Stratification of Children by Medical Complexity

John M. Neff, MD; Holly Clifton, MPH; Jean Popalisky, RN, DNP; Chuan Zhou, PhD

From the Center for Child Health, Behavior, and Development (Dr Neff), Department of Knowledge Management (Ms Clifton), Department of Clinical Effectiveness (Ms Popalisky), and Center for Child Health, Behavior and Development, Seattle Children's Research Institute (Dr Zhou), Seattle Children's Hospital, Seattle, Wash

The lead author, JMN, has had a contract from the Children's Hospital Association to contribute to the development of software from 3M Health Information Systems. One of these, CRGs, is used in this study. He also has a no cost research license from 3M Health Information Systems to use CRGs. He has no financial interests in the Children's Hospital Association or 3M Health Information Systems, and receives no royalty revenue from these organizations. Neither the Children's Hospital Association nor 3M Health Information Systems have had any input to this study and have not reviewed the results or the manuscript prior to submission. The other authors declare that they have no conflict of interest.
Address correspondence to John M. Neff, MD, Center for Child Health, Behavior and Development, Seattle Children's Hospital, PO Box 5371, CW8-6, Seattle, WA 98145-5005 (e-mail: john.neff@seattlechildrens.org).
Received for publication March 12, 2014; accepted October 25, 2014.

Abstract

Objective: To stratify children using available software, Clinical Risk Groups (CRGs), in a tertiary children's hospital, Seattle Children's Hospital (SCH), and a state's Medicaid claims data, Washington State (WSM), into 3 condition groups: complex chronic disease (C-CD); noncomplex chronic disease (NC-CD), and nonchronic disease (NC).

Methods: A panel of pediatricians developed consensus definitions for children with C-CD, NC-CD, and NC. Using electronic medical record review and expert consensus, a gold standard population of 700 children was identified and placed into 1 the 3 groups: 350 C-CD, 100 NC-CD, and 250 NC. CRGs v1.9 stratified the 700 children into the condition groups using 3 years of WSM and SCH encounter data (2008–2010). WSM data included encounters/claims for all sites of care. SCH data included only inpatient, emergency department, and day surgery claims.

Results: A total of 678 of 700 children identified in SCH data were matched in WSM data. CRGs demonstrated good to excellent specificity in correctly classifying all 3 groups in SCH and WSM data; C-CD in SCH (94.3%) and in WSM (91.1%); NC-CD in SCH (88.2%) and in WSM (83.7%); and NC in SCH (84.9%) and in WSM (94.6%). There was good to excellent sensitivity for C-CD in SCH (75.4%) and in WSM (82.1%) and for NC in SCH (98.4%) and in WSM (81.1%). CRGs demonstrated poor sensitivity for NC-CD in SCH (31.0%) and WSM (58.0%). Reasons for poor sensitivity in NC-CD are explored.

Conclusions: CRGs can be used to stratify children receiving care at a tertiary care hospital according to complexity in both hospital and Medicaid administrative data. This method will enhance reporting of health-related outcome data.

Keywords: administrative billing data; children; chronic diseases; clinical risk group; stratification

Academic Pediatrics 2015;15:191–196

What's New

Without stratification that includes complex chronic conditions, outcome measures in children will not reflect disease complexity. This article describes and validates a method for 3-way stratification of children in Medicaid health plan data and in a children's hospital data.

THE CHILD HEALTH Insurance Program Reauthorization Act of 2009 mandated the need to identify disparities in health care quality for children with special health care needs (CSHCN).[1] The population defined as CSHCN is broad and includes children with mild chronic diseases along with those with complex diseases.[2,3] Without further stratification, outcome measures of CSHCN will not reflect the range of disease complexities that exists. In an effort to address this and other quality of care data gaps, the Child Health Insurance Program Reauthorization legislation mandated the establishment of a national Pediatric Quality Measures Program, charged with enhancing and developing new quality of care measures for children. The Pediatric Quality Measures Program consists of 7 centers of excellence. One of these centers, the Center of Excellence on Quality of Care Measures for Children With Complex Needs (COE4CCN), was assigned the task of identifying methods to stratify CSHCN according to complexities.

Children with special health care needs (CSHCN) represent approximately 10% to 20% of children and consume about 40% to 60% of children's health expenditures.[3,4] A group of CSHCN, those with complex chronic diseases, identified in a health plan's administrative data in 1999 to represent less than 1% of children, accounted for approximately 15% of children's health expenditures.[4] These are children who either have significant chronic diseases in more than single body system, who have malignancies, or who are dependent on technology. In a 2009 assessment of trends in 28 freestanding children's hospitals, children with complex chronic diseases accounted for 19% of hospitalizations, 49% of hospital days, and 53% of charges.[5] This group appears to be increasing more than any other group in children's hospitals.[5–7] Outcome measures such as readmissions and admissions to the

intensive care units are considerably higher in children with complex chronic diseases.[8–15] Outcome/quality measures must be able to account for this variation in complexity in both health plan and hospital data, and must be able to separately identify those with complex chronic conditions. There are few data on the validity of methods to stratify children according to medical complexity. One risk adjustment software, Clinical Risk Groups (CRGs), has been used to classify children according to complexity and costs both in hospital and health plan data.[5,16] CRGs is a software product of 3M Health Information Systems and the Children's Hospital Association, formerly the National Association of Children's Hospitals and Related Institutions.[17] CRGs have been used to ascertain distribution of costs and health care utilization by condition groups, to evaluate the availability and use of oral health services in children, and to determine the hospital admission patterns from the emergency department (ED).[4,5,15,18] CRGs have been tested as a method to identify the need for ambulatory care coordination for children with lifelong chronic conditions from hospital data with 95% specificity and 76.3% sensitivity.[19]

An adaptation of CRGs for a 3-way stratification (nonchronic, noncomplex chronic, and complex chronic), has not been tested. CRGs have not been tested for the same group of children in hospital as well as health plan data. Such a 3-way stratification method represents an improved method that distinguishes those with complex chronic conditions from those with noncomplex chronic conditions and those with nonchronic conditions—groups with very different health care utilization patterns.[4] Such stratification can enhance reporting of outcome measures, interventions, and patient tracking.

The objectives of this study were to assess sensitivity and specificity of CRGs for a 3-way stratification of children in Seattle Children's Hospital (SCH) and Washington State Medicaid (WSM) claims data for complex chronic disease (C-CD), noncomplex chronic disease (NC-CD), and nonchronic disease (NC).

METHODS

ADMINISTRATIVE DATA SETS STUDY

Children aged 0 to 18 years insured by WSM and seen at SCH for at least 1 ED visit and/or inpatient stay in 2010 were eligible for inclusion in the study. SCH provided the claims data for these patients that were available to them, including all inpatient, day surgery, and ED encounters for 2008, 2009, and 2010. WSM provided combined data of encounters for managed care (MC) and claims for fee for service (FFS) for 2007, 2008, 2009, and 2010. The FFS data included all inpatient, outpatient, and pharmacy claims. MC data included inpatient and outpatient encounters. Not included were data from the state's mental health division or SCH inpatient psychiatric unit. In WSM data, 318 (46.9%) were enrolled in FFS and 360 (53.1%) in MC. The condition groups' distributions were different. C-CD was distributed 209 (77.4%) to FFS and 61 (22.6%) to MC; NC was distributed 25 (12.4%) to FFS and 177 (87.6%). to MC.

DEVELOPING CONSENSUS DEFINITIONS

This study used the same gold standard and consensus definition of conditions that has been described and used in a separate COE4CCN-funded study of a novel nonproprietary software, Pediatric Medical Complexity Algorithm (PMCA).[20] The Agency for Healthcare Research Quality requested that a nonproprietary software, PMCA, be developed for identification of children with complex chronic conditions. Except for the use of the same gold standard, these 2 studies have been kept separate with separate evaluation teams following the requirements for the use of CRGs by 3M Health Information Systems. The evaluation methodology was the same for both CRGs and PMCA studies.[20] Children were stratified 3 ways: C-CD, NC-CD, or NC.

The COE4CCN Medical Complexity Working Group developed the first consensus draft of definitions after review and discussion of 2 previously published care coordination conceptual frameworks and their accompanying definitions for levels of medical complexity.[21,22] The working group was selected to assure that the group had broad expertise in general outpatient and inpatient pediatric and an in-depth understanding of children with medical complexity. The final panel of 5 pediatricians included a former private practice general pediatrician now serving as a hospitalist at SCH concentrating on children with special health care needs and 4 academic generalists with expertise in general pediatrics and with a focus on children with medical complexity. Of the 4 academic pediatricians, 1 is primarily a hospitalist, 1 participates in a clinic for children with medical complexity and cares for them on the inpatient service, 1 has an active outpatient service in general pediatrics and serves as an attending physician on a general pediatric service, and 1 has had many years of experience in pediatric infectious diseases, has been an active attending physician on children's hospitals inpatient services, has expertise in children with special needs, and has developed a prepaid program for foster children.

All participants in this multistate and multi-institution COE4CCN project reviewed and provided feedback on the working group draft consensus definitions. The COE4CCN participants included 43 representatives from 2 state Medicaid agencies, Family Voices, pediatric nursing, hospital medicine, and outpatient primary care, as well as pediatric health services research. The final working group consensus definitions incorporated the COE4CCN participants' feedback (Table 1).

CRGs were used to draw a sample of 1000 patients from the potentially eligible population, excluding those who turned 18 during the study period. There was intentional oversampling of C-CD to assure that at least 500 of the 1000 were C-CD. A nurse researcher (JP), with at least 20 years of clinical experience with children with complex conditions, blinded to CRGs categorization, reviewed all available SCH patient electronic medical records of the sample and made assignments into 1 of 3 levels of medical complexity. When level assignment was unclear, cases were reviewed by a panel of physicians from the working group who were blinded to CRGs categorization. Final