An Evaluation of the Canadian Institute for Health Information Comprehensive Ambulatory Classification System

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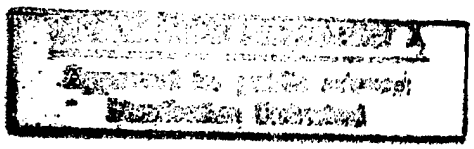

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The purpose of this study was to evaluate the Comprehensive Ambulatory Classification System (CACS) developed by the Canadian Institute for Health Information (CIHI). CIHI is a national, not-for-profit organization with a mandate to coordinate the development and maintenance of a comprehensive health information system for Canada. Previous to this evaluation, a healthcare team from the U.S. Army Medical Department Center and School evaluated the major ambulatory classification systems developed for the U.S. Health Care Financing Administration (HCFA). CIHI requested research evaluation assistance using the U.S. Army Ambulatory Care Database, the same data set used for the HCFA evaluations.

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EXECUTIVE SUMMARY

The purpose of this study was to evaluate the Comprehensive Ambulatory Classification System (CACS) developed by the Canadian Institute for Health Information (CIHI). CIHI is a national, not-for-profit organization with a mandate to coordinate the development and maintenance of a comprehensive health information system for Canada. The CIHI is directing a large project to develop a National Ambulatory Care Reporting System that includes the CACS. The Canadian CACS consists of 416 cells (groups) organized into 21 Major Ambulatory Clusters based on body system or functional grouping.

Previous to this evaluation, in response to a United States Congressional Mandate, a healthcare team from the United States (U.S.) Army Medical Department Center and School, Directorate of Health Care Studies and Clinical Investigation formally evaluated the major ambulatory classification systems developed for the U.S. Health Care Financing Administration (HCFA). Specifically, the study team evaluated the Ambulatory Visit Groups (AVGs) formulated by a group of researchers from Yale University (Fetter, 1980), the Products of Ambulatory Care (PACs) developed by the New York State Health Department (Tenan et. al., 1988), the Emergency Department Groups (EDGs) Version 1.2, created by Health Systems Research, Inc. (Cameron, et. al., 1990), the Ambulatory Patient Groups (APGs) Version I (Averill, et. al., 1990) developed by 3M - Health Information Services (HIS), and Version II (Averill, et. al., 1995), the Ambulatory Care Groups (ACGs) designed by John Hopkins University (Weiner, Starfield, Steinwachs, and Mumford, 1990), and the Products of Ambulatory Surgery (PAS) created by the New York State Health Department (Filmore, et. al., 1991).

The database used for all evaluations consisted of a patient visit data sample derived from

the Army's Ambulatory Care Database (ACDB) Study (Georgoulakis et. al., 1988). The ACDB study was conducted over a 21- month period (January 1986 to September 1987) during which over 3.1 million patient visits were recorded from six study hospitals. These visits represented care provided by more than 4,000 health care providers representing 50 clinical specialties.

The six Army Medical Treatment Facilities (MTFs) selected for the study, having diverse missions and populations, constituted a representative sample of Army Medical Department health care. The six sites were Brooke Army Medical Center, Fort Sam Houston, Texas; Womack Army Medical Center, Fort Bragg, North Carolina; Moncrief Army Community Hospital, Fort Jackson, South Carolina; Bayne - Jones Army Community Hospital, Fort Polk, Louisiana; Blanchfield Army Community Hospital, Fort Campbell, Kentucky; and Fox Army Community Hospital, Redstone Arsenal, Alabama.

Similar to the other evaluations, the study team utilized the same sample of data from the ACDB study. The sample consisted of 516,006 cases that were costed and reviewed for reliability. It should be noted that a case could be made for the utilization of a more current data set. However, if different data sets were utilized it would not be possible to make meaningful comparisons between the various classification systems.

Although a number of costing methodologies were developed by the study team, only one was employed with the CACS. This cost formula was utilized in the previous evaluations and represents (in our opinion) the most accurate costing methodology for the sample data set. This methodology was developed jointly by the study team and the New York State Department of Public Health. The cost formula is similar to the methodology used by the New York State Department of Public Health for reimbursement for their health care program (Medicaid).

A review of the number of patients by different age groups indicated that the population

in this study is similar to populations served by civilian community hospitals in the United States. Since the United States and Canada have similar demographics, an assumption can be made that the grouper results would be similar with a Canadian sample. However, since medical services (based on diagnoses) are not normally distributed in the population as the size of the sample is increased, one could expect to see additional cells of the CACS utilized.

Preparation for the evaluation including mapping (re-coding) the Canadian Procedures coded in the nomenclature of the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-CM-9 Procedures) into the American Medical Association's Physician's Current Procedural Terminology (CPT). The mapping (re-coding) was required so that the grouper could recognize similar procedures that are coded differently. Due to manpower constraints, this mapping (re-coding) was not as extensive as it was in previous evaluations. However, this shortcoming (the mapping re-coding) did not appear to be problematic as few visits were assigned to the ungroupable category (approx. 3.4%). Additionally, many visits that were not grouped were due to military unique procedures, i.e., types of flight (aviation) physicals that do not map (re-code) to an appropriate ICD-9-CM procedure.

The criteria designed to evaluate the CACS was similar to previous evaluations and included: (1) clinical meaningfulness (i.e., from a clinical perspective did the groups make sense); (2) administrative ease of implementation; and (3) statistical analysis of the grouper. The clinical evaluations indicate that the CACS were developed using sound medical logic (with the stipulation that the clinical evaluation was not extensive). However, the physician responsible for the evaluation is Chair of a University Medical Department, has extensive grouper experience, has military and civilian medical experience, and served as a member of the evaluation team (Cronson and Associates, 1996) that evaluated the Canadian Day Procedure

Groups (DPGs).

The criteria of administrative ease consists of two main components: (1) the installation and operation of the CACS software and (2) the transparency of the grouping methodology, i.e., can one readily understand the logic of the grouping methodology. The grouper program is written in the computer language of the Statistical Analysis System (SAS) and can run on a Pentium (or equivalent) personal computer. Instructions on the installation and use appear clear and appropriate. However, it is recommended that upon completion of the grouper algorithm development phase, the program should be re-written in a more efficient programming language other than SAS.

A series of statistical analyses (General Linear Model Procedure, Duncan's Multiple Range Test, Bonferroni (Dunn) T Tests, and Scheffe) were conducted utilizing cost as the dependent variable. Results from these analyses indicated that the CACS explained nearly 29% of the variance and a number of the CACS groups (cells) were similar in terms of resource consumption. The amount of variance accounted for by this grouper is currently the largest test statistic accounted for by previous grouper algorithms (Ambulatory Visit Groups, Products of Ambulatory Care, Products of Ambulatory Surgery, Emergency Department Groups, or Ambulatory Patient Groups) tested with this data set.

Based on our evaluation, the grouper logic appears to be clear, succinct and well illustrated in the Background Document provided to the study group. From all indications, (visits contained in the sample) the visits were assigned to the appropriate cell in accordance with the grouper logic. Groups that were not utilized (e.g. < 30 visit observations and 0 observations) are contained in Tables 3 and 4.

Based upon this evaluation, the following recommendations are provided:

(1) The grouping methodology (software code) should be written in a more efficient computer language.

(2) A thorough review of all groups that are the same (based on resource intensity) should be reviewed; this review should include both a resource and a clinical review.

(3) The cells that did not meet the required statistical procedure (30 or more) should be reviewed with respect to administrative and clinical appropriateness.

INTRODUCTION

In the 1986 Omnibus Budget Reconciliation Act (OBRA), the United States Congress directed the Health Care Financing Administration (HCFA) to develop an outpatient prospective payment system (PPS) for the facility component of Medicare. This directive was based on the success of Medicare's inpatient facility PPS in controlling Medicare expenditures. In accordance with this mandate, HCFA issued grants to various organizations to develop a PPS for the facility component of ambulatory care. Based on this directive, Congress, in the National Defense Appropriation Act of 1987 (NDA 1987, P.L. 99-661. Sec. 701, USC 1101), instructed the Department of Defense (DoD) to revise the method of allocating resources within the military health care system. The act specified that DoD implement a Diagnosis Related Groups (DRGs) type system to allocate resources to its medical treatment facilities (MTFs). The system for inpatient care was scheduled for implementation on 1 October 1987, but was not implemented until 1 October 1988. The system for outpatient facility resource allocation was initially scheduled for implementation on 1 October 1988. However, recognizing the challenges in developing an ambulatory classification system, Congress, in subsequent National Defense Authorization Acts, extended the deadline for the implementation of an outpatient system until 1 January 1999.

PURPOSE OF THE STUDY

To assist the DoD in meeting the objectives of the congressional mandate and to study the potential impact of a new method of allocating resources, the U.S. Army Medical Department initiated the Ambulatory Classification Evaluation Study (ACES). The purpose of the study was to review the available ambulatory classification systems for possible implementation by the military. The ACES study team utilized military data collected from the U.S. Army Medical

Department's Ambulatory Care Database (ACDB) study (Georgoulakis et. al., 1988).

DEVELOPMENT OF THE CANADIAN INSTITUTE FOR HEALTH INFORMATION AMBULATORY CARE REPORTING SYSTEM

The Canadian Institute for Health Information (CIHI) is the national, not-for-profit agency responsible for developing and maintaining Canada's health information system. CIHI is developing a National Ambulatory Care Reporting System. As part of this reporting system, CIHI is evaluating an ambulatory care patient classification system and requested research evaluation assistance from several former members of the Ambulatory Care Evaluation Study team. CIHI was interested in using the U.S. Army Ambulatory Care Database to assist with the evaluation of its classification system and comparisons to other ambulatory classification systems previously reviewed.

METHODOLOGY

An effective evaluation of any ambulatory classification system is best accomplished through the use of a large database containing a diversity of patients (i.e., age and gender) and types of visit (i.e., procedures and diagnoses). The study team extracted a sample of data from the Army Medical Department's ACDB study which met these requirements (Georgoulakis et. al., 1988). Researchers conducting the ACDB study collected clinical data on visits from all existing outpatient departments. During the 21-month data collection phase of the study, over 3.1 million patient visits were recorded from six study hospitals. These visits represented care provided by more than 4,000 health care providers across all Army outpatient medical specialties. For the purpose of this study, the researchers utilized the same sample of data used to evaluate the other ambulatory classification systems.

DATA COLLECTION INSTRUMENTS

Because of the magnitude of the ACDB project, mark sense technology was selected as the most appropriate and cost efficient method of data collection. Mark sense technology allows for pencil or pen entries to be electronically scanned for data and subsequently entered into a computerized database. In order to gain the most benefit from the study, a data collection form was developed for each clinical specialty. The patient collection instruments consisted of the same categories of data elements across all specialties. The forms contained four sections. The first section was completed by the patient and consisted of identifying information (e.g., social security number, age). The second section contained administrative information that was completed by the clinic receptionist or secretary. An example of this type of information is the location of visit (e.g., clinic, ward, home, etc.) The third and fourth sections required completion by health care providers. Elements in this section included length of time spent with the patient, diagnoses, procedures, and disposition.

STUDY HOSPITALS

The six hospitals selected for the study, having diverse military missions and populations, constituted a representative sample of Army Medical Department health care. Collectively, these hospitals serve a catchment area population of nearly a half million (424,000) beneficiaries. For example, Brooke Army Medical Center (BAMC), Fort Sam Houston (San Antonio), Texas, is a 425 bed facility that, in addition to providing a complete array of outpatient services, is a teaching hospital and operates a Level I trauma center. BAMC serves over 17,000 active duty military personnel, 53,000 military family members, and 39,000 retired military beneficiaries (Annals of Emergency, Medicine, 1989). Additionally, BAMC serves as one of three trauma centers in San Antonio, accepting all unstable civilian emergencies within its

geographic catchment area. Womack Army Medical Center, Fort Bragg (Fayetteville), North Carolina, is a 300-bed facility and, in addition to providing extensive outpatient services, contains a Level II trauma center. Womack provides care to the 82nd Airborne Division as well as large family member and retired military populations. The total population served is in excess of 125,000 beneficiaries. The remaining four hospitals in the study operated Level III emergency departments. Moncrief Army Community Hospital, Fort Jackson (Columbia), South Carolina, provides access to a large population of basic trainees, some tenant troops (troops who have their headquarters at a different installation), retirees, and family members. Moncrief also provides a full array of outpatient services and operates 175 beds. Moncrief's catchment population contains slightly more than 55,000 beneficiaries. Blanchfield Army Community Hospital, Fort Campbell (Clarksville), Kentucky, is a 200-bed facility and provides services to the 101st Airborne Division, family members, and a retired population. The beneficiary population of Blanchfield is approximately 70,000. Bayne-Jones Community Army Hospital, Fort Polk (Leesville), Louisiana, operates 150 beds, as well as, provides a full array of outpatient services to service members, their families, and retirees. The Bayne-Jones catchment population is around 40,000. The final medical treatment facility included in the study was Fox Army Community Hospital at Redstone Arsenal in Huntsville, Alabama. This hospital serves a stable military and beneficiary population of approximately 25,000 individuals. Fox primarily provides outpatient services and was a 100-bed facility.

CLINICAL RELIABILITY OF THE DATA

To provide an accurate and objective assessment of the quality of the data collected in the ACDB, a standardized scoring instrument was developed. Utilizing a modified Delphi technique (Polit & Hungler, 1983), the most important administrative and clinical data elements collected

in the patient visits was determined. Each of the data elements was then discussed, rank ordered, and assigned a relative value in terms of importance to the study. Using this weighing process, members of the study group selected three administrative and two clinical data elements. The data elements that represented the administrative area included the sponsor's social security number with the patient's family member prefix, the date of visit, and the clinic code. The selected clinical data elements consisted of the primary diagnosis, procedure, code, and the health care provider identification code. Following a pilot study, a random sample of 9,015 medical records was compared with the ACDB records (Moon et. al., 1988). An analysis of the records indicated a mean score of 10.56 (11 was the maximum score) and a standard deviation of 1.27. This indicates an extremely high degree of reliability between the patient medical record and the recorded ACDB data.

DIAGNOSTIC AND PROCEDURAL CODE REMAPPING

Under the direction of the physician member of the research staff, the unique Canadian and ICD-9-CM procedure codes were re-coded into military and CPT (Current Physician Terminology) procedure codes. Consultants from various specialties and a Canadian Nosologist assisted in re-coding some of the more esoteric codes. Preparation for the evaluation including mapping (re-coding) the Canadian Procedures coded in the nomenclature of the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-CM-9 Procedures) into the American Medical Association's Physician's Current Procedural Terminology (CPT). The mapping (re-coding) was required so that the grouper could recognize similar procedures that are coded differently. Due to manpower constraints, this mapping (re-coding) was not as extensive as it was in previous evaluations. However, this shortcoming (the mapping re-coding) did not appear to be problematic as few visits were assigned to the ungroupable category (approx 3.4%).

Additionally, virtually all visits that were not grouped were due to military unique procedures, i.e., types of flight (aviation) physicals that do not map (re-code) to an appropriate ICD-9-CM procedure code.

DEMOGRAPHIC CHARACTERISTICS OF THE DATA SAMPLE

A review of the number of patients by different age groups indicated that the population in this study is similar to populations served by civilian community hospitals in the United States. Since the United States and Canada have similar demographics, an assumption can be made that the grouper results would be similar with a Canadian sample. However, since medical services (based on diagnoses) are not normally distributed in the population as the size of the sample is increased, one could expect to see additional cells of the CACS utilized. Of the 516,006 visits in the sample, 281,276 (54.51%) were males and 234,730 (45.49%) were females. The proportion of young adult (21 to 29 years old) patients in the sample is 27.24%. Additional information on the gender and ages of the sample can be found in Table 1.

COST METHODOLOGY

To accurately evaluate the various ambulatory classification systems, the development of an equitable per visit cost was necessary. The study team developed several different methods to approximate a visit cost. The development of the various cost methodologies was necessary since U.S. military hospitals do not currently use a civilian type cost methodology that is capable of producing a "cost" or more precisely a "bill" for each individual visit.

Table 1 - Sample Beneficiary Status by Individual Patient and Patient Visit

BENEFICIARY STATUS	PATIENT VISITS		INDIVIDUAL PATIENTS	
	NUMBER	PERCENT	NUMBER	PERCENT
SEX:				
Female	234730	45.49	99108	43.34
Male	281276	54.51	129574	56.66
TOTAL	516006	100.00	228682	100.00
AGE:				
0-2	28484	5.52	13073	5.72
3-11	38169	7.40	19818	8.67
12-20	108787	21.08	51932	22.71
21-29	145238	28.14	62286	27.24
30-38	66083	12.81	28158	12.31
39-47	37785	7.32	17157	7.50
48-56	34970	6.78	15554	6.80
57-65	32818	6.36	12674	5.54
66 and older	23672	4.59	8030	3.51
TOTAL	516006	100.00	228682	100.00
BENEFICIARY STATUS:				
Military Active Duty	196735	38.13	80587	35.24
Family Member	194993	31.97	71755	31.38
Retiree	48726	9.44	18540	8.11
Other	105552	20.46	57800	25.27
TOTAL	516006	100.00	228682	100.00

U.S. Army hospitals are funded from several Department of the Army revenue sources. For example, military pay (salary) is paid from a centralized general fund account and may be regarded as "sunk" costs in that salaries are paid to military health care providers regardless of the number of patients treated. Civilian (U.S. Government) employee health care provider salaries and benefits are paid from a Major Army Command allocation of funds based upon establish personnel ceilings. The Medical Treatment Facility commanders, once given their allocations of personnel, have nominal authority to manage personnel and associated cost. Normal capital expenses, new buildings and equipment, are provided subject to availability of funds, from major commands or higher command levels and are not included in the hospital's operating budget.

Utilities are considered installation operating expenses and, as such, are not included in the hospital's operating budget. However, it should be mentioned that such installation expenses are captured in the Department of Defense Medical Expense Performance Report System (MEPRS) at the medical facility level. This and other expense data elements, as products of the MEPRS system will play a significant role in ambulatory care resourcing. Finally, it was not possible for the study team to develop cost methodologies associated with indirect health care cost (i.e., provider malpractice insurance, forms, or other such indirect costs). Nevertheless, as the military adapts to new ambulatory costing and resource allocation methodologies, all inclusive expense data is vital to insure fair and equitable medical treatment facility funding.

DEFINITIONS OF COST FORMULA COMPONENTS

A description of the various components that make up the cost formulas follows:

ANCILLARY: For those laboratory procedures indicated by CPT procedure codes within the range of 80002 - 89399, a percentage of the Civilian Health and Medical Program for the

Uniformed Services (CHAMPUS) rate was used. The following steps were taken to calculate this percentage. A military average for laboratory was calculated (total number of visits in the sample {516,006} multiplied by the average per visit MEPRS laboratory reimbursement of $3.36). This total was divided by the actual number of laboratory procedures performed (152,982) to provide an average cost per procedure of $11.33. The average for all CHAMPUS laboratory procedures was $18.25. The percentage of military to CHAMPUS ($11.33/$18.25) was 62.1%. This percentage was applied to laboratory procedures selected on the data collection form.

CHAMPUS: These rates are based on the CHAMPUS prevailing rate for each CPT procedure. The CHAMPUS prevailing rates (the amount of money paid) for a total number of claims for a particular state. The claim(s) are paid at the 80th percentile as the prevailing rate for the procedure in that state. The CHAMPUS prevailing rates in this study were the average of the regional rates at the time of the data collection. Additionally, the CHAMPUS prevailing rate, and a professional component accounting for the remaining 40%. (CHAMPUS Fiscal Intermediary Pricing File Extract Report for Fiscal Year 1988, August 1988).

CLMEAN: An average procedure cost per clinic group was employed for calculating a military supply cost. This average was computed by taking the sum of all CHAMPUS procedure costs for a clinic grouping divided by the number of visits in that particular grouping.

LAB: The number of laboratory procedures ordered during a visit was indicated on the front of the data collection form. This number was then multiplied by a computed average cost. The average cost for laboratory was calculated by multiplying the total number of visits in the sample, 516,006 by the military (MEPRS) average reimbursement per visit of $3.36. This total was divided by the actual number of procedures performed (152,982) in the sample to provide an

average cost of $11.33 (see Table 2).

RX: An average cost per prescription ordered was calculated based on the available MEPRS data. The MEPRS cost is spread over all visits without taking into consideration whether a prescription was actually ordered for a particular visit. In order to use the more specific visit services that were contained in the ACDB, it was necessary to compute an average cost per prescription and multiply this by the number of prescriptions ordered for a particular visit. The computations for obtaining the average cost uses the MEPRS average rate per visit ($5.43) multiplied by the total number of visits (516,006). The result was the total reimbursement ($2,801,912.00). This total rate was divided by the actual number of prescriptions (264,070) filled to determine average cost per unit ($10.61) (see Table 2).

Table 2 - Basis for Laboratory and Prescription Average Costs

	TOTAL VISITS	COST PER VISIT	TOTAL COST	N OF PROC	PER UNIT
LAB	516,006	$3.36	$1,733,780.00	152,982	$11.33
RX	516,006	$5.43	$2,801,912.00	264,070	$10.61

X-RAY: The charge for this service was obtained by using 39% of the CHAMPUS rate for those procedures contained in the CPT code range of 70002-79999. Since X-ray procedures have such a wide range of costs ($27.30 for a plain film to $661.00 for a CT Scan), it was decided that a percentage rather than the flat military (MEPRS) rate would be more appropriate. The total reimbursement was calculated by multiplying the number of visits (516,006) in the sample by the average reimbursement of ($1,284.85.00). This was divided by the number of plain films (55,308) for an average military reimbursement of $23.23 per plain film. This ratio 3.23/$59.52) of military to CHAMPUS was 39%. This percentage was applied to all radiological procedures including high technology procedures like MRI, CT Scan, etc.

OTHER SPECIAL COST CONSIDERATIONS

The inclusion of X-ray costs in the study formulas presented a special challenge to the study group as only the number and the general types of X-rays were included in the data collection instrument (i.e., plain films, CT scan). To capture the cost of this important aspect of medical care, a staff physician assigned a CPT X-ray procedure code to each clinic. The decision to assign a particular code to a clinic was based on the most common type of X-ray for that clinic. Some of the CPT procedure codes used in the study had no corresponding CHAMPUS costs. In order to use these codes, the physician assigned to the team selected a related CPT code to substitute for costing purposes.

The pain clinic presented another situation that required special treatment. Because of the specificity of the data collection form, duplication of documentation for injections sometimes occurred. To correct this double counting, an algorithm was written which grouped certain CPT procedures together and assigned a cost based on the more expensive procedure.

SUMMARY OF COST METHODOLOGY

In summary, the ACES Study team developed various cost methodologies using a variety of sources (e.g., MEPRS, CHAMPUS) to calculate resource utilization for each military health care visit. These cost equations allowed the investigation of various cost concepts using the combined strength of the ACDB data and in some equations, the CHAMPUS prevailing rates. In addition, the MEPRS cost data with its fundamental limitations was used. The development of each equation was an effort to investigate the various cost combinations and variations in those costs with respect to clinic visits in a military health care setting. Because of the limitations of the military cost expense system, the ACES team chose to incorporate the CHAMPUS prevailing rates into a "proxy cost" for cost consideration. For this CACS evaluation, we selected one cost

formula (Cost8) to use in our analysis effort. A brief description of this cost methodology follows:

$$\underline{\text{COST8}} = (.055 * \text{CLEMAN}) + \text{X-RAY} + \text{ANCILLARY} + \text{LAB} + \text{RX}$$

COST8 represents the sum of reimbursable costs as they currently exist in the U.S. Army Medical Department. It includes a computed military supply cost. The 5.5 percent of the CLEMEAN represents this computed supply cost. This percentage was derived with the assistance of Herb Filmore, New York State Department of Public Health. Moreover, it should be noted that the 5.5 percent military supply cost compares favorably with the supply cost developed and utilized for reimbursement by the New York State Department of Health.

ANALYSIS USING COSTS

The analysis of variance is the statistical technique that has been used by most grouper developers and evaluators to test the hypothesis that the grouper creates within group homogeneity and inter-group heterogeneity. Applying an analysis of variance to this kind of data requires care in interpreting the results. The assumptions underlying the use of parametric statistical methods are: (1) the observations are normally distributed in the population, (2) that variances of populations are the same, (3) observations in the sample have been randomly drawn, and (4) the data used are scaled on an interval or ratio scale of measurement. Using real world data makes it extremely difficult to satisfy all the assumptions for using parametric statistics. Therefore, a violation of an assumption is usually an insufficient reason to reject the use of a parametric statistic.

In order to evaluate the data and the grouper in the most objective manner a series of analyses was conducted. The first series utilized techniques for testing the normality of the distribution (i.e., how much did the data differ from a normal distribution). This skewness can

be reduced if a logarithmic transformation of the data is performed. To evaluate the soundness of the cells created by the CIHI grouper, a General Liner Model (GLM) procedure was performed in SAS using the sample data set as it was determined to be more appropriate when analyzing unbalanced data (unequal number of cases in each group).

RESULTS OF CIHI GROUPER

Similar to the other classification system evaluations, the study team utilized the same sample of data from the ACDB study. The sample consisted of 516,006 cases that were costed and reviewed for reliability. It should be noted that a case could be made for the utilization of a more current data set. However, if different data sets were utilized it would not be possible to make meaningful comparisons between the various classification systems.

The CIHI grouper program assigned 96.5% (497,714) of the 516,006 visits contained in our data sample. Approximately 3.5% or 18, 292 (3.5%) visits were not grouped due to our decision to exclude based upon limited occurrences (< 30 observations)(Table 3) or ungroupable visits (Code 9999) (Table 4).

Table 3 - Ambulatory Classification System Cells Receiving < 30 Observations

CACS Cell No.	CACS Cell (Group) Name	Observations
01	Nerve & other procedures	8
04	Orbital & other eye procedures	10
05	Lens procedures	4
12	Other sinus procedures	7
20	Angiography	13
22	Other vascular procedures	1

CACS Cell No.	CACS Cell (Group) Name	Observations
24	Minor vascular procedures	18
29	Ano-rectal procedures	14
33	Upper urinary procedures	20
34	Lower uri and genital procedures	19
39	Uterus and adnexal procedures	8
43	Maxillo-Facial procedures	21
44	Chest wall procdeures	27
46	Open reductions & internal fix	17
49	Lower extremity procedures	2
50	Knee procedures	1
51	Ankle & foot procedures	14
57	Breast plastic procedures	8
62	Hemodialysis	20
63	Transfusions	2
64	Cardioversion	2
201	Inv general circulatory, 0-1.4 yrs	11
202	Inv general circulatory, 1.5-11 yrs	28
203	Inv general circulatory, 12-17 yrs	13
251	Inv gen/endo/nut/meta, 0-1.4 yrs	9
252	Inv gen/endo/nut/meta, 1.5-5 yrs	7
253	Inv gen/endo/nut/meta, 6-17 yrs	14

CACS Cell No.	CACS Cell (Group) Name	Observations
357	Inv general male genital disorder, 0-17 yrs	2
551	Inv inflam MSK & conn tissue, 0-1.4 yrs	6
552	Inv inflam MSK & conn tissue, 1.5-5 yrs	5
553	Inv inflam MSK & conn tissue, 6-11 yrs	17
559	Mgmt inflam MSK & conn tissue, 1.5-5 yrs	28
656	Delivery with postpartum complications	3
658	Postpartum with complications	17
661	Pregnancy with abortive outcomes (complications)	25
751	Inv ophthalmology, 0-11 yrs	3
753	Inv ophthalmology, 18-44 yrs	22
754	Inv ophthalmology, 45+ yrs	28
1024	Coma	3
1025	Shock	29
1202	Rehab. Circulatory system	27
1204	Rehab, digestive system	1
1205	Rehab, endo/nutr/meta/immu system	8
1213	Rehab, infect & parasitic condition	3
1219	Rehab, injury & trauma, nerve or brain	16
1220	Rehab, injury & trauma, other	1
1233	Rehab, neoplasm, assessment	1
1240	Rehab, nervous system, assignment	6

CACS Cell No.	CACS Cell (Group) Name	Observations
1245	Rehab, nervous system, social particip.	1
1247	Rehab, respiratory	2
1248	Rehab, sense organs (eyes,ears), assessmt	2
1251	Rehab, sense organs (eyes,ears),physical low	1
1255	Rehab, skin & subcutaneous tissue	2
1257	Rehab, speech & swallowing, 40-59 yrs	6
1258	Rehab, speech & swallowing, 60-79 yrs	6
1260	Rehab,symptoms,signs & Ill defined cond, assessment	12
1265	Rehab,symptoms,signs & Ill defined cond, other rehab	29
2062	Preoperative exam	15
8218	Personality, affective & other MH disorder	6

(59 cells/groups with a total of 675 observations)

Table 4 - ACS Groups with Zero Observations

Major Ambulatory Cluster (MAC)	Associated Group (s)
MAC 1 - Atypical Dispositions	2001, 2021, 2022, 2041, 2042
MAC 2 - Circulatory	219
MAC 3 - Day Procedures	07, 09, 15, 18, 19, 25, 26, 27, 31, 32, 42, 47, 52, 56, 60, 65, 66, 67, 68
MAC 4 - ENT and Mouth	None
MAC 5 - Endo, Nutrition, and Metabolic	None
MAC 6 - Exam/Other	2058
MAC 7 - Gastrointestinal	None
MAC 8 - Genitourinary	None
MAC 9 - Hematology	None
MAC 10 - Hepatobiliary and Pancreas	None
MAC 11 - Mental Health and Addictions	8031, 8032, 8033, 8034, 8036, 8037, 8038, 8039, 8040, 8041, 8042, 8043, 8044, 8045, 8046, 8048, 8049, 0050, 8051, 8052, 8053, 8101, 8102, 8103, 8104, 8106, 8107, 8108, 8109, 8110, 8111, 8112, 8113, 8114, 8115, 8116, 8118, 8119, 8120, 8121, 8122, 8123, 8201, 8202, 8203, 8204, 8206, 8207, 8208, 8209, 8210, 8211, 8212, 8213, 8201, 8202, 8203, 8204, 8206, 8207, 8208, 8209, 8210, 8211, 8212, 8213, 8214, 8215, 8216, 8219, 8220, 8221, 8222, 8223, 8301, 8302, 8303, 8304, 8306, 8307, 8308, 8309, 8310, 8311, 8312, 8313, 8314, 8315, 8316, 8319, 8320, 8321, 8322, 8323
MAC 12 - Musculoskeletal and Connective Tissue	None
MAC 13 - Nervous System	None
MAC 14 - Oncology	703, 704
MAC 15 - Ophthalmology	752
MAC 16 - Pregnancy and Childbirth	653, 657
MAC 17 - Rehabilitation	1201, 1206, 1207, 1208, 1209, 1210, 1211, 1212, 1214, 1215, 1216, 1217, 1218, 1221, 1223, 1224, 1225, 1227, 1228, 1230, 1231, 1232, 1234, 1235, 1236, 1237, 1238, 1239, 1241, 1243, 1244, 1246, 1249, 1250, 1252, 1253, 1254, 1259, 1261, 1263, 1264
MAC 18 – Respiratory	None
MAC 19 – Skin and Soft Tissue	None
MAC 20 – Systemic Infection	955, 956, 957
MAC 21 – Trauma	1010, 1012, 1036

CONCLUSION

The criteria designed to evaluate the CACS were similar to previous evaluations and included (1) clinical meaningfulness (i.e., from a clinical perspective did the groups make sense); (2) administrative ease of implementation, and (3) statistical analysis of the grouper. The clinical evaluations indicate that the CACS were developed using sound medical logic (with the stipulation that the clinical evaluation was not extensive). However, the physician responsible for the evaluation is Chair of a University Medical Department, has extensive grouper experience, has military and civilian medical experience, and served as a member of the evaluation team (Cronson and Associates, 1996) that evaluated the Canadian Day Procedure Groups (DPGs).

The criteria of administrative ease consists of two main components: (1) the installation and operation of the CACS software and (2) the transparency of the grouping methodology, i.e. can one readily understand the logic of the grouping methodology. The grouper program is written in the computer language of the Statistical Analysis System (SAS) and can run easily on a Pentium (or equivalent) personal computer. Instructions on the installation and use appear clear and appropriate. However, it is recommended that once the development phase of the grouping algorithm is completed, the program should be re-written in a more efficient programming language other than SAS.

A series of statistical analyses (General Linear Model Procedure, Duncan's Multiple Range Test, Bonferroni (Dunn) T Tests, and Scheffe) were conducted utilizing cost as the dependent variable. Results from these analyses indicated that the CACS explained almost 29% (See Table 5) of the variance and a number of the CACS groups (cells) were similar in terms of resource consumption. The SAS Output for this GLM Procedure is contained in Table 6. The amount of variance accounted for by this grouper is currently the largest test statistic accounted

for by previous grouper algorithms (Ambulatory Visit Groups, Products of Ambulatory Care, Products of Ambulatory Surgery, Emergency Department Groups, or Ambulatory Patient Groups) tested with this data set.

Table 5 - R Square Comparisons of Grouping Methodologies Utilizing the Same Data Set and Same Cost Formula

Name of Grouper	No. of Groups	Groups Utilized	R2
CIHI ACS	416	198	.2880 Note 1
PAC/PACS	66	54	.2194
AVGs	570	323	.1863
EDGs	216	145	.1226
APGs:			
(Medical)	80	79	.1075 Note 2
(Signif. Procedures)	145	41	.2227

Notes

1. Due to differences in coding systems (U.S. utilizes the American Medical Association's Current Procedure Terminology: Canada utilizes the International Classification of Diseases 9th Edition Procedures and has developed procedures in the rehabilitation area) the obtained R2 may be underestimating the explanatory power of the grouper.

2. The APG system contains 297 groups. However, due to their unique methods of combining APGs they represent a unique system of trying to evaluate them in the exact same way as the other grouping system. For this reason they were divided into Medical and Significant Procedure APGs. Due to insignificant amount of data, other categories of APGs such as Laboratory, Radiology, Ancillary Tests and Procedures, Incidental Procedures, Chemotherapy Drugs, Pathology, and Anesthesia could not be evaluated. The APGs have been renamed the Ambulatory Patient Categories (APCs).

Table 6 - SAS Output for the GLM Procedure

COST8 EQUATION= .055*CLMEAN + XRAY + ANCILLARY + LAB + RX

XRAY IS .39 OF CHAMPUS, ANCILLARY IS .62 OF CHAMPUS.

GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES

ACS 198 02 03 06 08 10 1001 1002 1003 1004 1005 1006 1007 1008 1009 1011 1013 1014 1015 1016 1017 1018 1019 1020 1021
1022 1023 11 1203 1222 1226 1229 1242 1256 1262 13 14 16 17 2002 2022 204 205 2050 2051 2056 2057 2059 206
2060 2064 2065 2066 2067 2068 2069 207 2070 2071 208 209 21 210 212 213 214 215 216 217 218 23 254 255 256 257
258 259 260 262 263 28 30 301 302 303 304 305 306 307 35 351 352 353 354 355 356 358 359 36 360 361 362 363
364 37 38 40 400 401 402 403 404 405 406 407 408 409 41 410 411 413 45 451 452 453 454 455 456 48 501 502 53
54 55 554 555 556 557 558 560 561 562 563 564 565 566 567 568 569 58 59 601 602 603 604 605 606 607 609 61 611
612 614 615 616 617 651 652 654 660 662 663 701 702 755 756 757 758 8030 8100 8200 8318 851 852 853 854 855
856 857 863 901 902 903 904 905 951 952 953 954

NUMBER OF OBSERVATIONS IN DATA SET = 497714

DEPENDENT VARIABLE: COST8

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F
MODEL	197	60841788.22141250	308841.56457570	1021.67	0.0001
ERROR	497516	150395009.63074900	302.29180495		
CORRECTED TOTAL	497713	211236797.85216200			

R-SQUARE	C.V.	ROOT MSE	COST8 MEAN
0.288026	108.1527	17.38654091	16.07591955

SOURCE	DF	TYPE I SS	MEAN SQUARE	F VALUE	PR > F
ACS	197	60841788.22141250	308841.56457570	1021.67	0.0001

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
ACS	197	60841788.22141160	308841.56457569	1021.67	0.0001

RECOMMENDATIONS

The grouper logic appears to be clear, succinct and well illustrated in the Background Document provided to the study group. From all indications, (visits contained in the sample) the visits were assigned to the appropriate cell in accordance with the grouper logic. Groups that were not utilized (< 30 visit observations and 0 observations) were previously noted in Tables 3 and 4.

Based upon this evaluation, the following recommendations are provided:

(1) The grouping methodology (software code) should be written in a more efficient computer language.

(2) A thorough review of all groups that are the same (based on resource intensity) should be reviewed; this review should include both a resource and a clinical review.

(3) The cells that did not meet the required statistical procedure (30 or more) should be reviewed with respect to administrative and clinical appropriateness.

In our opinion, the implementation for any prospective payment system for ambulatory care will be more difficult than that experienced with the DRGs in the inpatient setting. Experience and use of diagnostic and procedural coding in the ambulatory setting is limited. Frequently, hospital based ambulatory clinic's lack the ability to link departmental cost and billing data to patient clinical data. Hospital Outpatient Departments would have to develop automated systems to link financial and clinical data, and become proficient at diagnostic coding. A standardized ambulatory medical record would have to be developed which contained the necessary information in the required form (diagnosis, procedure, disposition, etc.). This record should require one-time documentation of essential information.

Additionally, the meaningful implementation of any outpatient payment system, for the military or civilian community, would require the development of a standard costing methodology. The health care industry uses standard CPT-4 codes, ICD-9-CM codes, provider type and clinic type in an effort to develop patient groups that are clinically meaningful. The development of a standardized costing methodology that accurately compares the cost of ambulatory care is critical. Current charge based methodologies provide limited measures of a true patient encounter. Accordingly, without an accurate and comprehensive cost methodology, the reliability of an ambulatory classification system cannot be easily or accurately assessed.

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