sufficiently clinically precise that they can be used as a management tool for MCOs. The CRGs are a clinical model in which each individual is assigned to a single mutually exclusive risk group which relates the historical clinical and demographic characteristics of the individual to the amount and type of healthcare resources that individual will consume in the future. CRGs can be easily implemented, requiring only the data that are captured in routine transactions. Since the CRGs are clinically based, they create a language that links the clinical and financial aspects of care. Thus, CRGs are designed to serve as the foundation of management systems which support care pathways, product line management and case management.

The following chapters describe in detail how the classification system known as CRGs works.

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# Chapter 2: Overview of CRG software logic

Clinical Risk Groups (CRGs) are a management tool useful for prospective and retrospective applications. Using generally available data, CRGs assign each individual to a single severity adjusted category, the CRG. The assignment process is hierarchical with each individual being assigned to his or her CRG based on their most significant diagnosis or diagnoses. The process of identifying those diseases is conditional, relying on rules governing the presence and use of diagnoses, procedures, and demographic factors.

CRGs use readily available data that are routinely gathered as part of the processing of medical claims. Standard diagnostic and procedure coding systems are used. These include the International Classification of Diseases-9th and 10th Revisions-Clinical Modifications (ICD-9-CM and ICD-10-CM) for both diagnoses and procedures, the Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPCS) for procedures, and National Drug Codes (NDC). While these diagnoses and coding systems do not always include the clinical detail that might be desired, they do include extensive medical information especially when considered in entirety. In addition, what they lack in clinical precision is more than offset by their availability and accessibility.

Using these data, CRGs assign an individual to a single group, the CRG. With the exception of those CRGs which describe healthy individuals or individuals who only have acute problems, each chronic illness CRG incorporates severity of Illness Levels.

CRGs have four key features:

- Categorical Model. CRGs assign individuals to one and only one category. If multiple chronic diagnoses are present, they are addressed either through severity adjustment of the most significant diagnosis or through assignment to a CRG which includes multiple diagnoses.
- Severity Adjusted. All chronic diagnosis CRGs are severity adjusted and reflect the extent and progression of the diagnosis or diagnoses.
- Hierarchical. All CRG assignments rely on hierarchical decisions. This assures that criteria are consistently applied.
- Conditional. CRGs make extensive use of conditional relationships between and among diagnoses and procedures. This permits the recognition of precise clinical relationships.

CRG assignment occurs in five phases:

- Phase 1 creates a profile of the individual's past medical history.
- Phase 2 identifies the individual's most significant chronic diseases (if any) and the relative severity of the most significant chronic diseases.
- Phase 3 assigns the individual's risk group and severity level (i.e., the CRG).
- Phase 4 assigns the individual to aggregated risk groups.
- Phase 5 assigns the individual to alternative risks, optimized for prospective and retrospective applications.

## Overview of CRG software logic

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The five phases are summarized in the following table.

Phase	Description
Phase 1	<p>Creation of a Disease Profile and History of Past Medical Interventions:</p> <p>Pharmaceutical data, if available, are converted into diagnoses and procedures. Using clinical inferences based on the combinations of drugs, patterns of usage, and demographic criteria.</p> <p>Diagnosis codes are categorized into mutually exclusive categories called Major Diagnostic Categories (MDCs) depending on the organ system or etiology of the disease.</p> <p>Diagnosis codes in each MDC are further categorized into mutually exclusive Episode Diagnostic Categories (EDCs).</p> <p>Procedure codes (optional) are categorized into mutually exclusive categories called Episode Procedure Categories (EPCs).</p> <p>Some EDCs and EPCs conditionally create additional EDCs.</p> <p>After all EDCs and EPCs have been created, some EDCs and EPCs are eliminated at this point based on temporal relationships with other EDCs or EPCs.</p> <p>At the end of Phase 1, the disease profile and history of past medical interventions of an individual is described by a list of EDCs and EPCs.</p>
Phase 2	<p>Selection of Primary Chronic Disease(s) and Assigning Severity Levels:</p> <p>The EDC that represents the most significant chronic disease under active treatment, referred to as the primary chronic disease (PCD), is identified for each organ system and etiology (i.e., MDC).</p> <p>The PCD from each MDC is then assigned a Severity of Illness Level.</p> <p>At the end of Phase 2, the most significant chronic diseases (if any) and their associated severity levels are identified.</p>
Phase 3	<p>Determination of Base CRG and Severity Level for the individual:</p> <p>Based on the individual's PCDs and their associated severity levels, acute EDCs, and EPCs the individual is assigned to one of nine statuses.</p> <p>Each status is further subdivided into mutually exclusive base CRGs.</p> <p>The base CRG is selected hierarchically using the individual's PCDs, acute EDCs, and EPCs.</p> <p>The individual is assigned a Severity of Illness Level.</p> <p>The combination of the base CRG and the Severity of Illness Level constitute the individual's CRG.</p> <p>At the end of Phase 3, the individual is assigned to a CRG.</p>
Phase 4	<p>Consolidation of CRGs into Three Successive Tiers of Aggregation:</p> <p>CRGs are consolidated into three tiers of aggregation.</p> <p>Each successive tier has fewer base CRGs but maintains the severity level.</p> <p>The aggregated CRGs are referred to as ACRGs and the successive tiers of aggregation are referred to as ACRG1, ACRG2 and ACRG3.</p> <p>At the end of Phase 4, the individual has been assigned an ACRG1, ACRG2, and ACRG3.</p>

Phase	Description
Phase 5	<p>Assign Alternative Risk Groups:</p> <p>Two, alternative CRG models are created.</p> <p>One, the PCRGs is optimized for prospective applications.</p> <p>The other, the QCRG, is optimized for retrospective or concurrent applications.</p> <p>These models take the standard CRG model and where appropriate assign individuals to different groups using data not considered by the standard CRG model.</p> <p>Like the CRGs, both of these models are consolidated into three tiers of aggregation.</p> <p>At the end of Phase 5, the individual has been assigned a PCRG and QCRG with their respective aggregated groups.</p>

## Phase 1 – Creating the health profile

The first phase of CRGs creates the disease profile and history of past medical interventions for the individual. To create this disease profile and history of past medical interventions, CRGs, and for that matter all patient classification systems, must address the volume of data and data quality while retaining clinically meaningful information without being influenced by variations in practice patterns and data processing systems. The CRG disease profile and history of past medical interventions is created in four steps. Step 1 converts pharmaceutical data into diagnoses and procedures. Step 2 creates diagnostic and procedural categories. Step 3 conditionally creates additional diagnostic categories. Step 4 eliminates diagnostic and procedural categories using temporal relationships with other diagnosis and procedure categories.

### Step 1: Conversion of pharmaceutical data to diagnoses and procedures

Using rules based on the drug or combinations of drugs, pattern of prescription pharmaceutical use and demographic characteristics, the CRGs identify the most likely condition or conditions under treatment. These data are then made available for group assignment. However, it should be noted that not all drugs are used as many cannot be linked to a specific disease with any degree of confidence. For example, with the exception of women with gestational diabetes, anyone receiving insulin almost certainly is a diabetic even if this is not confirmed with an independent diagnosis. Therefore, a diagnosis of diabetes is assigned, except for women of child bearing age unless they are receiving other diabetes specific medications. On the other hand, albuterol is a common drug given for asthma and other pulmonary problems. An isolated prescription for albuterol may be given for asthma but it may also be used for bronchospasms or if asthma is suspected. Therefore it is not definitive. To assign asthma, the CRG logic looks for a sustained pattern of use.

## Step 2: Initial categorization of diagnoses and procedures

### *Diagnoses*

Each diagnosis is placed into a Major Diagnostic Category (MDC). There is an MDC for every body system, selected disease etiologies, and specified catastrophic conditions. Within each MDC, diagnoses are assigned to Episode Diagnostic Categories (EDC). There are six types of EDCs:

- Dominant Chronic EDCs. Serious lifelong chronic diseases, which often result in the progressive deterioration of an individual's health, and often times lead to or significantly contribute to an individual's debility, death, or future need for medical care, are classified as Dominant Chronic EDCs. Cerebral palsy, congestive heart failure, diabetes, and schizophrenia are examples of Dominant Chronic EDCs.
- Moderate Chronic EDCs. Serious chronic diseases, which usually do not result in the progressive deterioration of an individual's health, but can significantly contribute to an individual's debility, death, or future need for medical care, are classified as Moderate Chronic EDCs. Moderate Chronic EDCs are very variable in their severity and progression. Asthma, epilepsy, and bipolar disorder are examples of Moderate Chronic EDCs.
- Minor Chronic EDCs. Chronic diseases that can usually be managed effectively throughout an individual's life with typically few complications and limited effect upon an individual's debility, death, or future need for medical care, though they may be serious in their advanced stages or may be precursors to more serious diseases, are classified as Minor Chronic EDCs. Migraines and hyperlipidemia are examples of minor chronic EDCs.
- Chronic Manifestation EDCs. A Chronic Manifestation EDC is a manifestation or acute exacerbation of an underlying chronic disease and identifies both the exacerbation and the illness. Chronic Manifestation EDCs are also used to identify uncommon but distinct diseases within more frequently occurring EDCs. A Chronic Manifestation EDC may be used to determine the severity level of the EDC. Status asthmaticus and diabetic retinopathy are examples of Chronic Manifestation EDCs.
- Significant Acute EDCs. Significant acute illnesses can be a precursor to, or place the individual at risk for, the development of chronic illness, and can potentially result in significant sequelae, or can indicate the presence of yet to be diagnosed chronic illnesses. In the CRG logic, an acute illness is only classified as a significant acute illness if it occurred in the most recent six month period. Tachycardia and acute pancreatitis are examples of Significant Acute EDCs.
- Minor Acute EDCs. Minor acute illnesses, or events that may be mild or more serious but are self limiting, are not a precursor to chronic disease, do not place the individual at risk for the development of chronic disease, and should not result in significant sequelae. Upper respiratory infections and minor fractures are examples of Minor Acute EDCs.

MDCs are placed into a hierarchy of MDCs for later use. Similarly, within each MDC, the chronic EDCs are also placed into a hierarchy. This hierarchy always places Dominant Chronic EDCs higher than Moderate Chronic EDCs which in turn are higher than Minor Chronic EDCs.

The fact that an EDC is assigned, does not mean that an EDC will be used in the assignment for CRGs. Apart from the clinical relevance of a particular diagnosis, all diagnoses are subject to three edits in order to be considered.

1. In order to minimize the effects of poor coding and diagnostic visits, outpatient diagnoses and physician submitted diagnoses for inpatient care are not used unless they are recorded on two separate days.
2. Diagnoses from ancillary service providers such as ambulance companies, freestanding laboratories, pharmacies, etc. are ignored.
3. Diagnoses are also excluded from the analysis if they fall before or after the "to" and "from" dates which must be set in order to run the software. They are also excluded if they are fall outside the maximum age acceptable for the EDC.

If a diagnosis, or more correctly an EDC fails these edits, the EDC will not be used to assign the CRG. A review of the CRG output will identify which criterium or criteria it failed to meet. It may still be available for use in Phase 5 where two alternative models are created.

#### *Procedures*

Each procedure is placed into an Episode Procedure Category (EPC). It should be noted that EPCs play a limited role in CRGs and are used selectively. All EPCs, however, are available for management reporting.

### **Step 3: Conditional creation of additional diagnosis categories**

After all diagnoses and procedures have been categorized into EDCs and EPCs, selected EDCs and EPCs are used to create additional EDCs as clinically appropriate. The creation of EDCs is a conditional process expressed with a set of explicitly defined rules based on five attributes. These attributes are either expressed individually or in combination with one another. The five attributes are:

1. Recency of occurrence
2. Site of occurrence
3. Recurrence or persistence over time
4. Age of the enrollee
5. Combinations of diagnoses in the individual's history

Recency is used widely in CRGs. The use of recency of occurrence can be seen in chemotherapy. For an individual with a malignancy, a history of chemotherapy in and of itself is not significant. However, if that history is in the most recent six months, it is significant as it indicates on-going therapy, and a yet to be resolved malignancy.

Rules using the site of occurrence are used infrequently in CRGs. It is used for only two purposes. Primarily, it is used to differentiate levels of severity. For example, an individual with schizophrenia who has been hospitalized for schizophrenia or some other mental disease, is assigned a higher severity level, all else being equal, than an individual with comparable diagnoses but no hospitalizations. Its other use is to help identify the most significant chronic EDC in an MDC when there is more than a single chronic EDC present and they have comparable clinical significance.

Recurrence or persistence over time is used extensively in CRGs. For example, a minor infection successfully treated over a short period usually has limited long term implications. If, however, a minor infection recurs or persists over an extended period, it indicates the individual is in poor health and prone to infections in the future.

Excluding the pharmacy logic where both age and sex are widely used, CRGs make limited and selective use of age. Age is used only to distinguish neonatal from non-neonatal, pediatric from non-pediatric, and geriatric from non-geriatric interpretations of diagnoses.

#### **Step 4: Conditional elimination of diagnosis and procedure categories**

Some EDCs and EPCs are eliminated based on temporal relationships with another EDC or EPC. There are some instances where a procedure may resolve, albeit temporarily, a chronic condition. In addition, the significance of some EDCs is very different if it is a second acute event rather than the first.

### **Phase 2 – Primary chronic disease selection and severity assignment**

In Phase 2, the EDC that represents the most significant chronic disease under active treatment, referred to as the primary chronic disease (PCD), is identified for each organ system or etiology (i.e., MDC). The PCD from each MDC is then assigned a Severity of Illness Level.

The first step in Phase 2 is to eliminate from consideration as a PCD those chronic EDCs that are secondary to another chronic EDC. While any chronic EDC is a potential PCD, under certain circumstances, namely the presence of another chronic EDC which is the probable cause of the first EDC, a chronic EDC may not be allowed to be a PCD. For example, if an individual with diabetes also has nephritis, the nephritis would not be considered for PCD selection as it, in all likelihood, is caused by the diabetes. The first step in PCD selection is the exclusion of these EDCs from PCD selection.

The second step in Phase 2 is the selection of a PCD for each MDC and the assignment of a severity level. Of course, if there are no eligible chronic EDCs, there will be no PCD. PCD selection is a two part process. The first part is the selection of the PCD. The second part is the assignment of Severity of Illness Level for the PCD. PCDs are selected one at a time. After one is selected and assigned a severity level, another chronic EDC from a different MDC is selected as a PCD for its MDC, assuming one is present and eligible for selection.

#### **PCD selection**

PCD selection is done in order of EDC type (Dominant Chronic, Moderate Chronic, and Minor Chronic). Within each EDC type, the process is done by MDC rank order. Only one PCD can be selected per MDC. Eligible Dominant Chronic EDCs are always selected over eligible Moderate

and Minor Chronic EDCs. Similarly, eligible Moderate Chronic EDCs are always selected over eligible Minor Chronic EDCs. If, within an MDC, more than one EDC can be selected as a PCD, a PCD selection hierarchy based on recency, site of diagnosis, recurrence of diagnosis, and the MDC's EDC hierarchy is used. Once a PCD has been selected for an MDC, all other chronic EDCs in that MDC become ineligible for selection as a PCD.

After the first PCD has been selected and assigned its severity level, the next PCD is assigned, assuming, of course, that there is an additional chronic illness which has not been excluded from the PCD selection process. As pointed out earlier, once a PCD for an MDC has been selected, all other chronic EDCs in that MDC become ineligible for selection. In addition, if a chronic EDC is used in assigning a severity level to a PCD, it also becomes ineligible for PCD selection. This process continues until all chronic EDCs have either been selected as PCDs or excluded from the PCD selection process.

## PCD severity leveling

After a PCD for an MDC has been selected, it is assigned a severity level. Dominant and Moderate Chronic PCDs have four levels. Minor Chronic PCDs have two levels. Moderate chronic malignancy PCDs also have two levels as their more advanced stages are assigned through a separate severity leveling process. Similarly, severity levels for dominant chronic malignancies and chronic EDCs in the catastrophic MDCs are assigned through a separate severity leveling process.

The severity level describes the extent and progression of the disease selected as the PCD. A high level of severity is indicative of a more advanced stage of clinical illness and a need for relatively more future medical care. The assignment of the severity level is specific to each PCD and takes into account factors associated with more severe or advanced forms of the disease.

Individual EDCs and EPCs may be used by the severity leveling algorithm to assign a severity level to multiple PCDs in different MDCs. In order to avoid double counting, the process of PCD selection is hierarchical. Once an EDC or EPC is used to assign a severity level to a PCD it cannot be used by another PCD. In addition, any chronic illness used to assign a severity level cannot be selected as a PCD.

## Phase 3 – CRG selection and severity level assignment

At the end of Phase 2, all PCDs have been identified and assigned a severity level. The next step is the assignment of the status. Status assignment is based on PCDs with their associated severity levels and EDCs and EPCs. There are nine statuses.

Status is assigned hierarchically starting with most serious status, catastrophic, and going to the least serious, healthy. Individuals are assigned to the highest status for which they satisfy the specified criteria. If they do not meet the criteria for selection in a given status and group within that status, they are passed by the CRG logic to the next status for consideration. This occurs until they meet the criteria for selection.

Each status is further subdivided into mutually exclusive categories called base CRGs. Like the status, the base CRG is selected using the individual's PCDs and EDCs and EPCs.

If there is a chronic condition (i.e., any status other than Status 1 or Status 2), an overall severity level is assigned to the base CRG. The method of assigning the severity level varies by status.

The nine statuses and how their severity levels are determined can be seen in the following table.

### **CRG Status and the Determination of Severity Levels in Order of Assignment**

Status	Description
Status 9	<p>Catastrophic Conditions:</p> <p>Catastrophic conditions include long term dependency on a medical technology (e.g., dialysis, respirator, and TPN) and life-defining chronic diseases or conditions that dominate the medical care required (e.g., persistent vegetative state, cystic fibrosis, AIDS, and history of heart transplant).</p> <p>The severity level for Status 9, Catastrophic Conditions, is based on the presence of specific EDCs or EPCs that meet explicit conditions.</p>
Status 8	<p>Dominant, Metastatic and Complicated Malignancies:</p> <p>A malignancy that dominates the medical care required (e.g., brain malignancy) or a nondominant malignancy (e.g., prostate malignancy) that is metastatic or complicated (e.g., requiring a bone marrow transplant).</p> <p>The severity level for Status 8, Dominant, Metastatic and Complicated Malignancies, is set in three steps. The first step, setting the initial level, is designed to reflect the total burden of illness including both malignancy and non-malignancy related illnesses. The initial severity level is the higher of the two levels, with one based on the presence of non-malignancy PCDs and the other based on specified malignancy related complications and metastases. The next step adjusts the initial severity level if specific EDCs or EPCs are present and meet explicit conditions. The final step converts the interim severity level to the final severity level based on malignancy related conditions and metastases.</p>
Status 7	<p>Dominant Chronic Disease in Three or More Organ Systems:</p> <p>Dominant chronic disease in three or more organ systems is identified by the presence of three or more dominant chronic PCDs or two dominant chronic PCDs with a selected moderate chronic PCD.</p> <p>The severity level for Status 7, Dominant Chronic Disease in Three or More Organ Systems, is determined by establishing an initial severity level based on the severity levels of the three PCDs which form the base CRG. The initial severity is adjusted to determine a final severity level if specific EDCs or EPCs are present and meet explicit conditions (rules).</p>
Status 6	<p>Significant Chronic Disease in Multiple Organ Systems:</p> <p>Significant chronic diseases in multiple organ systems are identified by the presence of two or more PCDs, of which at least one is a Dominant or Moderate Chronic PCD. PCDs that are a severity level 1 minor chronic disease are not considered a significant chronic disease, and are not used to identify the presence of significant chronic disease in multiple organ systems. Minor Chronic PCDs that are severity level 2 minor chronic diseases are used.</p> <p>The severity level for Status 6, Significant Chronic Disease in Multiple Organ Systems, is determined by using the severity level of the two PCDs which form the basis of the base CRG to assign an initial severity level. The initial level takes into account the possibility that the two PCDs are of disparate importance. The initial severity is adjusted to determine a final severity level if specified EDCs or EPCs are present and meet explicit conditions (rules).</p>
Status 5	<p>Single Dominant or Moderate Chronic Disease:</p> <p>Single dominant chronic disease is identified by the presence of a single dominant or moderate PCD. If a Minor Chronic PCD with a level of 1 is present, it is ignored.</p> <p>The severity level for Status 5 Single Dominant or Moderate Chronic Disease is the PCD severity level.</p>

Status	Description
Status 4	<p>Minor Chronic Disease in Multiple Organ Systems:</p> <p>Minor chronic disease in multiple organ systems is identified by the presence of two or more Minor Chronic PCDs.</p> <p>The severity level for status 4, Minor Chronic Disease in Multiple Organ Systems, is based on the number of Minor Chronic PCDs and their severity levels.</p>
Status 3	<p>Single Minor Chronic Disease:</p> <p>A single minor chronic disease is identified by the presence of a single Minor Chronic PCD.</p> <p>The severity level for Status 3, Single Minor Chronic Disease, is the PCD severity level.</p>
Status 2	<p>History of Significant Acute Disease:</p> <p>A history of significant acute disease is identified by the presence within the most recent six month period of one or more Significant Acute EDCs or one of a set of Significant Acute EPCs with no PCDs (i.e., identifiable chronic conditions) present.</p> <p>There are no severity levels.</p>
Status 1	<p>Healthy:</p> <p>A healthy status is identified by the absence of any PCDs or Significant Acute EDCs or EPCs.</p> <p>There are no severity levels.</p>

## Phase 4 – ACRGs

The full CRG model may not be appropriate for all purposes or situations. Depending on the specific intended application and the size of the population, the user may need to work with fewer groups. There is a recommended approach generated by the CRG software. The user is free to develop his or her own consolidation algorithm.

CRGs are consolidated into three tiers of aggregation referred to as Aggregated Clinical Risk Groups (ACRGs). The three successive tiers of aggregation are referred to as ACRG1, ACRG2 and ACRG3, with ACRG3 being the highest level of aggregation, consisting of severity adjusted statuses. Each successive tier maintains status and severity levels while reducing the number of groups and, where appropriate, adjusting severity levels. Although the aggregation of CRGs reduces clinical precision, the aggregation into ACRGs maintains clinical meaningfulness. The ACRGs take into consideration the future medical care needs and clinical similarity of the individuals assigned to the Aggregated CRGs.

## Phase 5 – Alternative risk models

The standard CRG model does not use all the information available to it. As discussed earlier, whether or not an EDC is used when assigning the CRG depends on several factors, such as internal validation criteria. While this additional information is not used to assign the CRG, it is available. Some of this information can be useful.

The assignment of the standard CRG groups is a function of chronic illness that is, modified by acute illness and procedures. Individuals without validated evidence of chronic illness are assigned to Status 1 (Healthy) or Status 2 (Significant Acute). The preference given to chronic illness can be overstated in concurrent or retrospective analyses where an individual's health care utilization may be a function of some acute occurrence, e.g., delivery or trauma, rather than a chronic illness. In addition, the absence of validated evidence of a chronic illness does not necessarily mean that the illness is not present. The validation process, while it eliminates problems such as data entry errors and "rule-out" codes, also excludes people with chronic conditions that do not meet its criteria, limited as they are. For example, how should a single outpatient diagnosis of diabetes be interpreted? An isolated diagnosis is quite possibly an incorrect diagnosis that can be attributed to a "rule-out" or a data entry error. But, it might also be an accurate diagnosis. The individual's diabetes may be under control and require only infrequent contacts with health care providers. Alternatively, the diabetes diagnosis could be so recent that there may not have been sufficient time for the second visit to occur, which would validate the diagnosis. Another good example is a single outpatient diagnosis of a cerebrovascular infarction. At the time it occurs a cerebrovascular infarction can be reasonably expected to require a hospitalization and be reported on multiple occasions. An isolated diagnosis may reflect a follow-up to an earlier event, a "rule-out", or a simple coding error. The presence of either of these diagnoses, as well as diagnoses for other chronic and acute conditions, can be used to distinguish between people who are healthy with no evidence of a significant chronic illness or other medical condition and people who are assigned to the healthy group with some evidence of chronic illness, an acute disease, or condition that will require active medical intervention such as pregnancy or trauma.

To make use of these data, two alternative sets of CRG assignments have been created. One is intended for prospective applications and the other is intended for retrospective or concurrent applications. To differentiate these from the standard model, the prospective CRGs are referred to as the PCRGs and the concurrent model is referred to as the QCRGs. The P and Q identify the output record of each of the models.

Like the standard model, the PCRGs and QCRGs can be consolidated into three tiers of aggregations, the equivalent to ACRG1, ACRG2, and ACRG3.

## Conclusion

CRGs are significantly more complex in construction than other currently available population based classification systems. Other classification systems do not take into account the severity of illness within a chronic illness category. Nor, do they assign individuals with multiple co-morbidities to a single clinically defined group. Addressing the severity of illness and the interactions of co-morbidities is necessary for the evaluation of those relatively small numbers of patients who consume a disproportionate share of resources. Without comprehension of the severity of illness of these individuals and the impact of their co-morbidities, disease management is seriously handicapped.

To facilitate the use of CRGs, this definitions manual is provided. It allows the user to completely understand all aspects of the CRG logic. Different members of the clinical team will be interested in various aspects of CRG construction. It is important to provide a complete description of CRG logic for all members of the health care team.

It must be emphasized that the clinical complexity of CRGs is completely transparent for the software user. Each individual is assigned to one and only one CRG.

CRGs are an ongoing project. Future versions of CRGs will see the continuing refinement of the current model and the incorporation of more clinical indicators, such as laboratory values.



# Chapter 3: CRG software logic

The 3M™ Clinical Risk Group (CRG) clinical logic assigns each individual to a single mutually exclusive severity adjusted group, the CRG. The CRG clinical logic relies on hierarchy and conditionality to identify the most clinical relevant factors needed to assign the CRG. The CRG clinical logic is implemented in five phases.

## Hierarchy and conditionality

The assignment of a CRG requires provision for the correct classification of large and variable amounts of data across many different contexts. Key to this process is the ability to manage diagnostic data in such a way as to be sensitive to the fact that the significance of diagnoses varies by context. Therefore, the process of assigning a CRG is built upon hierarchical and conditional relationships which allow the use of context specific clinical judgments.

### Hierarchy

Hierarchy is key to the assignment of the CRG and its component parts. The assignment process is hierarchical. Hierarchy is implicit in the categorizations used by CRGs. It allows for the assignment of the CRG to be based on the individual's most significant diagnoses when there are multiple diagnoses. For example, there are three types of chronic Episode Diagnostic Categories (EDC) which can be chosen as the Primary Chronic Disease (PCD) of a Major Diagnostic Category (MDC): Dominant Chronic, Moderate Chronic, and Minor Chronic EDCs. Within each MDC, these three types are further refined by the assignment of a rank which identifies the most clinically significant EDC. The EDC type and the ranks facilitate the choice of the PCD for an MDC by assuring that the most significant EDC type will always be chosen. When there is more than one of that type, all else being equal, the most clinically significant of that EDC types will always be chosen.

### Conditionality

An essential component of the assignment of an individual to a CRG is conditional relationships between diagnoses, procedures and other patient characteristics (e.g., age). These relationships are referred to as rules. Sixty-six rules have been specified, although a few them are not used in the current version of CRGs.

Rules are based on five attributes. These attributes are either expressed individually or in combination with one another. The five attributes are:

1. Recency of occurrence
2. Site of occurrence
3. Recurrence or persistence over time

4. Demographic characteristics of the enrollee
5. Combinations of diagnoses in the individual's history

CRGs, when appropriate, place greater significance on more recent diagnoses and procedures. This is most often reflected in the severity leveling where, recency (e.g., a diagnosis or procedure being reported in the most recent six-month period) is used to assign a higher severity level than when the same diagnosis or procedure occurred prior to that period. For example, in severity leveling of malignancies, chemotherapy and radiation therapy are only used if they occurred in the most recent six month period, indicating active treatment.

CRGs make selective use of the site of service in classifying diagnoses. It is used for only three purposes:

1. The most important use of site of service is as a method to validate data. Diagnoses from outpatient settings, with a few exceptions, are required to be reported on two different days in order to minimize false positives stemming from "rule outs" and the less than rigorous coding often found in such settings. Data from inpatient facilities, on the other hand, need only be reported once.
2. Another use of site of service is the assignment of severity levels. For example, an individual with schizophrenia, who has been hospitalized for schizophrenia or some other mental disease, is assigned a higher severity level, all else being equal, than an individual with comparable diagnoses but no hospitalizations.
3. The other use of site of service is to facilitate the identification of the PCD when more than one chronic disease from the same MDC is present. Rules specifying an inpatient site of service, with one exception, require a diagnosis to be a principal diagnosis (PDX).

When site specifications are applied to procedures, the procedure is treated as a PDX even if a PDX is already present. This satisfies rule requirements for a PDX. For example, if a patient is admitted to a hospital with a PDX of renal failure and has a kidney transplant, both the renal failure and kidney transplant (which creates a diagnostic category called History of Kidney Transplant) are assumed to be a PDX for that admission.

CRGs make use of recurrence or persistence over time. Where appropriate, diagnoses and procedures are given more significance if their first and last occurrence is separated by a minimum specified period of time called a span. Recurrence and persistence are used to distinguish between chronic and acute conditions and for severity leveling. A variant of this concept, the break, is used to identify malignancy complications where treatment resumes after an extended period of time without treatment indicating a recurrence of the malignancy.

Apart from the pharmaceutical logic, CRGs make limited and selective use of demographic characteristics. Age is used only to distinguish neonatal from non-neonatal, pediatric from non-pediatric, and geriatric from non-geriatric interpretations of diagnoses. Sex and age are used primarily in conjunction with pharmaceutical data.

It is important to note that CRGs do not count the number of reported diagnoses beyond some simple edits and to the very limited extent needed to satisfy span and break rules. To do so would result in giving undue significance to factors such as variations in claim processing, practice patterns, etc., where healthcare providers might treat and report identical illnesses differently.

Appendix A.1 provides a complete list of the rules with a full set of specifications.

## Assigning the Clinical Risk Group

Every individual is assigned a single CRG in a five phase process. The first three phases assigns the CRG and the last two phases offer a consolidation algorithm and a pair of alternative models.

- Phase 1: A disease profile and history of past medical interventions is created. This profile consists of a set of diagnosis and procedural categories called Episode Diagnostic Categories (EDCs) and Episode Procedure Categories (EPCs).
- Phase 2: For each organ system, the most significant chronic disease under active treatment, the Primary Chronic Disease (PCD), is identified and the severity of illness level of the PCD is determined.
- Phase 3: The PCDs and associated severity of illness level along with the presence of other EDCs or EPCs are used to select the individual's base CRG and assign the severity of illness level.
- Phase 4: CRGs are consolidated into three successive tiers of aggregation called Aggregated Clinical Risk Groups (ACRGs).
- Phase 5: Alternative risk adjustment models for prospective and concurrent/retrospective applications are assigned.

### Phase 1: Creation of a disease profile and history of past medical interventions

CRGs use diagnostic, procedure, and pharmaceutical data. These data can be obtained from a variety of sources such claim records submitted for payment or some other extract of medical records. Any source of data (e.g., health surveys) can be used as long it contains the requisite information. These records can include data reported from many encounters over an extended period of time.

The objective of the first phase in CRG assignment is to reduce the level of detail in the data by classifying diagnoses and procedures into clinically meaningful categories. There are five steps in this process:

1. Pharmaceutical codes are assigned diagnoses or procedures based on the most likely disease under treatment or procedure being performed.
2. MDCs are defined and assigned diagnoses which are mapped into diagnosis categories.
3. Procedures are mapped into procedure categories.
4. Diagnoses and procedures, under certain circumstances, are used to create additional diagnosis categories.
5. Specific diagnoses and procedure categories are eliminated based on the presence of other diagnosis or procedure categories, and the sequence in which the encounter occurred relative to those other diagnosis and procedure categories.

At the completion of Phase 1, a complete list of diagnoses and procedure categories describing the individual's history of diagnoses and past medical interventions is created.

## Step 1: Identifying diagnosis and procedure codes from pharmaceutical data

Starting with Version 1.5, CRGs can use pharmaceutical data. Using rules based on the drug or combinations of drugs, pattern of prescription pharmaceutical use and demographic characteristics, the CRGs identify the most likely condition or conditions under treatment.

In order to identify the likely diagnosis under treatment, the CRGs analyze drug utilization in terms of either individual drugs or in combinations of two or three different drugs. This is refined, as appropriate, by the use of demographic factors, patterns of recurrent or persistent use, and how the drug is taken (mode of administration). For example:

- It is reasonable to assume that any person with a prescription for insulin is a diabetic. Therefore, any use of insulin within the last year, with the exception of women who might have been treated for gestational diabetes, will result in the assignment of diabetes.
- A drug such as nafarelin acetate (Synarel) is used primarily to treat endometriosis and early puberty. If it is given to an adult female, it is most likely that it is the former diagnosis. And, if it is prescribed for child, it likely that latter diagnosis. If, however, it is given to an adult male, a diagnosis of endometriosis is impossible. For men it is most likely being prescribed, albeit off-label, for benign prostatic hyperplasia (BPH).
- Drug patterns over time are also considered by the CRG logic. For example, diazepam is an anti-anxiety drug that is frequently prescribed for people undergoing stressful periods in their lives such as the death of a loved one, family dissolution, etc. A prescription or two within a limited period for diazepam cannot be considered indicative of any health problem. If, on the other hand, there are repeated prescriptions for diazepam over a period of at least six months in the course of a year, it is likely the individual's problems are of a more serious nature. Therefore it is reasonable to assign a diagnosis of acute stress and anxiety.
- Drugs may also have different applications based on their mode of administration. For example, beta blockers, typically used to treat hypertension if taken orally, are used to treat glaucoma if in taken in eye drop form. For another example, some chemotherapeutic drugs are used in extremely dilute formulations to treat skin problems with topical applications.

The CRG logic does not make use of all drugs. Numerous drugs have many clinical applications, may be clinically non-specific, or may simply be used to relieve non-disease specific symptoms. Therefore, they cannot be linked to any single diagnosis with any degree of confidence. Conversely, not every diagnosis can be identified by a drug therapy.

The CRG logic, with the exception of immunizations, uses only data incurred within one year of the ending date of the period specified by the user or data falling between the start date and the end date if that period is less than a year. Data from claims incurred before or after that period are ignored. Drugs that are not used in the logic, as well drugs with codes that are not recognized, are also ignored.

To make use of pharmaceutical data, CRGs use the eleven digit industry standard, National Drug Code (NDC). Each NDC can be linked to its active ingredient or ingredients. Where appropriate these ingredients are refined by mode of administration (e.g., oral versus topical) or can be

combined into broader drug classes (e.g., insulins or beta blockers) based on clinical application and similarity. Drugs can be assigned to multiple classes. These ingredients or classes are then used, alone or in combination, in conjunction with rules to assign diagnoses and procedure categories (EDCs and EPCs). It does this by creating records with diagnoses or procedure records to run within the standard CRG software. The assignment of diagnoses and procedures is done in the order of the CRG EDC hierarchy which will be discussed later. Procedures are assigned prior to diagnoses. Since treatment is considered proof of illness, all diagnoses created from pharmaceutical data are considered valid (i.e., not subject to CRG edits rules which require validation of outpatient diagnoses).

Appendix B.1 identifies all drugs and their classes used by CRGs. Classes are displayed on the top line and drugs in the left most columns. If a drug is identified as a chemotherapeutic drug, it creates two diagnoses, one for the malignancy being treated and the other for chemotherapy.

Appendix B.1.2 identifies the drug combinations and rules used to create EDCs and EPCs. Once a rule has been satisfied, any drug which may be used to satisfy any rule for that EDC is assigned.

## Step 2: Mapping diagnosis codes

### *Diagnoses*

The International Classification of Diseases (ICD-9-CM and ICD-10-CM) is used to code not only diseases, but also signs, symptoms, findings and other factors influencing health status. There were more than 14,000 valid codes in the year 2010 version of ICD-9-CM (hereafter referred to as disease codes). Codes are added and deleted on a regular basis. In order to facilitate the use of codes from extended periods of time, the CRG diagnosis tables include historical codes and specified short codes. If a code is revised or deleted and later reinstated, decisions about the use of that code are based on the latest definition. Starting with Version 1.8 functional status EDCs have been added to CRGs. These EDCs are numbered 900–917. As there are no standard functional status codes, codes were created using item reference numbers in the Outcomes and Assessment Information Set (OASIS).

Each disease code is categorized into one of a set of mutually exclusive and exhaustive categories called MDCs. The diseases in each MDC correspond to a single organ system (e.g., respiratory system, digestive system, etc.) or etiology (e.g., malignancies, systemic infectious diseases, etc.). With the exception of malignancies, specific catastrophic conditions, and certain types of trauma, which are assigned to their own MDCs, diseases that include both a particular organ system and a particular etiology (e.g., urinary tract infection) are assigned to the MDC corresponding to the organ system involved. Systemic infectious diseases such as tuberculosis are assigned to the systemic infections disease MDC.

There are 37 MDCs. Five of the MDCs are used for catastrophic conditions. Three are used for malignancies. The other 29 are used for distinct organ systems or etiologies.

Appendix B.2.1.1 lists the MDCs in numerical order and identifies their rank order. MDCs are also assigned a rank which is used to determine the order of PCD processing, the purpose of which will be discussed later.

The MDCs are further subdivided into EDCs. There are 557 mutually exclusive and exhaustive EDCs. Each EDC is classified as one of six EDC types. Four of the EDC types are for chronic diseases and two of the EDC types are for acute diseases. A disease is classified as chronic if the duration of the disease is lifelong (e.g., diabetes) or prolonged (i.e., the disease or its sequelae lasting 12 months or longer). Diseases which have a prolonged duration for which a cure (i.e., no evidence of the disease) is possible are considered chronic (e.g., malignancies). Lifelong or prolonged diseases controlled by medication or other means (e.g., hypertension) are also considered chronic. However, lifelong conditions which require minimal or no care (e.g., color blindness or myopia) are not considered chronic. In addition, the inclusion of the word chronic in the description of a diagnosis code by itself does not identify a chronic condition for CRGs (e.g., chronic otitis media). A disease is classified as acute if the duration of the disease is short and the disease would naturally resolve (e.g., pneumonia) or a treatment exists which cures the disease (e.g., a fractured leg). Signs, symptoms and findings (e.g., chest pain) are also considered acute. The six EDC types are defined as follows:

- Dominant Chronic EDCs. Dominant Chronic EDCs are serious lifelong chronic diseases which often result in the progressive deterioration of an individual's health and often lead to, or significantly contribute to, an individual's debility, death, or future need for medical care. Examples of dominant chronic EDCs include Spina Bifida (EDC 64), Chronic Obstructive Pulmonary Disease and Bronchiectasis (EDC 133), Congestive Heart Failure (EDC 179), Diabetes (EDC 424), Sickle Cell Anemia (EDC 606), and Schizophrenia (EDC 743).
- Moderate Chronic EDCs. Moderate Chronic EDCs are chronic diseases that are very variable in their severity and progression. They usually do not result in the progressive deterioration of an individual's health, but can significantly contribute to an individual's debility, death, or future need for medical care. Examples of Moderate Chronic EDCs include Epilepsy (EDC 14), Asthma (EDC 138), Crystal Arthropathy (EDC 352), and Bi-Polar Disorder (EDC 747).
- Minor Chronic EDCs. Minor Chronic EDCs are chronic diseases which can usually be managed effectively throughout an individual's life with typically few complications and limited effect upon an individual's debility, death, or future need for medical care. However, some minor chronic diseases may become serious if untreated or may be precursors to more serious diseases (e.g., Hyperlipidemia, EDC 445). Examples of Minor Chronic EDCs include Migraine (EDC 18), Chronic Hearing Loss (EDC 100), Chronic Thyroid Disease (EDC 446), and Depression (EDC 755).
- Chronic Manifestation EDCs. A Chronic Manifestation EDC describes a manifestation or acute exacerbation (e.g., Diabetic Neuropathy, EDC 432) that indicates the presence of an underlying chronic disease (e.g., Diabetes, EDC 424). Chronic Manifestation EDCs are often used to determine the severity level of the EDCs of the underlying chronic diseases associated with them. For example, Epilepsy Intractable (EDC 23) indicates a more severe case of Epilepsy (EDC 14), and this is reflected in the assignment of the severity level. Chronic Manifestation EDCs are also used to identify uncommon but distinct diseases within more frequently occurring EDCs.
- Significant Acute EDCs. Significant Acute EDCs are acute illnesses which can be a precursor to, or indicate that the individual is at risk for, the development of chronic disease (e.g., Tachycardia and Palpitations, EDC 225), or can potentially result in significant sequelae (e.g., Head Injury with Coma 1–24 Hours, EDC 38). In the CRG logic, an acute illness is only classified as a significant acute illness if it occurred in the most recent six month period.
- Minor Acute EDCs. Minor Acute EDCs are acute illnesses or events that may be mild or more serious but generally are self limiting, are not a precursor to chronic disease, do not place the individual at risk for the development of chronic disease, and should not result in significant sequelae (e.g., a fractured arm, common cold, or appendicitis).

Of the 557 EDCs, 61 are Dominant Chronic (DC), 64 are Moderate Chronic (MC), 41 are Minor Chronic (C), 104 are Chronic Manifestation (CM), 156 are Significant Acute (SA), and 131 are Minor Acute (A). In the CRG clinical logic, the categorization of an EDC as chronic or acute is an important distinction. The presence or absence of chronic EDCs is the foundation of CRGs. There are separate CRGs for individuals who are healthy (i.e., have no chronic or significant acute diagnoses), have a single chronic EDC, and individuals who have chronic EDCs from multiple organ systems (i.e., MDCs). For example, both congestive heart failure and chronic obstructive pulmonary disease form separate CRGs. Individuals who have both congestive heart failure and chronic obstructive pulmonary disease form another CRG.

Within each MDC the Dominant, Moderate, and Minor Chronic EDCs are ranked hierarchically in terms of their relative contribution to an individual's need for future medical care and likelihood of debility or death. Dominant Chronic EDCs are always ranked higher in the EDC hierarchy than Moderate or Minor Chronic EDCs and Moderate Chronic EDCs are always ranked higher than Minor Chronic EDCs.

Appendix B.2.2 lists the EDCs within each MDC by their place in the hierarchy of their MDC.

Appendix B.2.3 lists the ICD-9 and ICD-10 diagnosis codes in EDC and diagnosis code order.

While all diagnoses are assigned EDCs, not all EDCs can be used to assign the CRG. An EDC must pass three edits if it is to be used to assign a CRG.

1. Only those diagnoses reported by institutions (e.g., hospitals, skilled nursing facilities, etc.), physicians, and other medical professionals (e.g., nurse practitioners, physician's assistants, physical therapists, etc.) are used. Diagnoses from other sources such as ambulance companies, durable medical equipment suppliers, laboratories, or pharmacies are not used as they are often provisional and otherwise unreliable.
2. Outpatient diagnoses, with a few specific exceptions, must be reported on at least two separate days or they are not used. All diagnoses associated with inpatient stays from institutional providers are kept. With a few exceptions, a diagnosis reported only on a single day is not considered sufficiently reliable. The requirement of multiple days rather than multiple reports is used because a single contact on a single day may generate multiple claims and multiple reports of a diagnosis. For example, if a patient receives a diagnosis of diabetes from a single encounter in a physician's office and there are no other reports of diabetes, the EDC for Diabetes (EDC 424), while it is assigned, will not be used because it may be a coding error or may reflect diagnostic testing rather than be a diagnosis of an actual condition. If there are two encounters on separate days, the EDC is used as it is less likely that a coding error would be made twice. If the individual is hospitalized and a diagnosis of diabetes is recorded by the institution, the EDC of diabetes is assigned even if the diabetes was not to the PDX of the hospitalization. Single inpatient diagnoses are accepted because inpatient coding practices are generally more rigorous than those used in outpatient settings. The exceptions for outpatient diagnoses are a limited set of EDCs. These EDCs include medically significant unambiguous conditions that are often not treatable but present manifestations or complications (e.g., Down's Syndrome, EDC 582). Because these conditions are not treatable per se, they may not be noted in the patient's medical claims on multiple occasions. In addition there are procedures which may be reported by diagnosis codes which are also unambiguous and may not be reported multiple times. For example, renal dialysis may be reported through diagnosis codes (EDC 500) or procedure codes (EPC 300). Therefore, the dialysis EDC is kept even if it is reported for only a single outpatient visit.

3. Diagnoses are also excluded from the analysis if they fall before or after the to and from dates which must be set in order to run the software. For example, if the software is being used to assign CRGs based on the latest year of data, data from prior years is ignored. EDCs are also excluded if they are fall outside the maximum age acceptable for the EDC. An EDC will not be validated it is based on diagnoses older than the maximum age. Currently the maximum age is five years (twenty quarters). For many EDCs, especially acute conditions, the maximum age is less than that. For example, diagnoses for EDC 424, Diabetes, are ignored if they are more than five years old. For pregnancy or delivery EDCs, the cut off is one year. In the case of the former, it is reasonable to expect that if the person is truly diabetic, that it would have reported in the last five years. In the case of the latter, these are acute events which have little impact on health status outside of the year in which it occurs and the subsequent year.

Appendix B.2.4 lists those EDCs which do not need to be reported two times. Appendix B.2.5 specifies the EDC retention periods.

### Step 3: Mapping procedure codes

Procedures are reported using commonly used coding schemes. Procedures performed in hospitals are reported using ICD-9-CM and ICD-10-CM procedure codes. Professional services and procedures performed in an ambulatory setting are reported using Current Procedural Terminology (CPT) and Health Care Procedure Coding System (HCPCS) codes. All procedure codes were categorized into 639 mutually exclusive and exhaustive categories referred to as Episode Procedure Categories (EPCs). EPCs also include some groups created to facilitate the use of pharmaceutical data. These groups make use of dummy codes to facilitate their integration into the CRG logic.

Most EPCs exist only to facilitate reporting. Procedures, however, have selective use in the CRG clinical logic. One hundred seventy-nine EPCs, including groups created by pharmaceutical data, are used in the CRG logic. EPCs are used to indicate more advanced disease in the severity of illness leveling (e.g., a diabetic with circulatory complications who requires an above-the-knee amputation, EPC 130), to identify individuals who are dependent on some medical technology (e.g., Mechanical Ventilation, EPC 213), have had a procedure that has long term sequelae (e.g., Heart Transplant, EPC 44) or used in conjunction with pharmacy data. It is recognized that the inclusion of some procedures in the CRGs could result in higher future payments for individuals who had one of these procedures, thus theoretically, creating the financial incentive to perform more procedures. However, there is no real substance to such a concern because the increase in future payments is small relative to the cost of the procedure. It is unlikely that any fiscally prudent organization would incur substantial short-term costs in order to receive relatively small increases in long-term future payments. The other argument against the use of procedures is that organizations which provide poor quality care that results in the need for the procedure (e.g., the diabetic only needed the above-the-knee amputation because of poor care) would receive additional future financial compensation. However, the financial incentive remains to avoid procedures since the future increases in payment will not cover the cost of the original procedure for an extended period of time. Further, there will be enrollment and disenrollment between various payers. It is also essential that organizations not have the financial incentive to avoid enrolling individuals with a history of a major procedure. The overall functioning of the system and access to care are better served when there is a recognition of the future costs of such individuals. Thus, there is a selective use of procedures in the CRGs because, on balance, financial incentives to avoid enrolling individuals with a history of certain major procedures was

viewed as a more serious issue than potentially providing some additional future compensation for individuals who had a procedure that may have been avoidable.

Some EPCs are also used in the selection of significant acute CRGs, a topic which will be addressed later. It was decided that for this version of CRGs, the EPCs used to identify significant acute CRGs would only consist of those EPCs, omitting a few of the less clinically significant ones (e.g., Cataract Procedures, EPC 16) used elsewhere in the CRG logic. This approach excludes a number of EPCs which arguably could have been included. In light of the concerns acknowledged in the previous paragraph, it was decided to adopt a conservative approach and limit this group of EPCs to those used in other places in the CRG logic. Like EDCs, EPCs are subject to a retention period which, if they are used in CRG assignment, causes them to be ignored by the group assignment logic.

Appendix B.3.1 lists the EPCs and also identifies EPCs that are used in the selection of significant acute CRGs.

Appendix B.3.2 lists the assignment of procedure codes to EPCs. This appendix also specifies the code by type (ICD-9-CM, ICD-10-PCS, CPT, and HCPCS). Codes used by the pharmaceutical logic are assigned artificial ICD-9 and ICD-10 values for the purpose of the software.

Appendix B.3.3 specifies the EPC retention periods.

## Step 4: Creating additional EDCs

Under certain conditions, EPCs and EDCs can create another EDC. In addition, specified individual diagnoses may also conditionally create additional EDCs. These conditions or rules use recency of occurrence, recurrence or persistence over time, site of service, age, and combinations of these factors to determine if a chronic condition is present. The conditions specified by the rules vary from an EDC simply being present within the last two years, to rules requiring multiple occurrences at specific sites within a specified time period. Please note that only those occurrences which meet the EDC edit criteria discussed previously may be used to create another EDC.

There are seven circumstances under which EDCs or individual diagnoses may create other EDCs:

1. Multiple occurrences of an acute EDC or a specific acute diagnosis can create chronic EDCs. Selected acute EDCs that are persistent or are recurrent, as indicated by multiple occurrences over a period of time, can create a chronic EDC. For example, if Acute Pancreatitis (EDC 329) is reported at least twice over a period of time that spans at least 90 days between the two occurrences, the EDC Chronic Pancreatic and Liver Disorders - Moderate (EDC 314) is created.

2. Acute EDCs can create chronic EDCs. Selected acute EDCs can create a chronic EDC for the history of the Significant Acute EDC. For example, Acute Myocardial Infarction except Subendocardial - Initial (EDC 209) creates a chronic EDC, History of Myocardial Infarction (EDC 182). A history of a Significant Acute EDC is only created for Significant Acute EDCs that indicate significant progression of an underlying disease or may have long term sequelae (e.g., Cerebrovascular Infarction, EDC 42). The creation of a chronic EDC for the history of a Significant Acute EDC is sometimes dependent on the individual's age. The acute EDC for a hip fracture (EDC 377) creates the chronic EDC History of Hip Fracture > 64 Years (EDC 344) only if the individual is 65 years old or older. It should be noted that in CRGs the term "history of" has limited use. With one exception, it is only used to describe some of the EDCs which are created by acute EDCs or, as will be discussed later, by EPCs. The exception is for an EDC called History of Malignancy (EDC 843).
3. Individual diagnosis codes can create additional EDCs. Some diagnosis codes reflect multiple illnesses. For example, the code for Hypertensive Renal Disease with Renal Failure is initially mapped to the Chronic Renal Failure EDC (EDC 473). This diagnosis also indicates that hypertension is present. Therefore, the hypertension EDC (EDC 202) may also be created.
4. Chronic manifestation EDCs create chronic EDCs. All Chronic Manifestation EDCs will create the chronic EDC that specifies the underlying chronic disease associated with the manifestation or acute exacerbation. For example, the Diabetic Neuropathy Chronic Manifestation EDC (EDC 432) creates the Diabetes EDC (EDC 424).
5. Some diseases generally considered chronic are only categorized as chronic under certain conditions. For example, hypertension is generally considered a chronic disease (EDC 192). However, a single high blood pressure reading could be miscoded as hypertension, or several visits for hypertension over a short period of time may reflect monitoring following a single reading rather than the actual disease. Therefore, hypertension is considered a significant acute disease (EDC 221) unless the hypertension occurs at least twice over a period of time that spans at least 90 days (Rule 11) or a diagnosis of malignant hypertension (EDC 202) is coded.
6. Diseases which are chronic for some age groups may not be chronic for others. For example, congestive heart failure in adults is a chronic disease (EDC 179). However, congestive heart failure that occurs in children is usually associated with an underlying congenital anomaly and reflects the severity of the underlying anomaly rather than another chronic illness. Therefore, in children congestive heart failure is considered an acute disease (EDC 219). The one exception is congestive heart failure due to rheumatic fever which is always considered chronic. The assignment of EDC 179 (Congestive Heart Failure) is done in two stages. First, EDC 219 (Congestive Heart Failure Age Unspecified) is assigned. Then, if the enrollee is older than eighteen, EDC 179 is created.
7. Some groups of clinically similar EDCs are used to create a single group of similar EDCs called clusters. Clusters are only used to assign severity levels. Clusters are always acute even if they include chronic conditions. Clusters enable "either/or" counting of EDCs. For example, a cluster can satisfy Rule 11 (any site span of 90 days within a year) by two occurrences of one of the EDCs which is included in the cluster or by one occurrence each of two of the EDCs which are included in the cluster. There are 11 clusters.

Appendix B.4.1 lists the EDCs and individual diagnoses and the conditions (rules) under which they can create an additional EDC. The table consists of the following elements:

1. The first two columns identify the diagnoses and their description. Non-diagnosis specific rules are identified with an "\*\*".

2. The next two columns identify the EDC, with its description, that creates the new EDC.
3. The next two columns identify the criterion (rule) and its description used to create the new EDC.
4. The last two columns identify the EDC with its description that is created

EPCs can create chronic EDCs. Selected major procedures that are indicative of a history of advanced disease or have long term sequelae create chronic EDCs for the history of the major procedure. For example, the EPC for Coronary Bypass Surgery (EPC 47) creates the chronic EDC for History of Coronary Bypass Surgery (EDC 188). In the CRG assignment logic, no distinction is made between chronic EDCs associated with the history of a procedure and chronic EDCs associated with a diagnosis. In addition, some procedures (e.g., Chemotherapy, EDC 692 and EPC 310) can be reported with either diagnosis or procedure codes. All such EPCs are mapped to the equivalent EDC.

Appendix B.4.2 identifies the EPCs and the conditions under which they can create EDCs. It identifies the EPC and EDC and the rule under which the EPC creates the EDC.

## Step 5: The conditional elimination of EDCs

Once all EDCs and EPCs have been created, some are eliminated based on temporal relationships with another EDC or EPC. Three conditions can result in the elimination of an EDC or EPC.

A temporal relationship between EDCs can eliminate an occurrence of an EDC. When an acute diagnosis or EDC creates a chronic EDC, the occurrence of the acute EDC may be ignored. If a specific EDC occurs prior to the first occurrence of another specific EDC, the former EDC is not considered. For example, any occurrence of cerebrovascular infarction (EDC 42) prior to the first occurrence of acquired hemiplegia (EDC 3) is eliminated because the hemiplegia is likely a sequelae of the infarction. However, if cerebrovascular infarction is reported after the first occurrence of acquired hemiplegia, it is not eliminated since it is assumed to be a second occurrence and indicative of a further deterioration of the individual's health. The temporal relationship between cerebrovascular infarction and acquired hemiplegia is the basis for determining whether there has been an occurrence of the acute event. The time period for the elimination of the first EDC includes not only those occurrences prior to the initial report of the second EDC, but those occurrences within a specified time period after the initial occurrence of the second EDC as well. To continue with the aforementioned example, all reports of cerebrovascular infarction are ignored until 90 days after the first report of acquired hemiplegia. While not an absolute certainty any report of cerebrovascular infarction in the period after the report of the acquired hemiplegia may be a continuation of the original acute event (e.g., routine follow-up, transfer to a new facility, etc.) and may not be indicative of a new occurrence. Reports after the 90 day window are assumed to be for a new occurrence. This window is flexible and varies by the EDCs involved.

A temporal relationship between EDCs and EPCs can eliminate an occurrence of an EDC. An EPC can eliminate an EDC if it either resolves the problem or if it creates a new EDC and the acute EDC is used to assign it a severity level. All occurrences of an EDC that are prior to the occurrence of a specific EPC are eliminated. For example, all occurrences of angina (EDC 183) prior to a coronary bypass (EPC 47) are eliminated because the coronary bypass is expected to at least temporarily alleviate the angina. However, if angina occurs after the coronary bypass

EPC, the angina EDC is not eliminated since it indicates that the coronary bypass was not successful or that the underlying coronary artery disease has progressed. As with the relationship between EDCs, there is a window of time. For example, the window between the coronary bypass EPC and the angina EDC is 30 days, sufficient time to compensate for any late claims submitted on a monthly basis, or follow-up care for the angina. Angina occurring more than 30 days after the bypass is not ignored. In a similar sense, unrelated acute EDCs may also be ignored in order to only use those encounters after a specific event. For example, a Coronary Artery Bypass Graft (EPC 47) ignores prior occurrences of Cluster - Minor Infections (EDC 740) and the EDCs which make up the cluster.

A temporal relationship between EPCs can eliminate an occurrence of an EPC. If a specific EPC occurs prior to the occurrence of another specific EPC, the EPC is eliminated because the first procedure negates the significance of the other procedure. For example, occurrences of dialysis (EPC 300) prior to a kidney transplant (EPC 165) are eliminated because the kidney transplant is expected to eliminate the need for dialysis. However, if dialysis is reported after the kidney transplant, the dialysis EPC is not eliminated since it indicates that kidney transplant was not successful. The definition of the window of time is identical to that discussed previously. In the kidney transplant and dialysis example, the window is 30 days. Dialysis occurring more than 30 days after the transplant procedure likely indicates a failure of the transplant. Dialysis occurring prior to that may be due to claim reporting or related to some short-term problems following the procedure.

In the attached CRG\_Tables.xlsx spreadsheet

- Appendix B.5.1 identifies the EDCs which eliminate other EDCs.
- Appendix B. 5.2 identifies the EPCs which eliminate other EDCs.
- Appendix B.5.3 identifies the EPCs which eliminate other EPCs.

## Phase 2: Selection of primary chronic disease(s) and assigning severity levels

In Phase 2, the EDC that represents the most significant chronic disease under active treatment, referred to as the PCD, is identified for each organ system (i.e., MDC). PCDs are selected in hierarchical order by EDC type and MDC rank. Once a PCD is selected, it is then assigned a severity of illness level. After the first PCD is selected and its severity level assigned, the next PCD is selected and assigned a severity level. This occurs until all possible PCDs have been assigned and given severity levels.

The first step in Phase 2 is to eliminate from consideration as a PCD those chronic EDCs that are secondary to another chronic EDC. While any chronic EDC is a potential PCD, under certain circumstances, namely the presence of another chronic EDC which is the probable cause of the first EDC, a chronic EDC may not be allowed to be a PCD. For example, in the presence of cerebral palsy (EDC 7), the mental retardation EDCs (EDCs 584 and 588) which are chronic and would otherwise be allowed to become PCDs, are not allowed to become PCDs because they are assumed to be an aspect of the cerebral palsy.

Appendix C.1 identifies these combinations of chronic EDCs in which the presence of one EDC precludes the use of the other as a PCD.

The second step in Phase 2 is the selection of a PCD for each MDC and the assignment of its severity level. Of course, if there are no eligible chronic EDCs, no PCD can be selected. PCD selection is a two part process. The first part is the selection of the PCD. The second part is the assignment of severity of illness to the PCD. PCDs are selected one at a time. After one is selected and assigned a severity level, another chronic EDC from a different MDC is selected and assigned a severity level, assuming one is present and eligible for selection.

Individual EDCs and EPCs may be included in the assignment of severity levels to multiple PCDs in different MDCs. In order to avoid double counting, the process is hierarchical. PCD selection is done in order of EDC type (Dominant Chronic, Moderate Chronic, and Minor Chronic). Within each EDC type, the process is done in MDC rank order (i.e., the MDC hierarchy which has been described previously and can be found in Appendix B.1.2). Only one PCD can be selected per MDC. Eligible Dominant Chronic EDCs are always selected over eligible Moderate and Minor Chronic EDCs. Similarly, eligible Moderate Chronic EDCs are always selected over eligible Minor Chronic EDCs. Once a PCD has been selected for an MDC, all other chronic EDCs in that MDC become ineligible for selection as a PCD.

After the first PCD has been selected and assigned its severity level, the next PCD, which will be from another MDC, is selected. This of course assumes that there is an additional chronic illness which has not been excluded from the PCD selection process. As pointed out earlier, once a PCD for an MDC has been selected, all other chronic EDCs in that MDC become ineligible for PCD selection. In addition, if a chronic EDC is used in assigning a severity level to a PCD, it also becomes ineligible for subsequent PCD selection. This process continues until all chronic EDCs have either been selected as PCDs or excluded from the PCD selection process.

## PCD selection

PCD selection starts with Dominant Chronic EDCs. As previously stated, the MDCs are reviewed in rank order. If in an MDC there is only one Dominant Chronic EDC present which has not been eliminated as a potential PCD that EDC becomes the PCD for that MDC. If there are multiple Dominant Chronic EDCs present for that MDC, all of which are eligible for PCD selection, the EDC which is identified as the PCD is the one that satisfies the PCD selection hierarchy.

The PCD selection hierarchy, all else being equal, gives greater significance to the EDC receiving the most active treatment within the last year. Therefore, the PCD selection hierarchy uses site of service, recency and duration of treatment, and the EDC rank within the MDC to identify which chronic EDC is the most likely to be under active treatment. Within an EDC type, treatment in a hospital within the most recent year is highest in the selection hierarchy followed by treatment in an ambulatory setting within the most recent year which has been reported on at least two occasions spanning at least 90 days. If more than one chronic EDC of the same type meets the same PCD selection criteria, then the EDC rank in the MDC is used to select the EDC to be the PCD. If none of the criteria are met, then PCD assignment is based solely on EDC rank within the MDC.

The following table illustrates the selection hierarchy for dominant (and moderate) chronic EDCs in the same MDC:

<b>Site of Service</b>	<b>Recency of Treatment</b>	<b>Duration of Treatment</b>	<b>Rank</b>
Hospital	Last Year		Highest
Ambulatory	Last Year	90 days	Highest
Any			Highest

After all Dominant Chronic EDCs across all MDCs have been considered for selection as PCD, or if there are no eligible Dominant Chronic EDCs from any MDC present, an eligible Moderate Chronic EDC will be selected as a PCD if any are present. As previously discussed, Moderate Chronic EDCs from those MDCs which have had a Dominant Chronic PCD selected cannot be PCDs. Like with Dominant Chronic EDCs, the selection is done in MDC hierarchical order using the PCD selection hierarchy in the event that an MDC has more than one eligible Moderate Chronic EDC.

After all Moderate Chronic PCDs have been considered for PCD assignment, or if there are no Moderate Chronic EDCs present, eligible Minor Chronic EDCs are reviewed for PCD selection. As with Dominant and Moderate Chronic EDCs, the selection is done in MDC order. However, if there is more than one eligible Minor Chronic EDC from a single MDC present, the one with the highest rank within the MDC is chosen.

For example, the neurological MDC (MDC 11) has a higher rank than the cardiovascular MDC (MDC 51). When an individual has both hemiplegia (EDC 3) and congestive heart failure (EDC 179), both of which are Dominant Chronic EDCs, the hemiplegia is selected to be a PCD before congestive because it is in the neurological MDC. Congestive heart failure is selected as a PCD next. If, instead of hemiplegia, the individual has a history of a transient ischemic attack (EDC 12), a Moderate Chronic EDC in the neurological MDC, the congestive heart is chosen as a PCD first because it is a Dominant Chronic and the history of a transient ischemic attack is a Moderate Chronic. If there are only EDCs from the same MDC present, Dominant Chronic EDCs are always chosen before Moderate Chronic EDCs to be the PCD. Therefore, if an individual has EDCs for both hemiplegia and epilepsy (EDC 14) present, hemiplegia will always be the PCD. If, instead of hemiplegia and epilepsy, the individual had a history of a transient ischemic attack and epilepsy present, epilepsy, the lower of the two in rank, would only be chosen in the unlikely event that it met the hospitalization or outpatient criteria and the history of a transient ischemic attack did not.

## Assigning a severity level to each PCD

After a PCD for an MDC has been selected, it is assigned a severity level. The severity level describes the extent and progression of the disease selected as the PCD. A high level of severity is indicative of a higher degree of treatment difficulty and a need for relatively more future medical care. The assignment of the severity level is specific to each PCD and takes into account factors associated with more severe or advanced forms of the disease. This includes: a more severe form of the disease as identified through a Chronic Manifestation EDC (e.g., Intractable Epilepsy, EDC 23); comorbid chronic and acute EDCs from the same organ system (Cardiac Valve Disease, EDC 181, and Congestive Heart Failure, EDC 179); chronic EDCs from other body systems when they are secondary to and caused by the PCD (Nephritis, EDC 477, secondary to Connective Tissue Disease and Vasculitis, EDC 390); acute EDCs from other body systems when

they are specifically related or a reliable indicator of general health status (acute infections, acute neurological and gastrointestinal EDCs); and selected therapies or procedures if they are indicative of advanced disease or may have long term sequelae (e.g., History Of Coronary Artery Bypass Graft, EDC 188; Other Oxygen Therapy, EPC 268; Skin Graft, EPC 149). Any chronic illness used to assign a severity level to a PCD cannot be selected as a PCD in a subsequent MDC and cannot be used to assign a severity level to another PCD.

All PCDs are assigned a severity level. Most have a severity level assigned using a matrix relating the presence of specific EDCs and EPCs to an assigned severity level. For a very few PCDs, a severity level is assigned without a severity leveling matrix. For those PCDs whose severity level is determined by a matrix, the list of EDCs and EPCs is accompanied by the conditionality rules which for each EDC and EPC in the list specify the conditions that must be met in order for a specific severity level to be assigned. For example, if an individual with a PCD of Asthma (EDC 138), also has Chronic Bronchitis (EDC 141), the bronchitis must satisfy the conditions for Rule 11 (two occurrences at least 90 days apart) for it to be used to assign Level 2 to the asthma PCD. The number of severity levels specified in the severity leveling matrix varies by type of PCD. With the exception of malignancies, dominant and moderate chronic PCDs have four severity levels. Nondominant/nonmetastatic malignancy PCDs have only two severity levels assigned. More complex cases (e.g., metastatic malignancies and catastrophic conditions such as HIV disease or quadriplegia) are assigned severity levels as part of the CRG selection process which will be discussed later. Minor chronic PCDs also have only two severity levels because of the limited clinical spectrum of these diseases. It should be noted that the severity adjustment for catastrophic illnesses and malignancies which have an EDC type of Dominant Chronic (except for Secondary Malignancy, EDC 641, which is a Moderate Chronic) occurs outside of PCD severity leveling. Default levels are assigned only to facilitate processing.

1. The severity level for a PCD is determined with the following steps:
2. From the complete list of EDCs and EPCs created in Phase 1, the subset of EDCs and EPCs that are present in the severity leveling matrix for the PCD are identified.
3. For each EDC and EPC identified in Step 1, the conditionality rules in the severity leveling matrix are applied and each EDC's and EPC's contribution to the PCD's severity level is determined.
4. The severity level for the PCD is equal to the highest severity level associated with any of the EDCs and EPCs from Step 2.

If no EDC or EPC satisfies the conditions for Level 2 or higher, the PCD is assigned Level 1.

For example, a PCD of congestive heart failure (EDC 179) with unstable angina (EDC 206) for which there has either been a hospitalization in the most recent year (Rule 6) or had been treated twice at any site with the first and last treatment being at least 90 days apart (Rule 11) is assigned Severity Level 4. However, if there is no hospitalization for unstable angina during the most recent year and only a short episode of unstable angina within the last year (Rule 2), the congestive heart failure PCD is assigned Severity Level 3. Thus, the severity level of the congestive heart failure associated with the unstable angina varies depending on which conditionality rules relating to recency, recurrence, and the site of treatment apply to the unstable angina.

Since EDCs and EPCs can be used in the severity leveling matrix for PCDs in more than one MDC, it is possible that the same EDC or EPC could determine the severity level for more than one PCD. In order to avoid this possibility, the severity level for each PCD is determined with the constraint that no EDC or EPC can be used to determine the severity level (i.e., be the EDC or

EPC used in Step 3) of more than one PCD. Thus, PCDs chosen earlier in the PCD selection process have greater access to EDCs and EPCs for severity level assignment.

Appendix C.2 describes the PCD severity leveling matrices.

Appendix C.3 identifies PCDs with an assigned severity level.

## Phase 3: Selection of the base CRG and severity level for the individual enrollee

At the end of Phase 2, a PCD and severity level has been assigned for each MDC for which one is present. Therefore, all PCDs have been identified and assigned a severity level. The next step is the assignment of the CRG.

CRG assignment is based on the presence of PCDs with their severity levels and EDCs and EPCs that satisfy specific rules. Each CRG is assigned to one of nine statuses. CRGs are assigned hierarchically starting with most serious status, catastrophic, and going to the least serious, healthy. Individuals are assigned to the highest status and most significant base CRG in the status for which they satisfy the specified criteria. If they do not meet the criteria for selection in a given status, they are passed to the next status for consideration until they meet the criteria for selection. After the base CRG is selected for an individual, his or her overall severity level is assigned. Each status has its own method of determining the severity level.

The statuses are:

1. Healthy. Healthy status is identified by the absence of any PCDs or significant acute EDCs or EPCs.
2. Recent History of Significant Acute Disease. A history of significant acute disease is identified by the presence within the most recent six month period of one or more Significant Acute EDCs or significant EPCs. There are no PCDs present.
3. Single Minor Chronic Disease. A single minor chronic disease is identified by the presence of a single Minor Chronic PCD.
4. Minor Chronic Disease in Multiple Organ Systems. Minor chronic disease in multiple organ systems is identified by the presence of two or more Minor Chronic PCDs.
5. Single Dominant or Moderate Chronic Disease. Single dominant or moderate chronic disease is identified by the presence of a single Dominant or Moderate Chronic PCD.
6. Significant Chronic Disease in Multiple Organ Systems. Significant chronic diseases in multiple organ systems are identified by the presence of two or more PCDs of which at least one is a Dominant or Moderate Chronic PCD. PCDs that are a Severity Level 1 minor chronic disease are not considered a significant chronic disease and are not used to identify the presence of significant chronic disease in multiple organ systems, but Minor Chronic PCDs that are Severity Level 2 minor chronic diseases are used.
7. Dominant Chronic Disease in Three or More Organ Systems. Dominant chronic disease in three or more organ systems is identified by the presence of three or more dominant chronic or selected moderate chronic PCDs.

8. Dominant, Metastatic and Complicated Malignancies. A malignancy that dominates the medical care required (e.g., brain malignancy) or a nondominant malignancy (e.g., prostate malignancy) that is metastatic or complicated (e.g., requiring a bone marrow transplant).
9. Catastrophic Conditions. Catastrophic Conditions include long term dependency on medical technology (e.g., dialysis, respirator, and total parenteral nutrition, TPN) and life-defining chronic diseases or conditions that dominate the medical care required (e.g., persistent vegetative state, cystic fibrosis, AIDS, history of heart transplant).

Each CRG is assigned a unique five digit number. This number has two parts, the base CRG number and the severity level. The base CRG number is created by concatenating the status number with a group number. The second part is a one digit severity level with exception of Status 1, Healthy, and Status 2, Recent History of Significant Acute Disease, which do not have severity levels. For Status 4, Multiple Minor Chronic PCDs , where there is only a single base CRG the base CRG is the status number followed by "000".

The nine CRG statuses are subdivided into a total of 270 base CRGs which, when combined with their severity levels, results in 1080 CRGs.

## **Status 9: Catastrophic conditions**

First in the CRG status hierarchy are Catastrophic Conditions, Status 9. Catastrophic Conditions are either associated with long term dependence on medical technology, life-defining chronic diseases, or conditions that indicate an individual with a very serious illness which dominates his or her medical care requirements. Catastrophic Conditions are identified with rules. Two of the rules, Rule 4 Any Site Within Last 90 days, and Rule 9, Any Site - Span 30, are used only to define Catastrophic Conditions. There are 11 Catastrophic base CRGs, each of which is divided into four severity levels, for a total of 44 Catastrophic CRGs.

Appendix D.1.1 lists the catastrophic conditions.

Assigning a Status 9 CRG is a two step process. The first step selects the base CRG. The second step assigns the severity level.

### *Status 9 selection*

All Catastrophic Conditions are ordered hierarchically (e.g., renal dialysis without diabetes, base CRG 9020, is higher in the Catastrophic hierarchy than history of heart transplant, base CRG 9060). If there is more than one Catastrophic Condition present for an individual, the catastrophic condition that is highest in the Catastrophic hierarchy is assigned as the base CRG. For example, if an individual with HIV disease is also receiving TPN, he or she will always be assigned to the Status 9 group for HIV disease, base CRG 9030. The TPN, in this case, would contribute to the severity level of the HIV.

Appendix D.1.2 identifies the conditions which must be met for assignment to the Status 9 CRGs.

### *Status 9 severity level assignment*

For each catastrophic condition there is a four level severity leveling matrix that is specific to the catastrophic condition. Levels are set based on the presence of EDCs or EPCs which satisfy certain conditions or rules with level 1 being the default. For example, renal dialysis with diabetes (base CRG 9010) and the presence of significant amputations (EDC 362), results in the assignment of Level 2. A valid occurrence of chronic obstructive pulmonary disease and bronchiectasis (EDC 133) in the last six months (Rule 3) results in the assignment of Level 4. If, however, its latest occurrence is more than six months old (Rule 0), Level 2 is assigned.

Appendix D.1.3 describes the Status 9 severity leveling matrix.

## **Status 8: Dominant, metastatic or complicated malignancies**

Next in the CRG status hierarchy, Status 8, is dominant, metastatic, or complicated malignancies. There are 22 dominant or metastatic malignancy base CRGs, each of which is divided into four severity levels, for a total of 88 dominant, metastatic, or complicated malignancy CRGs. The groups are named and numbered based on the primary malignancy.

Appendix D.2.1 lists the Status 8 malignancy groups.

Assigning an individual to a Status 8 CRG occurs in the two steps common to all CRGs, the selection of a base CRG and then the assignment of a severity level. The base CRG selection identifies a primary malignancy or, if a primary malignancy cannot be identified, one of a specified set of special malignancy groups. After the base group is selected, a severity level is assigned.

### *Status 8 selection*

A Status 8 base CRG is selected if any of the following four conditions are met:

1. There is a dominant malignancy present.
2. There are multiple malignancies present (i.e., malignancies from more than one EDC).
3. There is a malignancy present along with one of a set of specified complications.
4. The EDC for a metastasis or the Secondary Malignancy EDC (EDC 641) is present.

Dominant malignancies identify individuals likely to be very ill with serious clinical manifestations of this group of malignancies. These manifestations will dominate the need for care and are likely to lead to the individual's death. Dominant malignancies were classified as Dominant Chronic EDCs. For example, a pancreatic malignancy (EDC 648) is a dominant malignancy. The presence of a single dominant malignancy EDC will result in assignment to Status 8. If there is a single dominant malignancy, it will be the primary malignancy.

Multiple malignancies are more complex to define from claim data. The presence of multiple malignancy EDCs may indicate a malignancy with localized spread, a metastasis, or the presence of two independent malignancies (i.e., a situation where a metastasis cannot be confidently identified using only claim data), or the separate occurrence of malignancies.

For the purposes of Status 8 selection, two types of malignancy combinations are not considered metastatic or independent malignancies. The first, consisting of the leukemia EDCs, are those malignancies which should never occur simultaneously. When they are reported at about the same time, it is the likely result of a coding error. For example, an individual with occurrences of both chronic lymphoid leukemia (EDC 652) and chronic non-lymphoid leukemia (EDC 653) would not be considered to have two different malignancies. The second type of combination are those malignancies which have, in all likelihood, spread beyond their initial sites into adjacent organs. These are not considered metastatic if the only other malignancies present are the ones identified as the probable localized spread of a primary malignancy and no other Status 8 criteria are met. Claims data does not provide sufficient detail to always distinguish between a possible metastases and a localized malignancy. An example of a localized spread of a malignancy is EDC 658 (Other Malignancies) and EDC 664 (Genitourinary Malignancy). EDC 658 includes EDC 685 (Gynecological Malignancies Except Uterine, Cervical, and Ovarian) as well as other low volume malignancies expressed as Chronic Manifestations to EDC 658. EDC 664 in the presence of EDC 658 is considered to probably be a localized spread of EDC 685 and therefore is not considered to be a distinct malignancy or metastases.

These groups of malignancies are identified in Appendix D.2.2.

If there are multiple malignancies present after accounting for the possibility of the localized spread of a malignancy, the Status 8 assignment process attempts to identify a primary malignancy and its metastases. For example, if a prostate malignancy (EDC 663) and a bone malignancy (EDC 682) are both present, the bone malignancy is considered metastatic to a prostate malignancy. EDC 663 is the primary malignancy and EDC 682 is the metastasis.

Appendix D.2.3 identifies primary malignancies and their metastases.

If there are multiple malignancies present which cannot be identified as metastatic to one another based solely on claims data, there are multiple primary malignancies. If there is more than one dominant primary malignancy present, the base CRG is 6001. If there is more than one nondominant primary malignancy present, the base CRG is 6002.

There are some procedures, conditions, and malignancy specific circumstances that indicate that a malignancy is complicated. If any of these are present, the malignancy EDC satisfies the criteria for Status 8 and will be selected as the primary malignancy assuming no other malignancy is present. In the event that more than one malignancy EDC is present, the primary malignancy will be determined by the multiple malignancy logic. An example of a procedure which indicates a complicated malignancy is a bone marrow transplant (Allogenic Bone Marrow Transplant, EPC 215, and Autologous Bone Marrow Transplant, EPC 219). Malnutrition (Severe Malnutrition, EDC 290, and Other Protein and Calorie Malnutrition, EDC 291) are examples of conditions which indicate a complicated malignancy. Examples of malignancy specific circumstances are somewhat more diverse. For example, additional chemotherapy or radiation therapy after an extended break (120 days) in treatment meets the criteria for a complicated malignancy. Special attention is given to the leukemias. Separate EDCs were created for "not in remission" and "with remission" diagnosis codes. These EDCs are Chronic Manifestations (CM) of their specific leukemia. Any occurrence of "not in remission" in the most recent six months of data, or any occurrence of "not in remission" after an occurrence of "with remission," satisfies the criteria for Status 8 selection. All pediatric malignancies are also considered to be complicated.

Appendix D.2.4 lists specific complications.

If there are no primary malignancies present but the EDC for secondary malignancies is present (EDC 641), it is assumed that there is some unidentified primary malignancy present. Under these circumstances, EDC 641 is treated as a primary malignancy for the purposes of creating the base CRG.

Primary malignancies that are not dominant, metastatic, complicated, or present in individuals with other malignancies are treated like any other PCD. Their CRGs are not assigned in Status 8 and are assigned in the subsequent portions of the CRG status hierarchy.

### *Status 8 severity leveling*

After a Status 8 base CRG is selected, an individual is assigned one of four severity levels. Assignment of a severity level for a Status 8 Malignancy is a three step process. It is designed to reflect the total burden of illness. Since individuals with a dominant or metastatic primary malignancy can also have diseases in organ systems that are not directly related to the presence of the malignancy, the severity level must consider PCDs from organ systems unrelated to the primary malignancy as well as the metastases and complications of the malignancy. The assignment of the malignancy severity level incorporates non-malignancy PCDs, malignancy complications and metastases, and base CRG specific adjustments. Severity level assignment for dominant and metastatic malignancies is a three step process. An initial severity level is set. The initial severity level is modified based on Status 8 base CRG specific adjustments. The final severity level is then set using the primary malignancy and the most significant condition which resulted in the selection of Status 8.

The first step to severity-adjust a Status 8 base CRG is to assign an initial severity level. The initial severity level is calculated two ways. First it is calculated using non-malignancy PCDs. Second it is calculated using malignancy related complications and metastases. The initial severity level is the higher level calculated by either of the methods.

In order to calculate a Status 8 level using non-malignancy PCDs, the non-malignancy PCD type and its severity level are considered. Greater significance is given to Dominant Chronic PCDs and to higher PCD severity levels. For example, if there is a Dominant Chronic PCD present, the minimum initial level will be 2. A second dominant chronic PCD results in the assignment of at least Level 3. If a Dominant Chronic PCD has a Severity Level of 4, the minimum initial level is 4.

Appendix D.2.5 describes the criteria, PCDs and their severity of illness levels, used by this method of assigning a minimum initial severity level.

Malignancy specific metastases and complications may also be used to assign a severity level. For example, if along with the malignancy there is a diagnosis for malnutrition (EDC 290 or EDC 291), the minimum initial Severity Level is 3. If there is a diagnosis of pleural effusion, the initial Severity Level is 4.

Appendix D.2.6 describes the criteria used by this method of assigning a minimum initial severity level.

After the initial severity level is assigned, it is then adjusted using EDCs or EPCs which satisfy specified rules. Adjustments are made by adding or subtracting levels within a range. For example, a factor of 1 means that the initial level will be increased by 1. A factor of -1 means that it will be decreased by one. The adjustments all take place within a range specifying a minimum and a maximum. If the adjustment raises the level, the maximum is the highest level to which the

initial level can be raised, and the minimum, the lowest level from which it can be raised. If the adjustment specifies a decrease, the maximum indicates the highest level that can be decreased and the minimum, the lowest level to which it can be decreased. For EDCs only one adjustment per MDC may be applied. If multiple adjustments from a single MDC can be made, only the EDC highest in the MDC hierarchy is used. No adjustment currently specifies more than a change of one level. For example, for base CRG 8647 (Lung Malignancy), the presence of EDC 294 (Peptic Ulcer Disease) which is reported twice in the most recent year with at least 90 days between the first and last reported encounter (Rule 11, Any Site - Span 90 Within Year), results in increase of one level up to a maximum of Level 4 (the highest possible level status 8). If instead of EDC 294, EDC 285 (Acute Gastrointestinal Diagnoses – Extreme) was reported at least once in the last six months (Rule 3, Any Site Within Last Six Months), there would be increase of one level starting with Level 2 to a maximum of Level 4. Individuals at Level 1 would remain at Level 1.

Appendix D.2.7 describes the criteria for adjusting the initial severity level.

The final severity level adjustment is made based on the type of malignancy and the presence of specific complications and metastases. Greater significance is given to major complications and metastases and this is reflected in higher severity levels. For example, for a dominant malignancy, if there is a major complication or a major metastasis present and the adjusted level is 1, the final level is 2. On the other hand, for the same dominant malignancy, if there is no complication or metastasis present and the adjusted level is 4, the final level is 3.

Appendix D.2.8 describes the criteria used to assign the final severity level.

## **Status 7: Dominant chronic disease in three or more organ systems**

Status 7 includes those CRGs that are composed of dominant chronic diseases or explicitly identified moderate chronic diseases in three or more organ systems. There are 21 base CRGs for individuals with three or more dominant or specified moderate chronic diseases, each of which is divided into six severity levels, for a total of 126 CRGs.

Appendix D.3.1 lists the Status 7 base CRGs.

Assigning a Status 7 CRG is a two step process. The first step selects the base CRG. The second step assigns the severity level.

### *Status 7 selection*

Selecting a Status 7 base CRG is a hierarchical process. Combinations of three PCDs are identified (e.g., congestive heart failure, diabetes and chronic obstructive pulmonary disease). These combinations include explicit groups such as the aforementioned example or default groups which include those Dominant Chronic PCDs which are not explicitly identified. Please note that some moderate chronic groups can also be used to assign a Status 7 CRG. The explicit groups were the most prevalent and thus most important to be identified separately for the purposes of disease management.

The combinations of three PCDs are ranked hierarchically. The use of the hierarchy assures that identical combinations of illness always result in the selection of the same base CRG. Individuals

are assigned to the first base CRG in the hierarchy for which the criteria are met. For example, if an individual has three Dominant Chronic PCDs, the combination of which does not match any of the explicit combinations, then the individual is assigned to a residual base CRG 7060 (3 Dominant Chronic PCDs) consisting of any combination of three dominant chronic PCDs not specified higher in the hierarchy. If, on the other hand, the individual has one of the Dominant Chronic PCDs, Congestive Heart Failure (PCD 179), the base CRG would be 7016 (Congestive Heart Failure and 2 Other Dominant Chronic PCDs) unless one or both of the other two dominant chronic PCDs satisfied the criteria for a higher ranked group. It is also possible that more than one PCD can meet the criteria for selection of the same base CRG when "residual" groups are specified (e.g., base CRG 7016, Congestive Heart Failure - 2 or More Other Dominant Chronic Diseases). If more than one PCD meets the same criteria for selection to the same base CRG, the one or ones with the highest severity level is chosen.

Appendix D.3.2 lists the PCD combinations needed for inclusion into a Status 7 base CRG.

#### *Status 7 severity level assignment*

The severity level for the base CRG is determined by using the severity level of each of the PCDs that comprise it. The severity levels of the PCDs are used to assign an initial severity level. This severity level is then adjusted using clinical criteria to assign the final CRG severity level. Each Status 7 base CRG is subdivided into six severity levels. The initial severity level of all Status 7 base CRGs is a function of the severity levels of the PCDs which comprise it. All three PCDs are assumed to have an equal significance. If there are more than three PCDs which could have formed the group, it is based on the PCDs with the highest severity levels. For example, if the three PCDs that comprise the CRG have severity levels of 4, 4 and 2, then the severity level of the CRG would be 4.

Appendix D.3.3 describes the assignment of the initial severity level.

After the initial severity level has been set, it may be increased or decreased if a specified EDC or EPC is present which meets selected rules. For example, the generic severity level for the base CRG comprised of congestive heart failure, diabetes and chronic obstructive pulmonary disease (base CRG 7010) is increased by one if the EDC for unstable angina is present and the unstable angina has been actively treated in the most recent six month period. Therefore, an initial Severity Level of 1 would become a Severity Level of 2. An initial severity level of 6 would remain unchanged because it is the maximum level. Negative adjustments work in a similar fashion. Rather than increase a severity level, the severity level is decreased within a defined range to some minimum. For example, for the base CRG 7001 (Renal Failure – Diabetes – Other Dominant Chronic), the presence of EDC 6 (Alzheimer's and Other Dementias) causes the severity level to be reduced by 1 for all severity levels through a minimum of Severity Level 1. Only one EDC from each MDC may be used to adjust the initial level. If there are more than one EDC present which could change a level, the EDC highest in the MDC hierarchy is used. The overall change is two levels in either direction.

Appendix D.3.4 describes the assignment of the final severity level.

## Status 6: Significant chronic disease in multiple organ systems

Status 6 includes significant chronic diseases in at least two organ systems. For individuals who do not meet the criteria for Status 7, but have multiple chronic diseases with at least one dominant or moderate chronic disease, explicit combinations of two PCDs are identified (e.g., the Dominant Chronic PCDs for congestive heart failure and diabetes). Minor Chronic PCDs with Severity Level 1 are never used in Status 6. The explicit pairs were identified based on their prevalence and/or importance for disease management. There are 61 base CRGs for individuals with significant chronic disease in multiple organ systems, each of which is divided into two, four or six severity levels for a total of 328 CRGs. In addition, as all diseases are not equal of clinical significance all pairs are assigned a pair type which will be discussed in detail later.

Appendix D.4.1 lists the Status 6 base CRGs and their pair type.

Assigning a Status 6 CRG is a two step process. The first step selects the base CRG. The second step assigns the severity level.

### *Status 6 selection*

The combinations of two PCDs that compose Status 6 are ranked hierarchically. Individuals with two or more PCDs are assigned to the base CRG that is highest in the hierarchy. The specified PCDs include both explicit PCDs and residual groups of PCDs. If the PCDs do not match any of the explicit combinations, then residual base CRGs are assigned. The residual base CRGs consist of any combination of two PCDs that are not explicitly specified in the hierarchy. Therefore, base CRG 6143 (Diabetes and Other Moderate Chronic Disease) does not include asthma (PCD 138) because it (asthma) is explicitly specified as part of base CRG 6144 (Diabetes and Asthma) even though base CRG 6143 is higher in the hierarchy than base CRG 6144.

The use of hierarchical selection guarantees that identical combinations of PCDs always result in the selection of the same base CRG for an individual even if that individual can satisfy the criteria for more than one base CRG. Not every PCD must be used in selecting the base CRG. If an individual has a single Dominant Chronic PCD and two Moderate Chronic PCDs, one of the Moderate Chronic PCDs will not be used in the selection of the base CRG. For example, an individual with diabetes (PCD 424), asthma (PCD 138), and hypertension (PCD 192) is always assigned to base CRG 6142 (Diabetes and Asthma) even though the criteria for base CRG 6144 (Diabetes and Hypertension) and base CRG 6242 (Asthma and Hypertension) are also met. Of the three base CRGs, base CRG 6142 is highest in the hierarchy. Therefore, the hypertension PCD is not used in the forming of the base CRG. It is also possible that more than one PCD can meet the criteria for selection of the same base CRG when "residual" groups are specified (e.g., base CRG 6270, Two Other Moderate Chronic Diseases or base CRG 6116, Congestive Heart Failure and Other Moderate Chronic Disease). If more than one PCD meets the same criteria for selection to the same base CRG, the one with the highest severity level is chosen. For example, if base CRG 6270 (Two Other Moderate Chronic Diseases) is selected and there are three moderate chronic PCDs present and only two can be used to satisfy the criteria for selection to this base CRG, the CRG logic takes the two PCDs with the highest severity levels.

Appendix D.4.2 lists the PCDs required for Status 6 base CRG selection.

### *Status 6 severity level assignment*

Each base CRG that is comprised of two PCDs is subdivided into two, four or six severity levels. The number of severity levels depends on the PCDs that comprise the combination. A base CRG comprised of a nonmetastatic malignancy PCD and a Severity Level 2 Minor Chronic PCD can have only two severity levels because nonmetastatic malignancies have only two severity levels and Minor Chronic PCDs are used only if they are Level 2 (i.e., have only a single level). Similarly, a base CRG consisting of a Dominant or Moderate Chronic PCD (other than a malignancy PCD) and a severity level 2 Minor Chronic PCD, can have only four severity levels. All other Status 6 base CRGs have six severity levels.

The assignment of a Status 6 severity level occurs in two steps. An initial severity level is assigned. The initial severity level is then adjusted and the final severity level is assigned.

The initial severity level for the CRG is determined using the severity level from each of the PCDs that comprise the base CRG. Since the individual PCDs that comprise the combination can be very different in terms of relative clinical significance (e.g., Congestive Heart Failure and Chronic Obstructive Pulmonary Disease, base CRG 6110 as contrasted with Congestive Heart Failure and any Minor Chronic PCD Level 2, base CRG 6117), the criteria used to determine the severity level for the CRG is specific to the pair of PCDs that comprise the combination. There are nine different types of assignment logic for determining the initial CRG severity level from the severity level of two PCDs. The pair type assignment logic designates one PCD as the senior PCD and the other PCD as the junior PCD.

These pair types are described in Appendix D.4.3.

After the initial severity level has been set, each base CRG may be adjusted if a specified EDC or EPC is present which meets a selected rule. Adjustments are made by adding or subtracting levels within a range. For example, a factor of 1 means that the initial level will be incremented by 1. A factor of -1 means that it will be decremented by one. The maximum allowed changes for any single adjustment is an increase or decrease of two. The adjustments all take place within a range specifying a minimum and a maximum. If the adjustment raises the level, the maximum is the highest level to which the initial level can be raised, and the minimum, the lowest level from which it can be raised. If the adjustment specifies a decrease, the maximum indicates the highest level that can be decreased and the minimum, the lowest level to which it can be decreased. For EDCs only one adjustment per MDC is allowed. If multiple adjustments from a single MDC can be made, the EDC highest in the hierarchy is used. The maximum adjustment, total increase or decrease, from the initial level is two. For example, if an individual is assigned to base CRG 6100 (Chronic Renal Failure and Other Dominant or Moderate Chronic Disease) and also has acquired hemiplegia (EDC 3), his or her initial level will be increased by one from level one through Level 5 to a maximum of Level 6. If the initial level is level 6, it will not be changed. If, instead of EDC 3, the individual satisfies the rules for EDC 442 (Chronic Endocrine, Nutritional, Fluid, Electrolyte and Immune Diagnoses – Moderate), his or her initial level will be increased by one from Level 1 through Level 3 to a maximum of Level 4. If the initial level is Level 4 or above, it will not be changed. Decrement work in a similar fashion. If an individual has Alzheimer's Disease (EDC 6, Alzheimer's Disease and Other Dementias) his or her initial level would be decreased by one to a minimum of Level 1. Therefore, if their initial level was 4, their assigned level would be 3.

The severity level adjustments made for the assignment of the final severity level are described in Appendix D.4.4.

## Status 5: Single dominant or moderate chronic disease

Fifth in the CRG status hierarchy, Status 5, is a single dominant or moderate chronic disease. If in addition to the Dominant or Moderate Chronic PCD, a Minor Chronic PCD with a Severity Level of 1 is also present, the Minor Chronic PCD is ignored for the selection of the base CRG. If a Minor Chronic PCD with Severity Level 2 is present along with a Dominant or Moderate Chronic PCD, a Status 6 CRG would have been selected.

As there is only one PCD for Status 5, it is selected as the base CRG (i.e., if the single PCD for the individual is diabetes, the base CRG is diabetes). The severity level for the CRG is the same as the PCD severity level. Nondominant/nonmetastatic malignancy PCDs have two severity levels. All other moderate and dominant chronic PCDs have four severity levels.

There are 107 base CRGs for individuals with a single moderate or dominant chronic disease, each of which is divided into two or four severity levels for a total of 400 CRGs. Excluded from this list of Base CRGs are PCDs which cannot be assigned to a Status 5 CRG due to the Status 8 and Status 9 logic.

Appendix D.5.1 lists the Status 5 base CRGs.

Detailed descriptions of the PCDs and their leveling assignments were discussed previously and may be found in Appendix C.2.

## Status 4: Minor chronic disease in multiple organ systems

Status 4 consists of a single Base CRG. Individuals with two or more minor chronic diseases are assigned to a single base CRG. The severity levels reflect the number of Minor Chronic PCDs present and the severity level of those Minor Chronic PCDs. The assignment of severity levels is hierarchical and reflects the severity levels of the Minor Chronic PCDs and the number of Minor Chronic PCDs. Greater significance is given to those PCDs with higher severity levels. There are four severity levels.

- Severity Level 4 is assigned to any individual who has at least two Minor Chronic PCDs at Level 2.
- Severity Level 3 is assigned for those individuals with one Minor Chronic PCD at Level 2 and at least one Minor Chronic PCD at Level 1.
- Severity Level 2 is assigned when there are three or more Minor Chronic PCDs at Level 1.
- Severity Level 1 is assigned when there are two Minor Chronic PCDs with Level 1 present.

Appendix D.6.1 describes Status 4.

### **Status 3: Single minor chronic disease**

Status 3 is for single Minor Chronic PCDs. Individuals assigned to this status will have only one Minor Chronic PCD. The base CRG is the same as the PCD. The severity level for the CRG is the same as the PCD severity level.

There are 41 base CRGs for individuals with a single minor chronic disease, each of which is divided into two severity levels for a total of 82 CRGs.

Appendix D.7.1 lists the Status 3 base CRGs.

Detailed descriptions of the PCDs and their leveling assignments were discussed previously and may be found in Appendix C.2.

### **Status 2: Recent history of significant acute disease**

Status 2 is a recent history of significant acute disease. An individual in Status 2 has no PCDs present but has, in the most recent six month period, at least one Significant Acute EDC or a significant EPC present. If the Significant Acute EDC (e.g., Subendocardial Infarction – Initial, EDC 211) creates a chronic EDC for the history of the significant acute (e.g., History of Myocardial Infarction, EDC 182), the individual would have a PCD present and, therefore, would not be assigned to the Status 2. Thus, individuals with significant acute diseases with significant sequelae are not included in this status. However, the significant acute diseases that are present in this status (e.g., Chest Pain, EDC 217) can be a precursor to chronic disease or place the individual at risk for the development of chronic disease. Thus, although the individuals in the history of significant acute disease status do not have any reported chronic diseases, they are distinct from healthy individuals.

Certain EPCs are also considered equivalent to a significant acute disease. For example, if the skin graft EPC is present, the individual is assigned to the history of significant acute disease status even if no significant acute EDCs are present. The performance of a skin graft is considered indicative of significant acute disease such as a significant trauma which might result in long term sequelae and the need for increased care in the future.

There are six base CRGs for individuals with history of significant acute disease. The six base CRGs are assigned hierarchically based on the number, duration of treatment, and MDC of the significant acute diseases present, with one base CRG reserved for individuals with a history of a significant procedure. There are no severity levels assigned to the history of significant acute disease CRGs.

Status 2 Base CRGs are described in Appendix D.8.1.

### **Status 1: Healthy**

Status 1 is for healthy individuals who have no PCDs and no Significant Acute EDCs or EPCs in the most recent six month period. They may have Minor Acute EDCs present (e.g., upper

respiratory infection, minor fractures, hernia, etc.) but are otherwise healthy. The healthy status also includes individuals who had no medical care encounters. It is possible that in any population this includes a subset of individuals with chronic diseases who either did not access the medical care system during the time period used to assign the CRGs or failed to meet the internal edit criteria for EDC and PCD assignment.

There are two CRGs for healthy individuals. One group consists of individuals with no encounters for medical care, Healthy Non-Users. For CRG Version 1.5 and earlier, non-users could have prescription drug records. Starting with CRG Version 1.6, the presence of prescription drug use precludes assignment to the non-user group. The other group, Healthy, consists of people with encounters for medical care. There are, of course, no severity levels assigned.

Status 1 Base CRGs are described Appendix D.9.1.

## Phase 4: Consolidation of CRGs into three successive tiers of aggregation

The full CRG model with its 1080 groups may not be appropriate for all purposes. The user may need to work with fewer groups. The following approach reduces the number of groups by aggregating them is included in software. As this approach is built on the CRG assignments, users can easily create their own aggregation algorithm.

The CRG software consolidates the 1076 CRGs into three tiers of aggregation. The aggregated CRGs are referred to as Aggregated Clinical Risk Groups (ACRGs) and the three successive tiers of aggregation are referred to as ACRG1, ACRG2 and ACRG3, with ACRG3 being the highest level of aggregation. Each successive tier of aggregation has fewer groups, while maintaining the CRG status and severity levels. The severity levels, however, are sometimes adjusted in order to address differences between the groups which are being aggregated. Although the aggregation of CRGs reduces clinical precision, the successive tiers of aggregation maintain clinical meaningfulness. The successive tiers of aggregation take into consideration the future medical care needs and clinical similarity of the individuals assigned to the aggregated CRGs.

For ACRG1, similar groups are merged. The initial severity levels are maintained.

- Status 1. No change.
- Status 2. No change.
- Status 3. Aggregation is into MDC based groups. MDC 21 (Diseases And Disorders Of The Eye) and MDC 31 (Diseases And Disorders Of The Ear, Nose, Mouth And Throat) are merged, as are MDC 111 (Diseases & Disorders Of The Kidney And Urinary Tract) and MDC 121 (Diseases And Disorders Of The Male Reproductive System).
- Status 4. No change.
- Status 5. CRGs are aggregated by MDC and PCD type (Dominant or Moderate Chronic). Congestive Heart Failure and Hypertension CRGs are not merged. MDC 51 (Diseases And Disorders Of The Cardiovascular System) and MDC 52 (Peripheral Vascular Disease And Other Non-Cardiac Vascular Diseases) are merged with the exception of Congestive Heart Failure and Hypertension.

- Status 6. CRGs are aggregated based on the senior PCD of the CRG or some other clinical factor (e.g., all malignancy based groups).
- Status 7. Status 7 is aggregated into seven base groups.
- Status 8. Status 8 is collapsed into three base groups roughly analogous to dominant malignancies, leukemias, and other malignancies.
- Status 9. The two dialysis based groups are merged. Otherwise, Status 9 groups are unchanged.

For ACRG2, the aggregation continues with groups being merged into larger groups. This merger begins to combine very disparate groups for whom the same severity level may not be equivalent. For example, ACRG1 505211 (Congestive Heart Failure - Level 1) and ACRG2 505321 (Hypertension - Level 1) are Status 5 groups within the same MDC which are very different in their clinical significance. This disparity is addressed by adjusting levels up or down, as appropriate.

- Status 1. No change.
- Status 2. No change.
- Status 3. CRG1 groups are aggregated into three groups.
- Status 4. No change.
- Status 5. CRG1 groups are aggregated into MDC and multiple MDC groups. No individual CRG groups remain except for diabetes which is in its own MDC. To compensate for the fact that groups within the same MDC can be unequal (e.g., Dominant and Moderate Chronic CRGs from the same MDC), severity levels are adjusted as appropriate.
- Status 6. CRG2 continues the aggregation process begun in ACRG1. Very limited use is made of adjusting severity levels.
- Status 7. CRG2 continues the aggregation process begun in ACRG1. Status 7 is aggregated into two base groups, each with six severity levels.
- Status 8. Status 8 is collapsed into a single group with five severity levels.
- Status 9. The ten ACRG1 groups are aggregated into six groups with four severity levels each. The axis of aggregation for ACRG2 is technological dependencies (i.e., respirator and TPN), major acquired chronic conditions (e.g., HIV), and congenital illnesses (i.e., congenital quadriplegia, cystic fibrosis, muscular dystrophy, and spina bifida).

#### **Number of groups and severity levels for Clinical Risk Groups (CRGs) and aggregated CRGs (ACRGs)**

CRG Status	CRG	ACRG1	ACRG2	ACRG3
<b><i>Status 9 – Catastrophic conditions</i></b>				
Base	11	10	6	1
Severity levels	4	4	4	6
Total	44	40	24	6

CRG Status	CRG	ACRG1	ACRG2	ACRG3
<b><i>Status 8 – Dominant, metastatic, and complicated malignancies</i></b>				
Base	22	3	1	1
Severity levels	4	4	5	5
Total	88	12	5	5
<b><i>Status 7 – Dominant chronic disease in three or more organ systems</i></b>				
Base	21	7	2	1
Severity levels	6	6	6	6
Total	126	42	12	6
<b><i>Status 6 – Significant chronic disease in multiple organ systems</i></b>				
Base	61	24	8	1
Severity levels	2,4,6	4,6	6	6
Total	328	140	48	6
<b><i>Status 5 – Single dominant or moderate chronic disease</i></b>				
Base	107	36	10	1
Severity levels	2,4	2,4	2,4,5,6	6
Total	400	138	44	6
<b><i>Status 4 – Minor chronic disease in multiple organ systems</i></b>				
Base	1	1	1	1
Severity levels	4	4	4	4
Total	4	4	4	4
<b><i>Status 3 – Single minor chronic disease</i></b>				
Base	41	16	3	1
Severity levels	2	2	2	2
Total	82	32	6	2
<b><i>Status 2 – History of significant acute disease</i></b>				
Base	6	6	6	1
Severity levels	NA	NA	NA	NA
Total	6	6	6	1
<b><i>Status 1 – Healthy</i></b>				
Base	2	2	2	2

<b>CRG Status</b>	<b>CRG</b>	<b>ACRG1</b>	<b>ACRG2</b>	<b>ACRG3</b>
Severity levels	NA	NA	NA	NA
Total	2	2	2	2
<b><i>Total</i></b>				
Base	272	104	38	9
Severity levels	1,2,4,6	1,2,4,6	1,2,4,5,6	1,2,5,6
Total	1,080	416	151	38

## Phase 5: Assign alternative models for prospective or concurrent applications

The standard CRG grouping logic does not use all the information available to it. As discussed earlier, whether or not an EDC is used when assigning the CRG depends in part on several factors, such as internal validation criteria or if it occurs within the appropriate time period as specified at the time of group assignment. While this additional information is not used to assign the CRG, it is available. Some of this information can be useful.

The assignment of the standard CRG groups is a function of chronic illness that is, modified by acute illness and procedures. Individuals without validated evidence of chronic illness are assigned to Status 1 (Healthy) or Status 2 (Significant Acute). The preference given to chronic illness can be overstated in concurrent or retrospective analyses where an individual's health care utilization may be a function of some acute occurrence, e.g., delivery or trauma, rather than a chronic illness. In addition, the absence of validated evidence of a chronic illness does not necessarily mean that the illness is not present.

The validation process, while it eliminates problems such as data entry errors and "rule-out" codes, it also excludes people with chronic conditions that do not meet its criteria, limited as they are. For example, how should a single outpatient diagnosis of diabetes be interpreted? An isolated diagnosis is quite possibly an incorrect diagnosis that can be attributed to a "rule-out" or a data entry error. But, it might also be an accurate diagnosis. The individual's diabetes may be under control and require only infrequent contacts with health care providers. Alternatively, the diabetes diagnosis could be so recent that there may not have been sufficient time for the second visit to occur, which would validate the diagnosis. Another good example is a single outpatient diagnosis of a cerebrovascular infarction. At the time it occurs a cerebrovascular infarction can be reasonably expected to require a hospitalization and be reported on multiple occasions. An isolated diagnosis may reflect a follow-up to an earlier event, a "rule-out", or a simple coding error. The presence of either of these diagnoses, as well as diagnoses for other chronic and acute conditions, can be used to distinguish between people who are healthy with no evidence of a significant chronic illness or other medical condition and people who are assigned to the healthy group with some evidence of chronic illness, an acute disease, or condition that will require active medical intervention such as pregnancy or trauma.

Starting with CRG v1.8 changes have been implemented for the PCRGs and QCRGs which affect the use of acute and significant acute EDCs. For chronic EDCs there are no changes. All acute and significant acute EDCs must pass CRG internal validation. The primary criteria for this is for an EDC to be associated with a hospital admission or be reported on two different days. For maternity and pregnancy EDCs, these criteria must be met in the latest year. For the other EDCs there is no one year criteria. The reason for this is that isolated diagnoses are either associated with events in previous time periods or are the result of miscoding. For example, an isolated claim for appendicitis (EDC 299) is either a follow-up to a prior surgery or coding error. In neither case is it likely to define the beneficiary's health status within the period in which it was reported or in some future period. An isolated claim for Parkinson's Disease (EDC 2), on the other hand, raises a significant possibility of a major on-going health concern and one which may be present in the future.

To make use of these data, two alternative sets of CRG assignments have been made available beginning with CRG v1.3. One is intended for prospective applications and the other is intended for retrospective or concurrent applications. To differentiate these from the standard model, the prospective CRGs are referred to as the PCRGs and the concurrent model is referred to as the QCRGs. The P and Q identify the output record of each of the models.

While the logic that assigns PCRGs and QCRGs is essentially identical, there are differences in the groups that are defined and the order in which the groups are assigned. For example, the QCRGs include a group for neonates and a group for individuals with acute health problems of limited duration such as serious infections, trauma, and appendicitis. These groups are not used for PCRGs. Also, acute problems take precedence over chronic diagnoses in QCRGs. Chronic illness, with the exception of pregnancy, takes precedence over acute illness for PCRGs. It should be noted that to define pregnancy for the PCRGs, it is first necessary to exclude women who gave birth because they also would have been pregnant in that year. The PCRG logic accomplishes this by assigning the delivery group prior to assigning the pregnancy group.

The QCRG groups are more appropriate for concurrent or retrospective applications. They include groups based on trauma, neonates and delivery. The delivery based groups reassign some individuals with chronic conditions (in a status other than Status 1 or Status 2) to a maternity based group. This exception makes sense from a retrospective perspective where giving birth is likely to be the primary focus of medical care in any given period, even when an individual has some chronic illnesses.

The PCRGs are more appropriate for prospective applications. They focus primarily upon isolated diagnoses of significant chronic conditions. PCRGs also include maternity based groups. These, however, are limited in scope to affect only individuals in Status 1 and Status 2 because the pregnancy may not result in delivery in the analysis period due to miscarriage or because the analysis period begins after delivery.

Appendix F1.1 identifies the PCRGs.

Appendix F1.2 identifies the QCRGs.

To assign PCRGs and QCRGs, two criteria are used,

- Group. The group hierarchy which links clinically similar EDCs, specifies the order by which EDCs are assigned to a PCRG or QCRG. The groups are assigned in order from lowest to highest.

- Status. The standard CRG Status as previously assigned. This identifies the status which affected by the reassignment.

PCRGs and QCRGs are assigned in hierarchical order based on the group and status affected. For the PCRGs and QCRGs, EDCs do not have to be validated. Once the PCRG or QCRG is assigned, it is not changed even if the criteria for another group are met. If an individual does not meet the criteria for reassignment, the PCRG or QCRG is the same as the standard CRG. As a result, the number of PCRGs and QCRGs is greater than the number of CRGs. It should be noted that in order to maintain continuity between versions of CRGs and simplify the transition between versions of CRGs it was decided to retain the numbering structure and used to the character previously used only for severity levels to make PCRG and QCRG distinctions in Status 1 and Status 2.

Appendix F2.1 displays the PCRG assignment logic.

Appendix F2.2 displays the QCRG assignment logic.

After the PCRG and QCRG are assigned, they are aggregated using logic identical to the CRG logic. Just as each CRG has a corresponding ACRG1, ACRG2, and ACRG3, there are comparable groups for the PCRG (PACRG1, PACRG2, and PACRG3) and the QCRG (QACRG1, QACRG2, and QACRG3).

Appendix F3.1.1 shows the aggregation of PCRG into successive PACRG1, PACRG2, and PACRG3 groups.

Appendix F3.1.2 shows the aggregation of PACRG1 into successive PACRG2 and PACRG3 groups.

Appendix F3.1.3 shows the aggregation of PACRG2 into PACRG3 groups.

Appendix F3.1.4 shows the PACRG3 groups.

Appendix F3.2.1 shows the aggregation of QCRG into successive QACRG1, QACRG2, and QACRG3 groups.

Appendix F3.2.2 shows the aggregation of QACRG1 into successive QACRG2 and QACRG3 groups.

Appendix F3.2.3 shows the aggregation of QACRG2 into QACRG3 groups.

Appendix F3.3.4 shows the QACRG3 groups.

The two following tables summarize the number of groups by aggregation for the prospective and concurrent models respectively.

**Number of groups and severity levels for prospective Clinical Risk Groups (PCRGs) and aggregated PCRGs (PACRGs)**

Status	PCRG	PACRG1	PACRG2	PACRG3
<b><i>Status 9 – Catastrophic conditions</i></b>				
Base	11	10	6	1
Severity levels	4	4	4	6
Total	44	40	24	6
<b><i>Status 8 – Dominant, metastatic, and complicated malignancies</i></b>				
Base	22	3	1	1
Severity levels	4	4	5	5
Total	88	12	5	5
<b><i>Status 7 – Dominant chronic disease in three or more organ systems</i></b>				
Base	21	7	2	1
Severity levels	6	6	6	6
Total	126	42	12	6
<b><i>Status 6 – Significant chronic disease in multiple organ systems</i></b>				
Base	61	24	8	1
Severity levels	2,4,6	4,6	6	6
Total	328	140	48	6
<b><i>Status 5 – Single dominant or moderate chronic disease</i></b>				
Base	107	36	10	1
Severity levels	2,4	2,4	2,4,5,6	6
Total	400	138	44	6
<b><i>Status 4 – Minor chronic disease in multiple organ systems</i></b>				
Base	1	1	1	1
Severity levels	4	4	4	4
Total	4	4	4	4
<b><i>Status 3 – Single minor chronic disease</i></b>				
Base	41	16	3	1
Severity levels	2	2	2	2

Status	PCRG	PACRG1	PACRG2	PACRG3
Total	82	32	6	2
<b><i>Status 2 – History of significant acute disease</i></b>				
Base	19	19	18	4
Severity levels	NA	NA	NA	NA
Total	19	19	19	4
<b><i>Status 1 – Healthy</i></b>				
Base	15	15	15	5
Severity levels	NA	NA	NA	NA
Total	15	15	15	5
<b><i>Total</i></b>				
Base	298	131	65	16
Severity levels	1,2,4,6	1,2,4,6	1,2,4,5,6	1,2,5,6
Total	1,106	442	177	44

**Number of groups and severity levels for concurrent Clinical Risk Groups (QCRGs) and aggregated QCRGs (QACRGs)**

Status	QCRG	QACRG1	QACRG2	QACRG3
<b><i>Status 9 – Catastrophic conditions</i></b>				
Base	11	10	6	1
Severity levels	4	4	4	6
Total	44	40	24	6
<b><i>Status 8 – Dominant, metastatic, and complicated malignancies</i></b>				
Base	22	3	1	1
Severity levels	4	4	5	5
Total	88	12	5	5
<b><i>Status 7 – Dominant chronic disease in three or more organ systems</i></b>				
Base	21	7	2	1
Severity levels	6	6	6	6
Total	126	42	12	6

Status	QCRG	QACRG1	QACRG2	QACRG3
<b><i>Status 6 – Significant chronic disease in multiple organ systems</i></b>				
Base	61	24	8	1
Severity levels	2,4,6	4,6	6	6
Total	328	140	48	6
<b><i>Status 5 – Single dominant or moderate chronic disease</i></b>				
Base	107	36	10	1
Severity levels	2,4	2,4	2,4,5,6	6
Total	400	138	44	6
<b><i>Status 4 – Minor chronic disease in multiple organ systems</i></b>				
Base	1	1	1	1
Severity levels	4	4	4	4
Total	4	4	4	4
<b><i>Status 3 – Single minor chronic disease</i></b>				
Base	41	16	3	1
Severity levels	2	2	2	2
Total	82	32	6	2
<b><i>Status 2 – History of significant acute disease</i></b>				
Base	22	22	22	4
Severity levels	NA	NA	NA	NA
Total	22	22	21	4
<b><i>Status 1 – Healthy</i></b>				
Base	18	18	18	5
Severity levels	NA	NA	NA	NA
Total	18	17	17	5
<b><i>Total</i></b>				
Base	304	137	71	16
Severity levels	1,2,4,6	1,2,4,6	1,2,4,5,6	1,2,5,6
Total	1,112	448	183	44

## Conclusion

The five phase process for determining the CRG assignment for an individual uses hierarchically structured and detailed clinical logic. Great emphasis has been placed upon the clinical logic for identifying individuals with multiple interacting comorbid diseases and their associated severity of illness level. Individuals are assigned to only a single CRG, the one that best characterizes them. To facilitate the use of CRGs, they can be aggregated to meet the user's needs and alternative models have been created to make use of data not used by the standard CRG model.

# Glossary

## A

### **Aggregated CRGs (ACRGs)**

CRGs, at the discretion of the user, can be aggregated in order to reduce the number of groups. There are three recommended tiers of aggregation. These are identified as ACRG1, ACRG2, and ACRG3. Each one progressively reduces the number of groups while maintaining, albeit with some adjustment, severity leveling.

## B

### **Base CRG**

The base CRG is the CRG without its severity level.

## C

### **Chronic Manifestation EDCs**

A manifestation or acute exacerbation of a chronic disease (e.g., diabetic neuropathy). The Chronic Manifestation EDC describes the manifestation or acute exacerbation (e.g., the neuropathy), and indicates the presence of the underlying chronic disease (e.g., diabetes). In addition, they are used to identify uncommon but distinct diseases within a more frequently occurring EDC, to determine the severity level of the EDC, and for management reporting.

### **Clinical Risk Group (CRG)**

A CRG is the severity adjusted risk group to which an individual is assigned. Each individual is assigned to one, and only one, risk group. There are two variants of CRGs, the ACRG and the Base CRG.

### **Concurrent Clinical Risk Groups (QCRGs)**

The QCRGs are a set of alternative risk group assignments designed for concurrent or retrospective applications. It is a limited reassignment of the CRGs. Like the CRGs it has a set of aggregated groups (ACRGs) called the QPACRGs.

## D

### **Dominant Chronic EDCs**

Serious lifelong chronic diseases which often result in the progressive deterioration of an individual's health, and often times lead to, or significantly contribute to, an individual's debility, death, and future need for medical care (e.g., cerebral palsy, congestive heart failure, diabetes, and schizophrenia).

## E

### **Episode Diagnostic Categories (EDCs)**

The diseases in each MDC are subdivided into EDCs. Each EDC is assigned to one of six EDC types. Four of these types refer to chronic diseases; the other two refer to acute diseases. A disease is classified as chronic if the duration of the disease is lifelong or of a prolonged duration. A disease is classified as acute if the duration of the disease is short or the disease would naturally resolve. The six EDC types are:

- Dominant Chronic EDC
- Chronic Manifestation EDCs
- Minor Acute EDCs
- Minor Chronic EDCs
- Moderate Chronic EDCs
- Significant Acute EDCs

### **Episode Procedure Categories (EPCs)**

All currently valid CPT, HCPCS, ICD-9, and ICD-10 procedure codes are assigned to an EPC. There are two types of EPCs, one which can be used to form Significant Acute CRGs and the other which cannot be. Both types may be used in CRG clinical logic. Most EPCs, however, are not used in the clinical logic. They are included to support internal management systems.

## M

### **Major Diagnostic Category (MDC)**

Each ICD-9 and ICD-10 diagnosis code is categorized into one of 37 mutually exclusive and exhaustive categories referred to as Major Diagnostic Categories (MDCs). The diseases in each MDC correspond to a single organ system or disease etiology. With the exception of catastrophic conditions, malignancies, systemic infectious diseases, and multiple trauma (which were assigned to their own MDCs), diseases that included both a particular organ system and a particular etiology were assigned to the MDC corresponding to the organ system involved.

### **Minor Acute EDCs**

Minor acute illnesses or events that may be mild or more serious but are self limiting, are not a precursor to chronic disease. They do not place the individual at risk for the development of chronic disease and do not result in significant sequelae (e.g., fractured arm, common cold, appendicitis).

### **Minor Chronic EDCs**

Minor chronic diseases can usually be managed effectively throughout an individual's life, typically with few complications and limited effect upon an individual's debility, death, and future need for

medical care (e.g., migraine headache, hearing loss). However, minor chronic diseases may be a precursor to more serious diseases (e.g., hyperlipidemia).

### **Moderate Chronic EDCs**

Serious chronic diseases which usually do not result in the progressive deterioration of an individual's health, but can significantly contribute to an individual's debility, death, or future need for medical care, are classified as Moderate Chronic EDCs. Moderate Chronic EDCs are very variable in their severity and progression. Asthma, epilepsy, and bipolar disorder are examples of Moderate Chronic EDCs.

## P

### **Primary Chronic Disease (PCD)**

From each MDC the most significant chronic disease under active treatment is identified. If chronic diseases from more than one MDC are present, multiple PCDs may be assigned.

### **Prospective Clinical Risk Groups (PCRGs)**

The PCRG is a set of alternative risk group assignment designed for prospective applications. It is a limited reassignment of the CRGs. Like the CRGs it has a set of aggregated groups (ACRGs) called the PACRGs.

## R

### **Rank**

CRGs make extensive use of hierarchies in the clinical logic. This logic in large part relies on an assigned rank. All MDCs and chronic EDCs within them are assigned an explicit rank which is used to determine which MDC or EDC takes precedence over another.

### **Rule**

CRGs make extensive use of conditional relationships in the clinical logic. These conditional relationships have been codified and are referred to as rules.

## S

### **Severity adjustment (leveling)**

CRGs and PCDs are severity adjusted or leveled. The number of levels depends on the type of group. The severity level reflects the extent and progression of the diagnosis or diagnoses.

### **Significant Acute EDCs**

A serious acute illness which can be a precursor to, or place the individual at risk for, the development of chronic disease (e.g., chest pain) or can potentially result in significant sequelae

(e.g., head injury with coma). In the CRG logic, an acute illness is only classified as a significant acute illness if it occurred in the most recent six month period.

### **Status**

CRGs are arranged into nine health statuses ranging from healthy individuals to individuals with catastrophic conditions.