Identifying and Classifying Children With Chronic Conditions Using Administrative Data With the Clinical Risk Group Classification System

John M. Neff, MD; Virginia L. Sharp, MA; John Muldoon, MHA; Jeff Graham, MD; Jean Popalisky, RN; James C. Gay, MD

Objective.—To identify and categorize children with chronic health conditions using administrative data.

Methods.—The Clinical Risk Groups (CRGs) system is used to classify children, aged 0–18 years, in a mid-sized health plan into mutually exclusive categories and severity groups. Enrollees are categorized into 9 health status groups—healthy, significant acute, and 7 chronic conditions—and are then stratified by severity. Utilization is examined by category and severity level based on eligibility and claims files for calendar year 1999. Only children enrolled for at least 6 months (newborns at least 3 months) are included.

Results.—This analysis of 34 544 children classifies 85.2% as healthy, including 19.6% with no claims; 5.2% with a significant acute illness; 4.6% with a minor chronic condition; and 4.9% with a moderate to catastrophic chronic condition. The average number of unique medical care encounters per child increases by chronic condition category and by severity level. Compared to national prevalence norms for selected conditions, CRGs do well in identifying patients who have conditions that require interaction with the health care system.

Conclusions.—CRGs are a useful tool for identifying, classifying, and stratifying children with chronic health conditions. Enrollees can be grouped into categories for patient tracking, case management, and utilization.

KEY WORDS: administrative data; children; chronic conditions; chronic illnesses; Clinical Risk Groups; prevalence; special health care needs

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Identifying children with special health care needs (CSHCN) is an essential first step to providing and evaluating appropriate programs and services for this important population.[1–3] In 1998, the Maternal and Child Health Bureau (MCHB) developed a broad and inclusive definition.[4] This definition has become the standard for developing tools for identifying and classifying CSHCN.[1,5–7]

Two basic approaches have been proposed for operationalizing MCHB's definition of children with special health care needs: categorical and noncategorical. The categorical approach identifies children based on their specific medical condition or defined condition status, whereas the noncategorical approach identifies children according to characteristics associated with having a special health care need, such as service use, medical needs, or functional status, independent of a specific diagnosis. Each approach has been demonstrated to have value in specific contexts. The categorical approach generally provides for more stratification of the population being analyzed (such as by specific conditions, condition severity, or number of conditions present). Since the categorical approach requires diagnostic information, it is most appropriate for classifying individuals and groups of individuals within health plans or programs that collect diagnostic and/or medical billing information for a predefined population. Such organizations can then use this CSHCN classification for tracking individuals and groups and for measuring costs and utilization. The noncategorical approach uses various survey tools to identify the consequences of having a special health care need, such as limitation in activities and increased medical or service needs, as reported by parents or caregivers to identify CSHCN. Because the noncategorical survey tools, by definition, focus on identifying the CSHCN population as a whole, they are not amenable to stratification and tracking of individuals and/or subgroups of the CSHCN population. No one approach can meet all possible needs for defining CSHCN in all situations.

Historically, categorical tools for identifying children and adults with special health needs have been limited to condition checklists and studies of sentinel conditions.[8,9] Such condition lists do not provide for evaluating the severity of individual conditions, comparisons across groups of conditions of similar severity, or the occurrence of multiple chronic conditions. The National Association of Children's Hospitals and Related Institutions (NACHRI) developed a diagnosis-based pediatric classification tool in the early 1990s that included a severity component but

From the Center for Children with Special Needs, Children's Hospital and Regional Medical Center, Seattle, Wash (Dr Neff, Ms Sharp, and Ms Popalisky); the Department of Pediatrics, University of Washington School of Medicine, Seattle, Wash (Dr Neff); the National Association of Children's Hospitals and Related Institutions, Alexandria, Va (Mr Muldoon); the Northwest Washington Medical Bureau, Burlington, Wash (Dr Graham); and the Department of Pediatrics, Vanderbilt University School of Medicine, Nashville, Tenn (Dr Gay).

Address correspondence to Dr John Neff, Center for Children with Special Needs, Children's Hospital and Regional Medical Center, 4800 Sand Point Way NE-MS: CM-09, Seattle, WA 98105-5371 (e-mail: jneff@chmc.org).

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no means of assessing severity for children with multiple chronic conditions.[10–13]

This article describes a new categorical tool, Clinical Risk Groups (CRGs), for identifying children with special health care needs and its application in a single health plan's pediatric population. The primary objective of this study is to demonstrate how this classification system can be used to identify children with special needs and to stratify them by severity level and chronic health condition. Potential uses of these stratifications within the health plan and for more diverse organizations are also explored.

METHODS

CRGs are a categorical clinical classification system that uses proprietary computer software to group individuals into mutually exclusive hierarchical categories and to assign each person to a severity level if he/she has a chronic health condition. CRGs are an integration of 2 systems, the Episode Grouper developed by 3M Health Information Systems (3M HIS) and NACHRI's Classification of Congenital and Chronic Health Conditions (CCCHC).

NACHRI's CCCHC was developed as an ICD-9-CM code–based classification system for children.[10] The CCCHC classified pediatric diagnoses as chronic (a condition expected to last at least a year and to have certain consequences) or nonchronic, based on the presence or absence of certain predefined ICD-9-CM codes in the child's medical encounter records. The chronic condition codes were further stratified according to 4 severity levels—mild, moderate, major, and extreme. Severity-level assignments of individuals into one of the 4 severity groups took into account the severity level of each individual diagnosis and disease progression. The pediatric division chiefs, including numerous pediatric specialists, of 2 medical schools, the University of Washington and Vanderbilt University, independently reviewed the specific codes and severity assignments. In general, the division chiefs at the 2 institutions agreed on the significant classifications and levels of severity of the conditions in their specialty. A medical advisory panel of NACHRI reviewed the final classification designation.

The CCCHC was tested on a State of Washington Medicaid database and combined encounter data from 11 private Washington health plans for 1993. Data for over 700 000 children were analyzed and demonstrated a correlation between severity level and charges.[10–13]

Independently, 3M had been working for several years to develop an episodic grouper designed for risk adjustment. There were several significant differences between the classification efforts of 3M and NACHRI. First, the 3M system ranked each individual into a single clinically defined risk category, whereas the NACHRI CCCHC placed each individual into a hierarchical severity group without defining the primary clinical condition. Second, the 3M system, with a few exceptions, required 2 encounters with the same diagnosis in order to classify that patient with a diagnosis, whereas the CCCHC system generally required only one encounter. Third, the 3M system evaluated not just the presence of a specific code for severity designation but also the time between code occurrences, age, gender, associated diagnostic and procedure codes, and numerous other complex relationships. Fourth, the 3M system was designed to be used at multiple levels of aggregation, from the full categorization (273 base categories, 1081 total cells) to Core Health Status Groups (9 base categories, 37 total cells), whereas the CCCHC simply defined a child's overall severity level. All of the components of the original 3M system were incorporated into the final combined system, CRGs.

The combined CRG system to be used for both adults and children was developed and tested jointly over a 4-year period.[14] The developmental effort was an interactive process, with NACHRI and 3M HIS physicians and analytical staff reviewing multiple sets of test runs and revising clinical specifications. In areas of disagreement, the 3M internist usually deferred to the NACHRI pediatricians in issues concerning children, and visa versa for adult issues. The 3 test databases used in this combined testing process were 1) a 2-year claims database from the state of Washington Medicaid program with approximately 250 000 noninstitutional recipients, aged 0–64 years; 2) a 4-year Medicare claims database with approximately 1 250 000 recipients, primarily over age 65; and 3) a 4-year private sector claims database of adults and their dependents with approximately 250 000 recipients, aged 0–64 years. Recently, the CRGs have been used to analyze charges by severity level in the same study population reported in this study, the Northwest Washington Medical Bureau.[15] All of these evaluations demonstrate a clear correlation of CRG category and severity designation with charges.

CRGs also have been evaluated in comparison to other systems with respect to their use for risk adjustment.[16] In a comparative analysis of CRGs with 5 other health status groupers (Disability Payment System [DPS], Ambulatory Care Groups—version 3 and 4 [ACGs 3 and 4], Diagnostic Cost Groups [DCGs], and Hierarchical Coexisting Conditions [HCCs]) based on Washington State Medicaid SSI enrollees (1994–95 and 1992–93) and 2 years of data on Washington Medicaid non-SSI enrollees (1992–93), the authors conclude that ''the most recent addition to the existing 'family' of groupers, CRG, generally performs as well as the other five and so offers another alternative measure of health status to researchers and payors.''[16]

The CRG clinical logic requires 5 distinct analytic phases to generate an individual's final patient classification[14] (Figure 1). In Phase I, each diagnostic and procedure code in the patient's medical record is evaluated and used to create the individual's disease profile and history of medical interventions. Each disease is classified into one of 533 Episode Diagnostic Categories (EDCs), and these, in turn, are grouped into 31 hierarchically ordered Major Diagnostic Categories (MDCs). Each MDC represents either a single organ system (such as respiratory, digestive, etc) or a major disease category (such as malignancies, trauma, and infectious diseases). Each EDC is

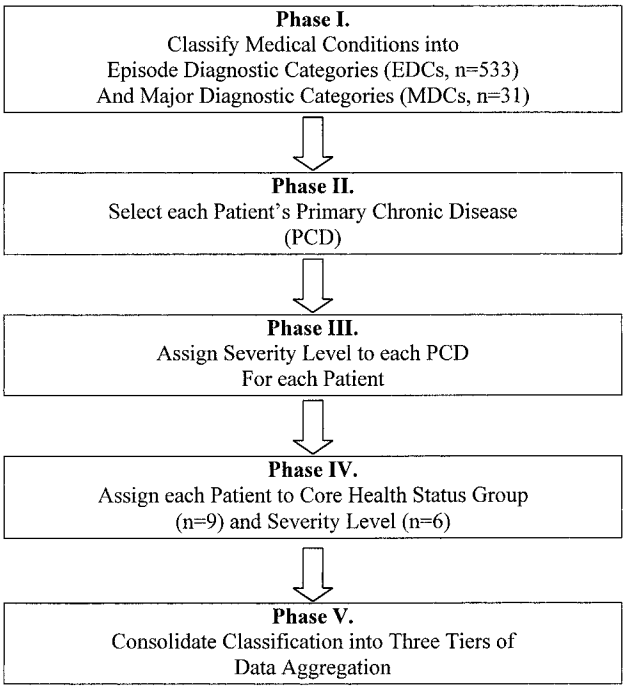

Figure 1. *Outline of CRG Clinical Logic.*

assigned to one of 6 groups: dominant chronic (60 EDCs), moderate chronic (65 EDCs), minor chronic (40 EDCs), chronic manifestation (99 EDCs), significant acute (151 EDCs), and minor acute (118 EDCs). Dominant chronic conditions are defined as serious medical conditions that often result in progressive deterioration of health and that also contribute to debility, death, and a future need for medical services. Moderate chronic conditions are those that are not progressive, that are highly variable, and that can contribute to individual debility, death, and a future need for medical care. Minor chronic conditions are those that can generally be managed throughout an individual's life with few complications. A manifestation of a chronic condition describes a condition that generally evolves from a primary chronic condition, such as diabetes with eye or circulatory manifestations. Significant acute conditions are those conditions that place an individual at risk for developing a chronic condition. Minor acute conditions are those that generally can be expected to be self-limited. There are 2 additional status groups formed out of the dominant chronic group, catastrophic and dominant/metastatic malignancies. The catastrophic are those chronic conditions that are expected to be life long, that are often progressive, and that require extensive services. Dominant malignancies are those that have a very difficult progression (eg, brain tumors) or that are fundamentally systemic (eg, leukemia). Other malignancies remain in their appropriate body system classification in the other chronic illness groups. This structure of the EDCs simplified, incorporating NACHRI's CCCHCs into the CRG logic. CCCHC severity levels 1–3, with little change, corresponded to the minor, moderate, and dominant CRG status groups, respectively. CCCHC severity level 4 matched with the CRG catastrophic status group.

Phase II of the CRG clinical logic focuses on selecting a patient's Primary Chronic Disease (PCD). This is required for individuals with multiple EDCs in a single organ system. When an individual is found to have more than one chronic EDC present in an MDC, the most significant chronic condition under active treatment is selected as the PCD. Criteria used to perform this selection include a predefined hierarchy of EDCs in each MDC, developed through extensive clinical review, site of treatment (hospitalizations being weighted more heavily), and frequency and duration of treatment. For example, when asthma and cystic fibrosis are both present in the same patient, the PCD becomes cystic fibrosis; when seizures and a progressive neurological condition are both present, the PCD is the progressive neurological condition.

In Phase III, a severity level is assigned to each PCD for each individual. Severity levels describe the extent and progression of the patient's disease and are determined by the chronic manifestation EDCs, comorbid and acute EDCs from the same or other MDCs, patient age (when a condition has an age-related progression), procedural codes, and some utilization measures, such as multiple hospitalizations.

In Phase IV, each patient is assigned to one of 9 CRG core health status groups based on his/her PCDs and severity levels. The CRG core health status group provides a general categorization of the patient's clinical condition. CRG core health status groups are hierarchically ordered, as follows: Catastrophic Conditions (most complex), Dominant, Metastatic and Complicated Malignancies, Dominant Chronic Conditions in 3 or more organ systems (triplets), Dominant or Moderate Chronic Conditions in 2 organ systems (pairs), Single Dominant or Moderate Chronic Conditions, Minor Chronic Conditions in multiple organ systems, Single Minor Chronic Conditions, History of Significant Acute Conditions, and Healthy (including those with no medical encounters).

In Phase V, the CRGs are consolidated into 3 tiers of aggregation, based on predefined hierarchical relationships between MDCs. Each tier represents a progressively higher level of aggregation, with the full set of 1081 categories (full CRG) being aggregated into Body Systems (413 cells, tier 1), Super Body Systems (149 cells, tier 2), and Core Health Status Groups (37 cells, tier 3). Tier 3, or Aggregated CRG3 (ACRG3), is the aggregation used in this analysis—the 9 Core Health Status Groups described above stratified by up to 6 severity levels, for a total of 37 cells. Each individual in the health plan is exclusively assigned to one of these 37 cells, and each cell represents a hierarchical health status group and severity level. Note that the number of severity levels defined varies across status groups (from 1 for Healthy and Significant Acute to 6 for the most complex groups) and that severity levels cannot be compared across status groups. That is, a severity level 2 for a patient classified as Minor Chronic is not comparable to a severity level 2 for a patient classified as Catastrophic.

Study Population

The Northwest Washington Medical Bureau (NWMB) is a health insurance plan in northwest Washington State.

It serves primarily 4 counties: Skagit, Whatcom, Island, and San Juan. The plan has contractual arrangements with virtually all of the practitioners in the region.

Through a mix of health plans, in 1999 the NWMB insured about 110 000 people, primarily in the 4 northwest counties. These plans included traditional fee-for-service, non-Medicaid managed care, Medicaid Capitated Managed Care (Healthy Options), Medicaid fee for service (those exempted from Medicaid Capitated Managed Care), Medicare supplement, and Washington's Basic Health Plan (the state-subsidized health insurance program). In these counties, all Medicaid recipients less than 19 years of age are required to enroll in capitated managed care (Healthy Options), except those who are institutionalized, enrolled in foster care or SSI, and a very small number with extraordinary special needs. Medicaid Behavioral Health Services are included in the managed care benefit package for up to 12 outpatient visits per year. All of the non-Medicaid plans include at least this benefit. Medicaid Managed Care patients who require more than 12 outpatient mental health visits or an admission for inpatient mental health care are referred to regional support services and are billed separately to the state. These additional services are not likely to show up as NWMB encounters. In 1999, NWMB insured 46 600 children, ages 0–18 years, representing about 45% of the population 0–18 years in the 4-county region. The NWMB insured children were covered as follows: Medicaid capitated managed care—37%, Medicaid fee-for-service—0.9%, non-Medicaid capitated managed care—17%, non-Medicaid fee-for-service—45%. All providers are required to submit claims to NWMB for all services provided, regardless of the type of health plan—capitated or fee-for-service—covering the patient's medical care.

Analysis

Eligibility and paid claims files for all children born on or after January 1, 1982 were obtained from NWMB on a strictly confidential basis without identification of individual children. The initial enrollment file indicated an enrollment of 48 013 children. Eleven thousand four hundred and eight of these children were identified as being covered by more than one health insurance policy (ie, were included multiple times in the enrollment file). Unique patient identifiers, independent of parent's membership, were created for all children, so that those covered by multiple policies were represented by a single unique identifier. These ''unique'' children were then screened for eligibility. Children over 1 year of age were required to be enrolled for at least 6 months during the 1999 calendar year; children born during 1999 had to be enrolled for at least 3 months. After creating unique patient identifiers and removing children who did not meet eligibility requirements, the resultant population for analysis included 34 544 unique children (48 013 total enrollees minus 11 408 with multiple coverage minus 3061 not meeting eligibility requirements). A Patient File containing a unique patient identifier, date of birth, gender, and period of eligibility was created from the NWMB eligibility data for CRG analysis.

The paid claims file for all children's claims processed through NWMB during calendar year 1999 contained 310 679 records. Of these, 293 626 were for the 34 544 eligible children identified above. After recoding to meet CRG specifications, a Claims File containing a unique patient identifier, date of service, site of service, provider type, diagnosis (ICD-9-CM) codes, procedure codes and type (ICD-9-CM, CPT, HCPCS), and principal diagnosis flag was created for CRG analysis.

These 2 files—the Patient File and the Claims File—were analyzed using 3M CRG Software (Windows NT version 1.0). The CRG software produces a number of different output records. The Grouping Results provide 4 distinct levels of aggregation. For the purposes of this article, classification results are reported at the highest level of aggregation, ACRG3, which identifies core health status group and severity level only. The CRG software also generates output information on how each claims record was used, all diagnostic categories identified for each patient (both for Major Diagnostic Categories and Episode Diagnostic Categories), counts of records per patient, and several different error records (ie, medical code errors, missing data).

Estimation of prevalence rates for specific medical conditions required identifying all Episode Diagnostic Categories recorded for each child, not just the dominant condition, since many children have more than one chronic condition. Within each specific medical condition group—whether at the Major Diagnostic Category level or the Episode Diagnostic Category level—unique patient identifiers were checked to insure that children were not counted multiple times within diagnostic groups.

RESULTS

CRG classification results for the NWMB calendar year 1999 data are summarized in Tables 1 through 4. Table 1 summarizes the CRG classification of the 34 544 eligible, unique children covered by NWMB at the CRG's highest level of aggregation: CRG core health status group by severity level (ACRG3). The 29 446 children (85.2%) classified as healthy include 6773 children (19.6%) who had no claims recorded by the health plan during calendar year 1999. Children with no claims are more likely to be older than those with claims; 86.7% of children with no claims were 5–17 years old, compared to 71.2% in the claims group ($P < .001$). The remaining 5098 children were classified by CRGs as having either significant acute conditions (1807 children; 5.2%) or one or more chronic conditions (3291 children; 9.5%). Note that of those children classified as chronically ill, 1585 (4.6% of all children) have minor chronic conditions singly or in pairs, and 1706 (4.9%) have moderate to catastrophic chronic conditions singly or in pairs. Note also that Table 1 does not show all 37 cells of the ACRG3 aggregation. The chronic pair and chronic triplet status groups were merged, since very few children exhibit more than 2 dominant chronic conditions. Likewise, relatively few children

Table 1. CRG Classification of NWMB CY99 Medical Billing Data for Eligible Members Ages 0–17 Years*

Status	Level of Severity					Totals	
	0	1	2	3–4	5–6	#	%
Healthy	29 446					29 446	85.2
Significant acute	1807					1807	5.2
Single minor chronic		1345	165			1510	4.4
Multiple minor chronic		52	2	21		75	0.2
Single dominant or moderate chronic		1010	435	94	7	1546	4.5
Pairs & triplets		70	24	24	8	126	0.4
Malignancies		1	11	5	0	17	>0.1
Catastrophic		6	3	8	0	17	>0.1
Totals by level of severity	31 253	2484	640	152	15	34 544	100.0
Percentage distribution by level of severity	90.5	7.2	1.9	0.4	0.0	100.0	

*Note that the Healthy category includes 6773 eligible children with no encounters during calendar year 1999. Pearson Chi-square significant at $P < .001$ for distribution. CRG, clinical risk groups; NWMB, Northwest Washington Medical Bureau.

are classified in the higher severity levels. For the NWMB pediatric population, only 44 of the 34 544 children (0.13%) were classified at severity level 4 and above.

Table 2 provides examples of the primary chronic health conditions identified within each of the single condition CRG status groups along with their frequency in the NWMB pediatric population. Of the 1510 NWMB children classified as having a single minor chronic condition, three fourths of the children were diagnosed with either Attention Deficit Hyperactivity Disorder (ADHD), minor musculoskeletal conditions, minor eye problems, or minor mental health, including non–major depressive conditions. In the single dominant/moderate CRG status group, asthma is the most frequent condition at both severity level stratifications illustrated. Mental health conditions, including conduct and major depressive condi-

Table 2. Examples of Primary Chronic Diagnoses (PCDs) by Selected Clinical Risk Group (CRG) Status Groups and Severity Levels

	Total No. of Children	Percent of Category (%)
Status group 3—single minor chronic condition		
Attention deficit/hyperactivity disorder	617	40.9
Chronic joint/musculoskeletal diagnosis—minor	248	16.4
Chronic eye diagnosis—minor	150	9.9
Depression (nonmajor)	114	7.5
Chronic mental health diagnoses—minor	45	3.0
All other conditions in single minor	336	22.3
Total for all single minor chronic (34 conditions)	1510	100.0
Status group 5—single dominant or moderate chronic, severity levels 1 & 2		
Asthma	591	40.7
Conduct, impulse control, other disruptive behavior disorders	161	11.1
Depressive and other psychoses	60	4.1
Diabetes	46	3.2
Curvature or anomaly of the spine	45	3.1
Chronic mental health diagnoses—moderate	44	3.0
Chronic alcohol abuse	41	2.8
All other conditions in this status/severity category	463	31.9
Total for status group 5, sev 1 & 2 (68 conditions)	1451	100.0
Single dominant or moderate chronic, severity levels 3 & 4		
Asthma	39	41.1
Chronic metabolic & endocrine diagnoses—major	6	6.3
Complex cyanotic & major cardiac septal anomalies	5	5.3
Diabetes	5	5.3
All other conditions in this status/severity category	40	42.1
Total for status group 5, sev 3 & 4 (28 conditions)	95	100.0
Malignancies & catastrophic conditions, severity levels 1–4		
Spina bifida	6	17.6
Acute lymphoid leukemia	5	14.7
Cystic fibrosis	4	11.8
Other malignancies	4	11.8
All other conditions in this status/severity category	15	44.1
Total for status groups 8 & 9 (17 conditions)	34	100.0

Table 3. Distribution of Average Number of Unique Encounters* per Member by Clinical Risk Group (CRG) Status and Severity Level, NWMB CY99 Eligible Members Ages 0–17 Years

Status	Level of Severity					Status Group Totals
	0	1	2	3–4	5–6	
Healthy	3.4					3.4
Significant acute	11.7					11.7
Single minor chronic		10.5	18.2			11.4
Multiple minor chronic		16.5	21.0	24.3		18.8
Single dominant or moderate chronic		13.4	18.4	26.4	27.6	15.7
Pairs & triplets		26.8	36.7	53.3	104.4	38.6
Malignancies		22.0†	77.1	80.0		74.7
Catastrophic		17.2	43.0	40.9		32.9
Totals by level of severity	3.9	12.3	20.2	32.9	68.5	5.0

*Unique encounters were defined as a specific patient visiting a specific provider at one location on a particular date. Multiple billings associated with a single visit are counted as one encounter.

†Not an average, as only one individual in this cell. ANOVA between group differences significant at $P < .001$ level for group totals for both status groups and severity levels. NWMB, Northwest Washington Medical Bureau.

tions and other moderate chronic mental health diagnoses, are the PCDs identified for over 18% of the children classified as severity level 1 or 2 with a single dominant or moderate chronic condition. In the dominant/moderate CRG status group, severity levels 3 and 4, asthma is again the most common condition. The other diagnoses in this group are predominantly non–mental health conditions that occur at very low frequencies. Children in the catastrophic and malignancy CRGs are most likely to be diagnosed with spina bifida, cystic fibrosis, acute lymphoid leukemia, and other malignancies, all at extremely low overall frequencies.

Table 3 summarizes the average number of unique medical care encounters recorded in the health plan's administrative data for each child during calendar year 1999 by CRG status group and severity level. These figures are not synonymous with total encounters, as ''unique encounters'' do not reflect multiple billings from the same provider on the same date (eg, multiple lab tests or hospital physicians). Unique encounters are defined here as a specific patient visiting a specific provider at one location on a particular date. Children classified as healthy had an average of 3.4 unique encounters during 1999, including the 23% of healthy children with no encounters. Note that although CRGs are based in part on numbers of encounters, frequency alone does not correlate with severity level or status group. Those classified as significant acute averaged about the same number of unique encounters as those in the single minor chronic group. Whereas the average number of encounters generally increases as severity increases within each chronic condition status group, and the average number of encounters generally increases across core health status groups as medical complexity increases, this pattern is certainly not perfectly consistent, nor is it expected to be. Other encounter characteristics, such as type of provider, site of service, specific medical procedures performed, and time between both similar encounters and procedures are significant factors in the CRG classification algorithm.

In addition to identifying a person's PCD, CRGs also

Table 4. Prevalence Rates for Selected Chronic Condition Groups, All Diagnoses Recorded for Each Child

Diagnosis-based Condition Groups	Number of NWMB Children*	% of NWMB Children	Prevalence from Literature Review (%)	Reference Citations
Asthma	682	1.97	4–6 (a)	20–22
Attention deficit hyperactivity disorder	789	3.08 (b)	2.5–4.0 (b)	23
Cystic fibrosis	4	0.03	0.02 (c)	24
Cerebral palsy	6	0.02 (d)	0.2–0.5 (d)	25–27
Diabetes	58	0.17	0.1–0.2	28
Learning disorder	101	0.39 (b)	>5 (b)	29
Malignancies	25	0.07 (e)	0.08	30
Mental health conditions	999	5.54 (f)	6–12 (f)	31
Mental retardation	64	0.25 (b)	0.4–3 (b, g)	32–34
Total unique children analyzed	34 544			
Total children with chronic conditions	3291			

*Note that these are *unique* children *within* conditions groups (ie, each child is only counted once per condition group, but may appear in multiple condition groups in the table). NWMB, Northwest Washington Medical Bureau. Parenthetical letter designations are as follows: (a) National asthma prevalence of 4–6% for children 0–17 years from National Health Interview Survey [20,22]; estimated at 4.9% for children 1–17 years using administrative data and a single outpatient or inpatient asthma diagnosis [21]; (b) school-aged children, ages 5–17 years; (c) Washington State Cystic Fibrosis Registry, 1999; (d) ages 0–10 years; (e) Washington State Tumor Registry, 1999; (f) mental health conditions includes children in NWMB with both chronic and acute conditions identified through clinical risk groups (CRGs). 541 of the NWMB children had at least one chronic mental health conditions; 458 children had acute mental health conditions only. National estimate relates to ''emotionally disturbed children.'' Age range for both estimates is 9–17 years; (g) .4% represents severe mental retardation, IQ < 50 [32].

provide for identifying all chronic conditions identified in the medical encounter records for each individual. Table 4 summarizes prevalence rates for selected chronic condition groups based on all chronic conditions identified at the Episode Diagnostic Category level for each NWMB child. Although asthma and ADHD continue to show high frequencies of occurrence—as they did at the patient level (Table 2)—mental health conditions, excluding ADHD, affect a particularly large percentage of NWMB children. Mental health conditions classified by CRGs as chronic affect 541 NWMB children, ranking third in terms of frequency of chronic health condition, behind asthma and ADHD. CRGs also identify another 458 children as having acute mental health conditions—conditions that are expected to be self-limiting but that have the potential to become chronic. These diagnoses include stress, anxiety, adjustment, and neurotic conditions. Taken together, the combined chronic and acute mental health conditions affect more children than any single physical chronic health condition. Examples of conditions included in the mental health combined group are eating disorders, depression, conduct and bipolar disorders, and schizophrenia. Such conditions often occur in combination with other physical or mental chronic conditions but may not always be identifiable from the individual's final mutually exclusive CRG category. Several examples can help clarify this. When an individual has multiple mental health conditions, only the diagnosis selected as primary will show in the final CRG classification. If a child has both ADHD and a depression or anxiety disorder, the child is classified within the mental health hierarchy as having ADHD, with the depression or anxiety disorder taken into account in the severity level assignment. If a child has a moderate chronic physical condition and a minor chronic mental health condition, the final CRG assignment will be a single moderate chronic physical condition, with the minor chronic mental health condition taken into account in the severity level assignment. If a child has both a moderate chronic physical condition and a moderate chronic mental health condition, the final CRG assignment will be a chronic pair category. This pair may specifically identify the presence of a mental health condition, or it may be more broadly defined (because of low case volume constraints).

DISCUSSION

Claims data collected and maintained by health plans are a source of clinical and procedural information that can be used to identify and classify children having a wide range of chronic health conditions. Using 3M's CRG software and these data, we have shown how each child can be classified into mutually exclusive clinically based categories, defined by health status and relative severity. CRGs also can be used for estimating the prevalence of specific chronic health conditions in a population by analyzing the system's output at the EDC level, identifying all chronic conditions found in the medical record of each patient, as opposed to the PCD. These applications have been demonstrated in a case study of children enrolled in the NWMB, a mid-sized health plan in Washington State.

Health plans are under increasing pressure to identify chronically ill populations for case management.[17] Categorical identification tools, such as CRGs, are particularly useful for such applications, as they are specifically designed to stratify the chronically ill population. In contrast, noncategorical identification tools do not discriminate between levels of severity or identify children with specific chronic conditions that might be targeted by specific disease management programs by health plans. CRG classification can assist a health plan to identify those children who have complex chronic conditions or who are at increased risk for developing such conditions and can use this information to help determine which children should receive case management services. In the case study presented here, case management services might be targeted at several different levels: 1) all children identified with a chronic condition = 3291 children, 9.5% of child population; 2) those identified with very severe chronic conditions, for example, severity levels 5 and 6, = 15 children, <1% of population; 3) by specific condition categories such as asthma, diabetes, malignancies, cystic fibrosis, ADHD, or mental health conditions (Table 4); 4) those children identified as being at risk of developing chronic illnesses (significant acute) = 1807 children, 5.23% of NWMB child population; 5) children with dominant high severity (severity level 3 or above) or complex chronic conditions (pairs, triplets, malignancies, or catastrophic) = 261 children (Table 1).[18]

Since there is currently no gold standard for validating identification of children with chronic health conditions, it is difficult to assess the accuracy of CRGs used for this purpose. In a case study of 497 randomly sampled NWMB children classified using 2 noncategorical survey tools as well as CRGs, the 3 tools agreed in most cases (ie, in identifying the individual child as either having or not having a chronic health condition). CRG chronic classification agreed with the one survey screener for 85% of the children and with the other screener for 90% of the children.[7]

Another way to validate the CRG classification results is to compare the prevalence rates for specific conditions estimated using CRGs with those found in the general pediatric literature. Prevalence comparisons are demonstrated for 9 chronic conditions or condition groups in Table 4. Certain of these conditions—asthma, ADHD, learning disorders, mental health conditions, and mental retardation—were selected for comparison because of their relative frequency in children. The other 3 conditions—cystic fibrosis, cerebral palsy, and diabetes—were selected because they can be considered sentinel chronic conditions that are resource intensive and life-long.[9]

The comparisons in Table 4 indicate that, from an overall population prevalence standpoint, CRGs appear to do well in identifying children with ADHD, cystic fibrosis, diabetes, malignancies, and mental health conditions. The NWMB prevalence rates calculated from CRG classification are consistent with those found in other studies. In contrast, asthma appears to some degree to be underreported. Cerebral palsy, learning disorders, and mental re-

tardation seem to be significantly underidentified. With the possible exception of cerebral palsy, these results are consistent with the characteristics of the administrative data that form the basis of the CRG system. Conditions that require frequent interaction with the health system, especially if they require physician contact, hospitalization, or clinical tests, are much more likely to be identified in administrative data than those that do not generally require medical intervention. Treatment for learning disorders and mental retardation is rarely the primary purpose of a medical visit, and thus, these conditions are not often coded in health-plan administrative data. The underidentification of cerebral palsy might be explained by the existence of separately funded neurodevelopment centers where these children might be receiving most of their care.

CRG classification logic may also explain some of the relative underidentification of some conditions, such as asthma. CRGs require a minimum of 2 coded diagnoses during a 12-month period for identification. The comparative studies cited either relied on parent report or only required one diagnostic encounter to achieve their higher prevalence rates. CRGs also do not evaluate prescription use as an indicator of an ongoing chronic condition. Some children who have been diagnosed with asthma only rarely experience asthma attacks requiring medical attention and might only be identifiable in health plan data through pharmacy claims. Whereas the NWMB prevalence rate for mental health conditions is within the low range of the prevalence rates found in the literature, this may not be true for other health plans, as coding of any condition is at least partially determined by the medical provider's expectation of reimbursement. Health plans that do not provide reimbursement for certain types of services are unlikely to find those services consistently appearing in their administrative data.[19] Conversely, plans that provide a richer set of mental health benefits may observe a higher prevalence of these conditions. In comparing prevalence rates for specific conditions derived from administrative data, regardless of the classification methodology, it is important to understand local reimbursement characteristics, coding, and practice patterns.

There are certain inherent limitations in this tool as well as in any other tool that uses only administrative data to identify and classify children with chronic illnesses. Any tool used to classify individuals will need to be updated periodically to account for changes in technology and therapy and to incorporate new and revised codes. No encounter-based system can be used to develop full population prevalence figures for a geographic area. It only can be applied to the population covered by that specific encounter database and by those who meet the tool's eligibility requirements. No diagnosis-based tool will identify individuals who are enrolled and eligible but who for some reason do not use health services reimbursed by their health plan. For our NWMB population, 19.6% of the children meeting eligibility requirements had no encounters during calendar year 1999 in the plan's administrative database. To the extent that services are received outside of the health plan, such as through a child's school or the public health system, such services will not be recorded in health-plan administrative data. Many children with speech or learning disorders, who receive most or all of their care through a school or public health system, and those with mental health conditions, who are cared for entirely in separate mental health programs not billed through their health plan, will not be captured in the plan's administrative database.

Given these data limitations and methodological constraints, it is not surprising that compared to noncategorical survey tools, CRGs identify a smaller percentage of children as CSHCN. Overall, CRGs classified 9.5% of the eligible NWMB children as having a chronic condition. In contrast, analysis of the National Health Interview Survey found that 12% of the children met the full MCHB definition of CSHCN, and 18% met all or part of the definition.[5] CRGs perform especially well in identifying children who have moderate to severe chronic conditions requiring regular medical intervention. In our study population, CRGs identified 4.9% of the children as moderate to severe in this group, a figure that is conceptually comparable to the 6.5% estimated by others to have a chronic condition that compromises their ability to perform usual age-appropriate activities.[6]

This study represents the first application of CRGs for identifying and classifying CSHCN in a specific health plan. To the extent that comprehensive medical encounter data is available, we believe it provides an appropriate methodology for identifying CSHCN and for stratifying those children with respect to severity and medical complexity. CRGs can be a useful tool for case identification for targeting disease-specific programs for case management, even though there may be limitations in the system and the underlying data. No one CSHCN identification system is likely to meet all possible epidemiological, public health, case management, and risk adjustment needs. The CRG system, which is categorical and based on medical encounter information, is one tool that can effectively address the need to identify specific children for case management and program planning. This tool will require updating at least every 3 to 5 years to incorporate information gained from further utilization and to accurately reflect medical technology, therapy, and coding. To the extent that the quality of data collected through administrative databases and the tool improves over time, the utility and validity of CRGs as a CSHCN identification tool will also improve.

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