980395

Risk Adjustment and Rate Setting Methods in Public Programs

A Report to the Legislature

January 1998

Minnesota Department of Health
Health Economics Program

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For More Information Contact:

Health Economics Program
Minnesota Department of Health
121 East Seventh Place, Suite 400
P.O. Box 64975
St Paul, Minnesota 55101-0975

Phone: (612) 282-6367
Fax: (612) 282-5628

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Executive Summary

Background

The 1995 MinnesotaCare Law (Chapter 234) directed the Minnesota Departments of Health and Human Services to develop a risk adjustment system for the state-run public health care programs for implementation by January 1998. Legislation passed in 1997 required an interim report to the legislature by February 1, 1998, on risk adjustment and rate setting methods.[1] This report provides background and technical information regarding the accumulated joint work of the Departments of Health and Human Services on the development of a risk adjustment mechanism for use in rate setting for the Prepaid Medical Assistance Program (PMAP) over the last two years.

Health Status Based Risk Adjustment in Capitation Rate Setting

Risk assessment is a method by which data regarding enrollee health status is used to assess or *measure the risk of future health care resource use. Risk adjustment* is a method of using the results of risk assessments to *adjust capitation payments* so they are more consistent with health care expenditures. Recently developed risk assessment technology based on diagnoses has enabled us to develop risk assessment models that more accurately adjust capitation rates for enrollees with differing levels of risk of future expenditures. Risk adjustment employs this technology so that health plans have greater incentives to: (1) enroll individuals with high health care needs, and (2) focus on quality and efficiency.

Managed care organizations provide a set of comprehensive medical services to their enrolled members for a fixed, prepaid premium or capitation. Prevailing methods of establishing capitation payments are based primarily on combinations of demographic risk factors each of which have distinct payment rates. Historically, the demographic risk factors that have been used to distinguish capitation rates for public programs are age, gender, Medical Assistance program, institutional status, and Medicare eligibility. However, by adding more direct measures of the health status of populations to existing demographic factors, we can make capitation rates more consistent with expenditures. The diagnosis histories of individuals over time are one method of measuring health status, and have been shown to be effective in increasing the consistency between capitation rates and health care expenditures.

The Minnesota Departments of Health and Human Services have tested applications of this new risk assessment technology and developed the following recommendations regarding health based risk adjustment for use in setting capitation rates for Minnesota's prepaid public health care programs.

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[1] Laws of Minnesota, Article 2, Section 61, SF 1208.

Recommendations

- Adopt a risk assessment model based on the Johns Hopkins ACG Case-Mix System for the PMAP program during the first year of risk adjusted rate setting.

- The risk adjustment system for selected Minnesota prepaid public health care programs should be implemented on January 1, 1999 in two distinct stages: Stage 1: Risk Assessment and Testing, in which the methods by which the risk of particular program populations is assessed and tested; and Stage 2: Risk Adjustment, in which the results of the assessments of the risk of program populations are used to adjust capitation rates.

- Continuously monitor, evaluate, update, and refine the risk assessment and risk adjustment methods, since the technology is continuing to develop.

SUMMARY

Risk adjustment is a mechanism to better target payments to health plans or other entities so that payments reflect the expected *risk* of the population being enrolled or cared for. Risk in this context refers to the risk of above average health care costs. Risk adjustment is critical to assure that health plans are competing more on the basis of quality and efficiency, and less on the basis of enrolling the healthiest enrollees. *Risk adjustment is intended to increase the incentives for prepaid entities to enroll and care for individuals with chronic or high cost health conditions by paying them more fairly for enrolling these populations.*

The 1995 MinnesotaCare Law (Chapter 234) directed the Minnesota Departments of Health and Human Services to develop a risk adjustment system for the state-run public health care programs. Staff of the two departments have been working together with our advisory committee and a team of consultants over the past year and a half to carry out this task. Our charge is development of a risk adjustment system for the health care services associated with PMAP and MinnesotaCare programs, as well as for the Demonstration Projects for People with Disabilities and the Prepaid General Assistance Medical Care (PGAMC) program. *This report reviews the status of this development process for the PMAP, and the prepaid MinnesotaCare and PGAMC programs. Legislation authorizing prepaid managed care Demonstration Projects for People with Disabilities expanded the scope of the work surrounding the development of risk adjusted payment systems. However, this report focuses on those populations currently enrolled in managed health care programs. Substantial work has been done on the development of a risk adjustment system for the disabilities demonstrations, which will be reported in a separate document.*

To date, we have reviewed existing risk assessment models, and obtained copies of the three most promising systems - the ACG Case-Mix System (ACGs),[i] [ii] Diagnosis Cost Groups (DCGs),[iii] and the Disability Payment System (DPS).[iv] We have tested many of these systems on Minnesota public programs data, interviewed the developers of these systems, and reviewed studies comparing them.

> ✓ **Currently, we are recommending the use of the ACG Case-Mix System as the primary risk assessment system for the PMAP and prepaid MinnesotaCare programs.**

Risk adjustment models based on ACGs requires diagnosis data from a minimum of six months of claims or encounter data together with age and gender. DHS has distributed a letter to all health plans notifying them of its intent to use encounter data regarding health care encounters for risk adjusting capitation payments for the PMAP and prepaid MinnesotaCare populations.

> ✓ **We recommend that the risk adjustment system be implemented as of January 1, 1999, in two distinct stages: 1) risk assessment and testing followed by 2) risk adjustment.**

We recommend that the implementation of risk adjustment in prepaid public programs rate setting should take place in two separate stages beginning January 1, 1999. The ***first stage*** is the ***risk assessment*** testing stage. During this stage of implementation, the *risk of future health care resource use for public health care program recipients is assessed* using encounter data received by DHS, and the impacts of the resulting rates on health plan revenues and expenditures will be evaluated. The ***second stage*** is the ***risk adjustment*** stage in which *the risk of PMAP enrollees will be assessed and used to adjust capitation rates that will be effective January 1, 2000.* Risk assessment and risk adjustment will continue from this point forward using new encounter data in both the development of future capitation rates, and assessing the risk of public program populations for future risk adjusted rate setting.

> ✓ **We plan to add selected non-diagnosis based risk factors to these risk adjustment models. For example, selected socio-economic variables derived from existing eligibility data will be evaluated for possible inclusion in the risk adjustment model(s).**

In the future, we expect to consider additional factors that may be available from other sources as well. In particular, Minnesota statute requires that the risk adjustment system "attempt to reflect the special needs related to poverty, culture, or language barriers ... of the public program population." [v] To specifically address this provision, we plan to examine the degree to which both immigrant status and the coded nationality of PMAP eligible immigrants helps to predict future health care risk. Please see Appendix D for a more detailed discussion of this research.

In addition, we are also recommending that we give serious consideration to the DPS for the PGAMC population. While we intend to evaluate all three risk assessment systems mentioned above for possible application to this program, we expect that the PGAMC population may resemble a population for which certain chronic health conditions may be more prevalent than in the general population. Since the DPS accounts for many chronic conditions explicitly, we expect it may be more applicable to this population than a risk assessment system that does not.

We have discussed our progress with the Public Programs Risk Adjustment Work Group (PPRAWG), and the health plans are supportive of the use of these models for risk adjustment. However, they have expressed strong interest in having several remaining issues resolved quickly. Many of these issues are highlighted in Appendix C.

What is Risk Adjustment

Risk adjustment is a mechanism to better target payments to health plans or other entities so that payments reflect the expected *risk* of the population being enrolled or cared for. Health plans or other prepaid entities with an enrollee population that includes more high-cost enrollees than other plans will receive correspondingly higher total payments.

Conversely, those with a lower-than-average risk enrollee population will receive relatively lower payments. *Without risk adjustment, health plans have reduced incentives to enroll and care for high risk individuals and a strong incentive to enroll individuals with low health care needs, since rates are less consistent with likely expenditures than they might be. Risk adjustment is a means of "leveling the playing field" so that health plans are better able to compete on the basis of quality and efficiency, rather than on the basis of their ability to selectively enroll low risk individuals.*

The 1995 MinnesotaCare Law (Chapter 234) directed the Minnesota Departments of Health and Human Services, to develop a risk adjustment system for the state-run public health care programs, for implementation by January 1998. During the 1997 legislative session, implementation of risk adjustment in PMAP was delayed until after the 1998 legislative session.[2] This law also required the Departments to prepare an interim report on the development of risk adjustment and rate setting methods "for the legislative commission on health care access to facilitate a public hearing and testimony prior to the 1998 legislative session." An earlier draft of this report was prepared for the hearing, and the hearing was held on December 17, 1997, at the Capitol View Conference Center. One individual, a health plan representative, testified at the hearing. His comments overall indicated satisfaction with the report and progress to date. However, he did express some concerns which were noted and will be addressed prior to any implementation. The hearing was scheduled for 2:00 - 5:00 p.m., however, since there were no others interested in testifying, it was adjourned at 2:30 p.m. (See Appendix F).

In addition, it is important to note that, in the context of the existing structure Minnesota's current state-run prepaid public programs (e.g., PMAP), risk adjustment can be used to adjust capitation payments to each participating health plan. However, it should be emphasized that it can also be used to determine relative amounts DHS pays to counties under a county-based direct contracting arrangement. In both cases, risk adjustment can determine *relative differences* in the risk of populations, and assist in distributing available resources equitably.

PROCESS USED TO DEVELOP A RISK ADJUSTMENT SYSTEM FOR PMAP

Consultants and Advisory Committee

Staff of the two departments have been working together with an advisory committee, The Public Programs Risk Adjustment Work Group (PPRAWG), and a team of consultants from HealthSystem Minnesota (HSM) and the University of Minnesota (U of M) over the past year and a half to carry out this task. Our charge has been to develop a risk adjustment system for the medical care services associated with PMAP, prepaid MinnesotaCare and PGAMC programs, as well as for the Demonstration Projects for People with Disabilities.

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[2] Laws of Minnesota, Article 2, Section 61, SF 1208.

Long term care services have been excluded from our analyses to date, although we have reflected the need to examine the utility of some of these models in predicting total (medical plus long term care) costs and we expect to do some of this in the near future.

Staff from Minnesota Department of Health (MDH) and the Department of Human Services (DHS) and our consultants from HSM and the U of M have been meeting weekly to facilitate the work of the risk adjustment project. These weekly meetings focus on analysis and implementation issues, or the behavioral simulation. These meetings have been critical in establishing ongoing discussions between the two agencies, and have provided a forum to identify and resolve many issues involving risk adjustment and its relationship to other rate-setting issues. In addition to these weekly meetings, the PPRAWG has met every month or two and provided indispensable input into the development process. This group represents health plans, providers, counties, program population representatives, and others who have developed a sound understanding of the purpose of risk adjustment and its value to the public programs.

Database Development

MDH is developing a data set that contains a comprehensive record of demographic, eligibility history, and fee-for-service (FFS) utilization experience for all individuals eligible for any state-run FFS public health care programs for the period calendar year 1994 through June of 1996 (i.e., 30 months). In May 1996 we obtained a copy of the MMIS[3] database that contained the FFS claims for services paid in calendar years 1994 and 1995 for Medical Assistance (MA), GAMC and MinnesotaCare from DHS. Demographic data for all individuals eligible for any of these programs as of March of 1996 was obtained from MAXIS. The MAXIS data system is the information system that DHS uses to manage the cash assistance, food stamp, and medical assistance eligibility determination process, and to make payments for the cash assistance and food stamp programs. Over the past year and a half we have cleaned this first wave of data, and assembled relevant databases and analysis files.

Subsequently, we obtained a second MMIS database containing the same data elements for FFS claims paid in calendar years 1996 and the first half of 1997. In combination, these two databases will allow us to assemble a complete record of all health service utilization and costs for services that occurred over the 30-month period of calendar year 1994 through June 1996.[4] In future data development we plan to augment this data by adding similar data from the second half of 1997 allowing us to build the full three year database for program eligible populations and services that occurred during the complete period of calendar years 1994 through 1996 (36 months) to be able to address particular research questions relevant to particular risk adjustment implementation alternatives (See below).

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[3] Medicaid Management Information System

[4] Providers have up to one year to submit claims after a service has been provided.

Research staff have assembled an MA non-disabled analysis file for fiscal year 1995 (FY95), and the 30-month (January 1994 - June 1997) analysis file will be available very early in 1998. Research staff are also in the process of developing additional analysis files for the other program populations targeted for risk adjustment as well (i.e., MinnesotaCare, PGAMC, and the disabled). For each of these program populations, when the 30-month analysis files are available, it will contain complete and relevant eligibility, diagnosis, demographic, and health care expenditure history data for the 30-month period from calendar year 1994 through June 1996. To date, we have developed the one year prospective risk adjustment models from the FY95 data set for the MA non disabled population (see Model Development section). In addition, when the 30-month data set is available for analysis, the current 12-month models will be re-evaluated and model sensitivity will be systematically evaluated relative to:

(1) the length of time during which diagnoses are observed (e.g., six months vs. a full year);
(2) the characteristics of the population on which the model(s) is (are) estimated;
(3) the length of time between diagnosis observation and charge measurement periods (i.e., the lag); and
(4) the length of time during which charges are measured.

And, these analyses will be further augmented when the complete database for calendar years 1994-1996 becomes available.

Because of delays in receiving and processing encounter data, the database we are using contains no data regarding health care utilization for current PMAP enrollees. This issue was identified over a year ago, and has been discussed among the MDH and DHS staff and consultants, as well as with the PPRAWG. Although it would certainly be preferable to include PMAP data in our initial modeling, since the resulting models would be more likely to be applicable to PMAP, our lack of access to encounter data has precluded that to this point. We are working on alternatives including using Blue Plus encounter data MDH has obtained from Blue Cross Blue Shield of Minnesota, and Hennepin County data from Metropolitan Health Plan. We also anticipate using DHS encounter records collected during the risk assessment stage of implementation (see Implementation section) to validate final model development and to create the final risk model and weights.

Irrespective of our possible access to alternative sources of encounter data from prepaid health plans, the developers of the risk assessment models do not feel that the weights across risk categories in any of the risk assessment systems we are considering would be dramatically different between FFS and managed care environments. Nevertheless, we are doing several things to compensate for the lack of PMAP data in the database we are using to set risk adjustment weights. We are collecting weights from numerous public and private sources, both within Minnesota and nationally to use as comparisons with the weights we create using Minnesota public programs data. This will provide us with the opportunity to examine any significant differences between our weights and these others.

We will also determine the degree to which there are significant differences between weights created with FFS data, and those created with managed care data, and evaluate our confidence in the FFS models based on these findings.

Therefore, the data on which we focused our initial development efforts include:

- MAXIS data containing much of the key demographic data for the individuals eligible as of March 1996.

- MMIS II claims data for claims with payment dates in the calendar years 1994 and 1995 extracted in April/May of 1996; a subsequent extraction of claims with payment dates in calendar year 1996 through June 1997. Data from the subsequent extraction are being added the to the current claims database at this time. This database will include all services provided during the period January, 1994 through June 30, 1996 (i.e., the 30-month database)

- Eligibility histories by major program for January 1994 through June 1996. This file contains major program monthly eligibility start and end dates for all individuals who were eligible at any time during 1991 through 1996 for any of Minnesota's public health care programs.

Throughout the development of the risk adjustment data, personal and organizational identifying information has been handled in accordance with the requirements of the Minnesota's Data Practices Act and federal data privacy requirements. Individual identification numbers have been encrypted effectively preventing the specific identification of individuals (i.e., individual 'x' can only be identified as individual 'x' throughout the data but never as John Smith of #1 Main St., Any Town, MN).

Encounter Records

The shift from FFS to prepaid managed care changes the flow of dollars in the health care system. In prepaid managed care in Minnesota's public health care programs, monthly capitation payments are prepaid by DHS to health plans, whereas under FFS DHS directly reimbursed health care providers for services billed. And, depending on the type of managed care model, and the degree to which the risk due to capitation is shared between providers and health plans, records of health care encounters continue to be managed, but now by health plans. However, again, depending on the type of managed care model, these records often do not include charges or payments for specific services.

The need remains, however, for encounter data to support risk adjustment; rate-setting; utilization, access, and quality studies; future planning; and studies of small populations of high policy interest.

To meet this need, the federal Health Care Financing Administration (HCFA) requires states participating in prepaid Medical Assistance to collect "encounter" records from managed care plans in lieu of records of claims for billed services, and recommends a core list of data elements for these purposes.[vi]

Encounter data records information regarding the health services provided by prepaid health plans and contain much of the same information about those services that is included in a billing claim record. Using HCFA's recommendation as a minimum, DHS specified its own set of encounter record data elements, and then developed an information system to accept the records. It utilizes standard uniform billing formats, but does not require the reporting of per service charges or payments, but includes the data elements appearing in Appendix E.

In addition, historically under FFS, DHS allowed providers to submit claims up to one year after the services were provided. Now, under PMAP for example, health plans are asked to delay the submission of their encounter data until six months after encounter records or claims are finalized and/or paid by the health plans. Assuming PMAP providers have up to six months to submit claims to health plans from when the services occurred, services can also be up to one year old when they are submitted to DHS. At present, the accumulated DHS encounter record database contains approximately 2.6 million records with service dates from July 1, 1994, through December 31, 1996. However, due to this encounter service date vs. submission lag noted above, we cannot assume that encounter data for services provided in calendar year 1996 will be complete until end of calendar year 1997.

Encounter record quality during this period remains unknown for the risk adjustment project due to the lack of a mechanism linking data quality with payment, particularly since ambulatory diagnoses have not historically been used for payment purposes. However, with the implementation of risk adjustment, the uncertainty decreases because plans would then need to submit complete, timely and high quality encounter records to receive the most appropriate and timely risk adjusted capitation payments.

Simulation

Another part of the risk adjustment project currently underway is the development of a behavioral simulation exercise. This exercise involves the development of computer-based simulation software designed to assist in the evaluation of health plan behavior in both risk adjusted and non-risk adjusted economic markets. The objective of the exercise is to discover health plan behavioral responses to the risk adjustment system so that auditing and implementation modifications can be taken to support the risk adjustment payment system.

The simulation software was recently tested at a one day pilot event that brought Minnesota health plan representatives together with a national expert in risk adjustment for the purposes of evaluating the software and the discussion of risk adjustment issues.
During the event, we gathered a great deal of information about the software to be used in the actual simulation exercise from actuaries, health plan economists and sales representatives.

In the two months since that event, based primarily on the feedback provided by the participants, we have made significant enhancements to the simulation software.

We anticipate starting the actual simulation experiment with both local and national participants in December 1997. Over the coming months, as participants play the simulation software, we will be gathering simulated behavioral data from an anticipated group of between 10 to 20 participants . Each participant will assume the role of a health plan manager for one of four different health plans competing in the health market in a virtual (simulated) state using actual Minnesota data. Demographic, health plan, and provider data from MN was aggregated into the virtual state. The resulting product is a unique state with a distinct Minnesota flavor featuring 40 counties, 160 clinics, and four health plans.

Based upon our estimated number of participants, we expect to have three to five versions of the simulation software operating at the same time (i.e., three to five unique 'games' being played). Within each 'game,' competing plans are able to market themselves to different populations, add or remove clinics from their network, and engage in other activity in response to the business environment. We expect to play approximately ten cycles with each cycle representing one year. Participants will record their business decisions into the simulation game, save their files to disk, and the disks will be mailed to our simulation programmer. Risk adjustment and simulation software experts from within Minnesota will participate in updating the simulation, so that plan responses from all four competitors during each annual cycle are fed into the successive cycle in preparation for the next year's business decisions. Once updated, the disks will be returned to the participants and the next cycle of play will begin. The data gathered from each separate simulation game will eventually be pooled and used to evaluate health plan behavior under risk adjusted and non risk adjusted payment systems.

At the conclusion of the national simulation, some time in the spring of 1998, a debriefing event of the participants will be held. Two or three national experts on risk adjustment will be invited to participate and speak to the participants. This event will give us an opportunity to learn about the participants' perception of the reality of the simulation and risk adjustment activities in other states.

At the conclusion of the simulation exercise, we anticipate knowing a great deal about how risk adjustment is likely to influence how health plans react to high risk populations or high risk geographic areas. In addition, we expect to gain some insight into the marketing approaches health plans use within the system. We expect that this information can be used to improve how the risk adjustment payment system is implemented.

MODEL DEVELOPMENT

Introduction

Throughout this section, *risk assessment* methods or models refer to the *methods by which the risk of future health care resource use is assessed or measured*, whereas *risk adjustment* methods refer to the *methods by which risk assessment models are used to adjust capitation rates*. The following (1) describes our preliminary findings regarding the evaluation of alternative risk assessment models with respect to particular criteria, (2) offers a recommendation for an initial risk adjustment model for the Medical Assistance non-disabled population, based on those findings, and (3) describes future directions for risk assessment and risk adjustment model development.

Risk Assessment Model Evaluation Criteria

At the beginning of discussions about risk adjustment in Minnesota, we realized the need to utilize and build on existing local and national research work in the area of risk assessment, and to focus our efforts on models that utilized data that would be available through claims, encounter, and eligibility systems wherever possible. These emphases later translated into two *major explicit criteria by which we decided to evaluate alternative risk assessment methods: predictive accuracy and administrative feasibility.*[5]

By *predictive accuracy* we mean primarily aggregate predictive accuracy, or the degree to which a model accurately predicts some measure of total resource use over a period of time (e.g., the correspondence between predicted and actual total charges) for a population. Our review of risk assessment models nationally has allowed us to focus on the models that have been tested on a variety of populations, and which we expect will maximize predictive accuracy.

By *administrative feasibility* we mean the degree to which a model is efficient to implement. For example, a model that relies on data that is routinely collected for other purposes is preferable to one that requires the collection of new data. And, a model that minimizes changes in the way data is currently being collected and managed by purchasers and providers is preferable to one that would require major changes in those processes.

In addition, it has always been one of the main goals for the use of risk adjustment in capitation rate setting to enhance incentives to seek out and care for high risk and special needs populations.[6] Therefore, a *third major criteria by which we judge alternative risk adjustment methods is their relative ability to predict resource use accurately across groups that might*

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[5] "Risk Adjustment: Report from the Commissioner of Health and the Commissioner of Commerce to the Legislature," January 1995. MDH.HCDP3.005

[6] Ibid., January, 1995, MDH.HCDP3.005

differ systematically in some way that might be known or knowable by the health plans or prepaid entities - predictive accuracy across non-random groups. Therefore, a model for which aggregate prediction errors do not differ appreciably across non-random groups is preferable to one for which prediction errors (and by implication discrepancies between capitation rates and per capita costs) are substantially different for some (e.g., high risk) groups, but not others.

Preliminary Risk Assessment Model Evaluation Results

We began our evaluation of alternative models with the recommendation that the initial public programs risk assessment model should be based on one or some combination of *population-based diagnosis classification systems*. We initially proposed three diagnosis classification systems for evaluation as the possible basis for a risk adjustment mechanism for Minnesota public health care programs - Ambulatory Care Groups (ACGs), Diagnosis Cost Groups (DCGs), and the Disability Payment System (DPS). This recommendation was discussed with the stakeholders through the PPRAWG, and they agreed with the direction. Based on preliminary testing, other studies that have addressed relative predictive performance, and administrative considerations, we have narrowed our list of alternative models to two - ACGs and DPS, for the following reasons.

First, there is substantial evidence that the predictive performance of ACGs and DCGs is comparable. However, in terms of stakeholder acceptability and administrative feasibility, ACG's has some advantages. Many PMAP plans currently use ACGs in managing their utilization and costs, and consequently many Minnesota health care purchasers, health plans, and providers are more familiar with ACGs than any other relevant risk assessment method. This experience and familiarity make it difficult to recommend DCGs for this population in the absence of overwhelming differences in predictive accuracy.

Second, results from some initial models we tested against these criteria strongly suggest that a model based on ACGs may be optimal for the Medical Assistance non-disabled population. More specifically, we initially estimated "prospective" risk assessment models in which we used the diagnoses associated with services that occurred during the first half of FY95 to explain and predict total allowable billed charges[7] that occurred during the second half of FY95 for individuals that were continuously eligible for Medicaid non-disabled programs during FY95.[8] This model was the type initially evaluated because it corresponds to the "prospective" nature of the timing between the period when diagnosis histories will be assessed and the period during which those histories are expected to be used to fix rates for a population when risk adjustment is implemented (See the section "Implementation Details" for more information regarding risk adjustment implementation).

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[7] Hereafter referred to as "charges"

[8] See APPENDIX A for additional details regarding diagnosis classification, subpopulation selection methods, and initial test results.

With respect to the first two evaluation criteria, a model based on ACGs results in optimal predictive accuracy for the Medicaid non-disabled population in the aggregate. We evaluated a model based on the mutually exclusive ACGs, and a model based on the Ambulatory Diagnostic Groups (ADGs) which are the categories into which individual's diagnoses are initially grouped by the ACG Case-Mix System. In an ADG model, individuals can essentially be classified into multiple diagnostic categories. We found the ADG model to have superior individual predictive accuracy. In fact, the ADG model predicts aggregate charges for this population that are essentially equivalent to their observed charges. And, as indicated above, a risk adjustment model based on the ACG system would be most likely to rely on data that is already being collected by plans or purchasers, and would require minimal if any changes in the way plans and providers are collecting claims/encounter data.

With respect to the third major evaluation criteria, to gauge the possible improvement in predictive accuracy across non-random groups that could be gained from an ACG-based model, we compared the results of (1) the ACG-based model;[9] (2) a demographic[10] square root model in which the same transformation of charges used for the ACG model was used; and (3) a demographic model for which charges on their original dollar scale are analyzed. The results are compared in terms of "Prediction Error" and "Predictive Ratios."

"Prediction Error" is the average difference between the predicted and actual charges for each individual across the non-random groups, and represents the average error in predicting total charges per person for the six month period. Prediction errors that are *greater than zero (0) indicate the average dollar amount that predicted charges exceed the actual* for each non-random group. Whereas, prediction errors *less than zero* (0) *indicate the average dollar amount that predicted charges are less than the actual for each group.* The "Predictive Ratio" is the ratio of the average predicted to average actual charges across groups, and represents the proportion of the average actual charges represented by the average predicted charges.

The results are shown in Table 1. The three models compared are identified under "Risk Assessment Method" and comprise the three blocks of rows. For each model the average predicted and actual total charges for the second half of FY95 are shown for each category of actual total charges for the first half of FY95, which comprise the columns (i.e., $0, $1-142, $143-359, etc.).

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[9] Hereafter, although the diagnosis-based risk assessment model we are focusing on uses ADGs, we refer to it as an ACG-based model to acknowledge that it employs the "Johns Hopkins ACG Case-Mix System" for classifying diagnoses.

[10] Although the current rate setting process is based on age, gender, program, Medicare eligibility, and institutional status, only the first two of these factors were included in the demographic models since the other three are held constant by virtue of the subpopulation selected for initial model estimation.

These categories represent the non-random groups we initially tested. We selected these groups because they represent one method by which prepaid entities can readily differentiate populations on the basis of the risk of future health care resource use (i.e., prior resource use risk groups).

The results show that the *demographic models we estimated markedly over predict actual charges for the lowest risk groups, and substantially under predict actual charges for the highest risk groups*. One way to appreciate the magnitude of these prediction errors is to examine the average prediction errors. For example, for the lowest prior use risk group (first half FY95 charges = $0), the average prediction error for the demographic models is about $740 per eligible individual over the period second half FY 95. However, for the highest risk group ($966 or more), the average prediction error is about -$1,640 for the period (See Figure 1b). Thus, *for the highest prior use risk group*, for example, *per capita revenues*[11] *would be on average $1,640 less than expenditures,*[12] if the risk adjustment model was *based on such a demographic model.*

However, *the proposed ACG-based model results in a substantial reduction in these errors.* For example, for the lowest risk group, the average prediction error for the ADG model is only about $125 per eligible individual over the period second half FY 95. And, for the highest risk group, the average prediction error becomes -$449 for the period (See Figure 1b). Therefore, assuming this model is the basis of a risk adjustment model, although some incentives for risk selection would remain across these groups, they are substantially reduced compared to the demographic models (See Figures 1a and 1b).

Another method of characterizing the differences in prediction errors is to assume that the prior use risk groups comprise hypothetical or simulated health plans, sum up revenues and expenditures for each risk model, and examine how a simulated balance sheet might be affected by a diagnosis-based risk adjustment model by health plan populations. We performed such an exercise, the results of which are shown in Table 1c, for which the raw data comes directly from Table 1. Figure 1c shows graphically how such simulated aggregate PMAP capitation revenues and expenditure experiences might change under an ADG model for each hypothetical health plan. For instance, for lowest risk health plan (health plan A), the ADG model would reduce the amount the State would over pay the health plan by about $11,000,000 (i.e., $13,552,693 - $2,298,625 = $11,254,068) from the demographic model. However, for the highest risk health plan (health plan E), the ADG model reduce the amount the health plan is under paid dramatically by about $20,000,000 (i.e., $27,668,900 - $7,552,180 = $20,116,720).

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[11] assuming that capitation payments are simply set equal to predicted charges.

[12] assuming reimbursements are simply set equal to charges.

Initial Risk Adjustment Model Recommendations

Since the ACG-based risk adjustment model we have developed thus far is likely to (1) ensure state-wide aggregate rate equity for this population,[13] and (2) substantially increase the equity between rates and costs across various groups with different levels of future risk, we recommend that we:

(1) *Adopt an ACG-based square root model for the Medicaid (MA) non-disabled population for the first year of risk adjusted rate setting (January 1,2000).*[14]

In addition, preliminary tests of models that include both ADGs and the DPS chronic condition classification for this population have demonstrated that predictive accuracy can be significantly enhanced by such a hybrid model.

Future Model Development Directions and Recommendations

With respect to the Medical Assistance non-disabled population, we believe we can resolve statistically most of the remaining prediction errors for the ACG-based model. However, based on some earlier findings, we plan to evaluate the degree to which the Medicaid non-disabled ACG-based model can be improved by incorporating some form of the DPS chronic disease diagnosis classification system into the ACG-based model. Therefore, we recommend that we:

(2) *Evaluate an ACG/DPS hybrid model that is based on both ACGs and the DPS chronic disease diagnosis classification system for the Medicaid non-disabled for the second year of risk adjusted rate setting (January 1, 2001).*

As suggested above, although we can resolve the problem of under prediction for high risk groups statistically, we believe a hybrid model that incorporates DPS will help prepaid entities better manage high risk populations than a statistically adjusted model that is based solely on ACGs because the model would identify clinically meaningful chronic diseases that predict higher future costs. We therefore expect a hybrid model may ultimately be capable of (1) ensuring state-wide rate equity, (2) ensuring that the model can be the basis of equitable rates for high risk populations, and (3) giving providers an additional tool for managing care.

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[13] assuming total payments as measured here for the six month second half FY 95 period are essentially equivalent to total payments for a comparable future period and population.

[14] The reader is referred to Appendix B for details regarding the proposed ACG-based square root model.

With respect to the MinnesotaCare program population, we plan to give serious consideration to the initial ACG-based risk assessment model used for the Medicaid non-disabled population for its applicability to the MinnesotaCare population due to the administrative efficiencies that would result from a common system. However, we fully intend to evaluate the risk assessment systems mentioned above for possible application to this program.

For the PGAMC population, we are recommending that we give serious consideration to the DPS for the PGAMC. While we intend to evaluate all three risk assessment systems mentioned above for possible application to this program, we expect the PGAMC population to most resemble a disability population for which mental health or substance abuse problems may be more prevalent than in the general population. Since the DPS accounts for these and many other chronic conditions explicitly, we expect it may be more applicable to this population than a risk assessment system that does not.

Further, with recent changes to PGAMC eligibility criteria, we expect the movement of a significant portion of the PGAMC population to the MinnesotaCare program. As a result, any model development for this population must be based on the new PGAMC eligibility criteria to ensure the selected eligible population most closely represents the future PGAMC population.

RECOMMENDED RISK ADJUSTMENT MODEL FOR PMAP

In this section we (1) highlight characteristics of the proposed risk assessment model for the Medicaid non-disabled population, and (2) briefly describe the risk adjustment model.

Risk Assessment Model

The ACG-based risk assessment model we are proposing for first year implementation for the Medicaid non-disabled population is a *square root model based on the Ambulatory Diagnosis Groups (ADGs)*, the initial categories into which diagnoses are classified by the ACG grouper. The reader is referred to Appendix B for details regarding the proposed ACG-based square root model. The ACG grouper uses the ICD-9-CM[15] diagnosis codes assigned to individuals in a given period of time as documented by providers from health care encounters on insurance claims/encounter records to classify individuals into one or more of 32 possible ADGs.[16] The ADG classification is then combined with age and gender to classify individuals into one and only one of up to 94 mutually exclusive ACG categories. The diagnosis classification system is based on (1) minimum within category utilization variance, and (2) seven explicit clinical and epidemiological criteria.[vii]

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[15] International Classification of Diseases, 9th Revision, Clinical Modification

[16] Of a total of about 15,000 possible ICD-9 codes that exist, slightly more than 13,000 have been classified into the 32 ADGs.

Many of the clinical and epidemiological criteria used in developing the classifications relate to clinical issues that are relevant to the predictability of need for health care over time (e.g., likelihood or persistence of diagnosis, need for continued treatment, specialist services, disability).

The developers of the ACG system recommend that users employ either the mutually exclusive ACGs, or the thirty-two non-mutually exclusive ADGs.[viii] The reader is referred to Appendix B for additional details regarding the ACG system. As a result, the ACG model used here was comprised of the 32 possible ADGs, and age and gender factors (See Table 2).

The *square root risk assessment model* proposed here is based on ADGs in which the square root of total charges incurred during the second half of FY95 are regressed on the linear additive combination of demographic variables and the 32 ADGs corresponding to the diagnoses associated with the services that occurred during the first half of FY95. The results of this regression are used to predict the square root of future health care charges.[17] We performed a square root transformation of charges, since preliminary analysis revealed that the charge distribution for this population was not statistically normal, and highly skewed toward high total charges. This is often done under such circumstances to obtain a transformation of the dependent variable that has a distribution with more normal characteristics. These results are then converted back into the original dollar scale which become the basis for the risk adjusted capitation rates.

The main reason we propose the square root form of an ADG model for this population is that it has substantially superior predictive accuracy across both non-random groups than either a similar ADG-based model that attempts to predict untransformed health care charges, or the demographic models we tested. This means that, from among the models we considered, it is the model that is least likely to produce incentives for risk selection. The reader is referred to Appendix B for the detailed technical specification of the proposed model.

The mathematical nature of the square root model has direct implications for the administration of a risk adjusted rate setting process . In particular, the nature of the functioning of the square root model means that relative risk factor weights on the dollar scale are not possible. This has implications for the implementation and administration of the rate setting process. A more detailed discussion of this issue appears in the next section: the Risk Adjustment Model.

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[17] The model is developed using multiple regression analysis, which is a statistical method that analyzes relationships among two or more variables. More specifically, regression analysis is a statistical method that seeks to explain variation in a dependent variables (in our case second half FY 95 health care charges) by using information about a set of independent variables (in this case age, gender, and ADGs). The results are used to predict the risk of future health care payments for each person, based on each person's configuration of age, gender, and ADG classifications.

Risk Adjustment Model

The risk adjustment model is based on the *square root risk assessment model in which, unlike the current method of rate setting, a monthly capitation rate will be set for each eligible person, not for groups of eligible persons.* Essentially, the risk adjustment model calculates capitation rates from (1) individual risk weights, which are estimated from the database on which the risk assessment model was developed, and (2) explicit capitation payment policy decisions. The reader is referred to Appendix B for technical details regarding the process by which risk adjusted rate setting system will be implemented, but it is important to highlight two of its key features here.

The Conversion Factor: First, this method of rate setting has the flexibility to enable risk adjusted rates to be further modified ***based on explicit payment policy decisions independent of risk adjustment*** (e.g., trending, legislatively mandated adjustments, geographic payment policy). These additional modifications can be achieved through the use of a constant ***Conversion Factor (CF)*** by which each individual's risk weight is multiplied to set a rate for each individual in a given program population or subpopulation. Using the conversion factor, policy makers can establish and/or modify program or subpopulation budgets as they have in the past (or as they wish to in the future), while leaving both the relative weight of each persons rate and the distribution of capitation payments within programs or subpopulations to the risk adjustment model.

Weights for Risk Factors or Individuals: Second, the nature of the process by which the results of the square root model are used to calculate rates theoretically creates weights that reflect both (a) the independent effect of each risk factor, and (b) the (interaction) effects of the occurrence of each risk factor with every other risk factor (i.e., the effects of multiple conditions). This feature of the model is attractive from the standpoint that it can dynamically account for some of the clinical complexities involved in the occurrence of multiple clinical conditions (the unique contribution of multiple conditions to the risk of future utilization). However, due to the mathematical nature of the model, it becomes impractical to attempt to estimate relative risk weights in dollar units that could be attributed to each individual risk factor. Therefore, this rate calculation method consists of a formula/equation which calculates a predicted annual payment amount ***for each individual*** based on each individual's values on the demographic and ADG variables, and the weights assigned to each of those on the square root scale. This feature of the proposed risk adjustment model has immediate implications for the implementation and administration of the risk adjusted rate setting process. The discussion of these implications appears in the next section.

IMPLEMENTATION DETAILS

In this section we discuss (1) how the risk adjusted rate setting system will be implemented; (2) the underlying implementation issues and administrative implications of risk weights for individuals vs. risk factors, (3) how rate setting and payment policy issues interface with risk

adjustment; (4) the process by which final rates will be set, and (5) implications for the administration of a risk adjusted payment system. The reader should refer to Appendix B, for a more detailed overview of a risk adjusted rate setting implementation tool for use in PMAP.

How the System Will Be Implemented

We recommend that the risk adjustment system be implemented in two distinct stages over a period of two years beginning on January 1, 1999. The first stage, the ***risk assessment and testing stage***, will involve the assessment of the risk of health plan populations using diagnosis codes from health plan PMAP encounter data from the period January 1, 1998 through June 30, 1998. Resulting test capitation payments will be used to calculate health plan revenues for their PMAP populations. These results will be compared to actual state PMAP expenditures and health plan payments for the same period. These comparisons will enable the plans and DHS to evaluate the magnitude of expected changes in PMAP revenues and expenditures. Large discrepancies between actual vs. test revenues and expenditures may indicate the presence of problems that will need to be addressed prior to full implementation.

Subsequently, during the second stage of implementation, the ***risk adjustment stage***, we will implement a risk adjustment model that will be the basis for capitation rates that will be effective January 1, 2000. During calendar year 1999, the risk assessment stage, health plans will receive capitation payments based on the current rate setting process.[18] This risk adjustment model that will be implemented January 1, 2000 will be based on risk assessments for PMAP populations using data from health care encounters that occur between October 1, 1998 and March 31, 1999. Risk adjusted rates cannot be established until the January 1, 2000, contract cycle for the following reasons:

- Diagnosis histories for a minimum of six months are necessary to assess population health risk with any validity (e.g., 10/1/98 - 3/31/99).

- An encounter data submission waiting period is needed for health plans to resolve claims submission and adjudication processes with their providers (e.g., 4/1/99 - 9/30/99).

- Encounter data must then be submitted by health plans, cleaned and processed by DHS, and diagnoses processed and individual risk adjusted rates assigned prior to the beginning of the calendar year 2000 contract period (e.g., 10/1/99 - 12/31/99).

With respect to the rationale underlying a two stage risk adjustment implementation plan, the following are the key reasons:

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[18] During calendar year 1998, work on refining the FFS-based risk assessment models for the PMAP and disability populations will continue. And, risk assessment models for the prepaid MinnesotaCare and PGAMC populations will be developed and refined.

- Other states who are implementing health based risk adjustment using diagnosis data have found that the *first year of implementation needs to be focused on encounter data collection* (i.e., completeness and accuracy) and testing. Washington State for example, strongly recommends this approach to other states based on their experience with risk adjusting their state employee population.[ix]

- Encounter data has only been routinely submitted by health plans since October 1, 1997, and ambulatory diagnosis codes have not historically been used for payment. A *period of time is needed to refine the encounter data processing* cycle and, importantly, to allow plans the opportunity to *assure* themselves that their *diagnosis data are complete and accurate.*

- The risk assessment period will make it possible to develop rates and conduct payment simulations based on health plan PMAP encounter data. These rates and simulations can be used to *inform health plans of likely changes in the current rate structure prior to its formal implementation* on January 1, 2000.

- The development of risk adjustment models requires a measure of resource use for calculating risk of future utilization. Historically, resource use has been reflected by per service charges and payments made to providers in the FFS environment. Since current encounter data submissions do not routinely include charges and payment data, the *assessment stage would create the opportunity to develop alternative measures of health care resource use for future versions of the risk adjustment models that are based on encounter data.*

As previously described, the implemented payment model we are currently recommending for non-disabled PMAP programs will use ADG's based on past diagnoses submitted to DHS as part of the routine submission of claims/encounters in combination with age and gender information to establish a risk weight for every individual enrolled in PMAP. For new enrollee's, or individuals of insufficient eligibility, the risk weight for these enrollees is still an issue. One option is to set payments based on age and gender until a sufficient period of continuous eligibility has elapsed, at which point diagnosis histories can be validly classified. The time frame needed to establish that diagnosis history is at issue, since we have found in preliminary tests that a one year period captures more chronic conditions than only six months enabling the model to better predict expenditures based on the occurrence of multiple conditions. The model's sensitivity to the length of time over which diagnoses are observed will be tested once 30 months of data becomes available.

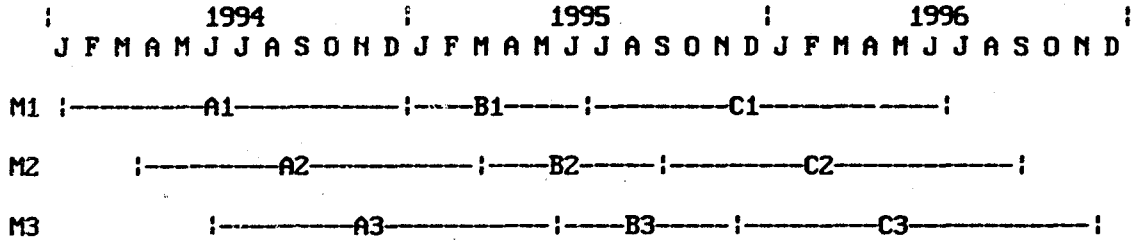
Currently there is a time lag of almost twelve months between when health care encounters occur and when the data for a given period becomes available to DHS for use in rate setting.

This twelve month period is used primarily to maximize the quality of data by both the health plan and DHS. As encounter record submission becomes more timely, we expect this lag period to drop to nine months and eventually six months. The presence of this time lag requires a similar lag period in model development.

In addition, implementation discussions between MDH and DHS have focused on developing risk adjusted payments that will be updated periodically (e.g., quarterly, annually). To emulate this plan and to incorporate the concept of this lag into the implemented model, we intend to use the 30-month database (available early 1998) to estimate a model which uses a one year risk assessment period, followed by a six month lag period, to predict the health care charges for a subsequent year.

When the full three years worth of data becomes available, this model could then be advanced quarterly, for example, two consecutive times allowing us to test the accuracy of an model that features diagnosis and charge periods of a full year in length, and a six month encounter submission lag. Rates based on such a prediction model could be updated quarterly, allowing us to test for model reliability over time. Testing this possible implementation model would take a form similar to that depicted in Figure 2.

Figure 2
Example Implementation Model Scenario



M= Model number
A= Diagnosis Period
B= Lag Period
C= Predicted Charge Period

This model is just one potential implementation model we are discussing. As part of our plan to test model sensitivity to various lengths of diagnosis, lag time, and expenditure periods, the lengths of periods A, B, and C in Figure 2 can be altered accordingly. From such tests, balanced against administrative feasibility, the final form of the model for implementation will be recommended.

Remaining Implementation Issues

There are a number of issues that have been identified by staff and the PPRAWG that will need to be resolved prior to risk adjustment implementation. Some of these are risk adjustment issues, which need analytic or policy evaluation. Some of these are rate setting issues, and need to be resolved through established DHS rate setting and payment policy making processes. Most of these issues require some discussion across the two agencies, to assure that decisions made in one agency are understood and consistent with decisions made in the other.

Therefore, (1) risk adjustment models developed using the initial estimation subpopulation must yet be validated and adapted to the remaining subpopulations, and (2) explicit payment policy decisions must yet be made regarding particular issues, such as setting initial rates prior to access to diagnosis histories for individuals who have not been continuously eligible for a sufficient period of time.

The reader is referred to Appendix C for further discussion of the remaining implementation issues.

How Final Weights and Rates Will Be Set

Final weights will be set for each individual, rather than by risk factors, due to the nature of the square root form of the risk assessment model (See MODEL DEVELOPMENT section). The risk assessment model will be a "prospective" model that incorporates both each individual's the assessed risk, and current or new payment policy decisions. By prospective we mean individuals' risk, as assessed or measured over the course of some prior time period, is used to establish relative risk weights for each individual. These weights will then be used to adjust their capitation rates for some later time period. The lengths of the risk assessment period and the period for which risk rates will be fixed, as well as the interval between these periods, will be recommended pending our evaluation of model sensitivity to these issues and administrative concerns.

Each individual risk weight will be converted into a capitation rate by multiplying by a **conversion factor (CF).** The conversion factor will enable the implementation of explicit payment policies in developing a final capitated payment rate. As a result, final rates will incorporate both each individual's relative risk weight from the risk assessment model and explicit rate setting and/or payment policy decisions.

Implementation and Administrative Implications of Individual Weights

Since the proposed risk adjustment model involves managing person level databases, both DHS and the prepaid payment entities (health plans, counties, etc.) should agree on standardized formats and variable definitions for those databases. Without such agreement, projected revenues and expenditures between the state and the prepaid entities could be highly discrepant. In addition, for participating organizations who have not yet developed such databases, there will be significant technical additions (i.e., human and hardware) to their administrative costs. Managing the proposed risk adjustment model will therefore be significantly more information intensive than managing rates for a relatively few rate cells. The reader is referred to Appendix B for (1) a detailed discussion of the required database required for this process, (2) an example of how risk adjusted rates could be calculated from such a database, and (3) a detailed illustration of how risk adjustment and payment policy would interface in that process.

Since the marginal costs/benefits to both DHS and the health plans due to risk adjustment are as yet unknown, we plan to evaluate the magnitude of expected changes in PMAP revenues and expenditures. In addition, we will also attempt to assess the additional administrative costs to both DHS and the health plans, and gauge the anticipated marginal cost/benefit resulting from risk adjustment implementation during the risk assessment and testing stage.

Evaluation and Improvement

After submission of the model and risk weights, there are a number of additional research activities related to risk adjustment that will be necessary prior to actual implementation. First, we will continue to obtain comparison weights from as many external sources as possible, to check for any weights that are outliers, especially due to small numbers of cases in some risk categories. Second, we will utilize PMAP data as soon as it is available to test the weights against PMAP encounter data. This will give us a chance to make modifications if necessary to the weights. Third, we will assist DHS and health plan staff in gaining familiarity with using the model. At the point of implementation, MDH will assist DHS in the initial assignment of enrollees to risk categories and the initial determination of payment rates for each enrollee. Fourth, we will continue working to develop the model and weights for the disability pilot programs. We will work within the timetable of implementation of the pilots.

We will also test the use of the DPS model as well as the ACG model on the PGAMC population, and develop recommendations for implementing risk adjustment in the PGAMC population.

Evaluation of Factors Other Than Diagnosis

The Public Programs Risk Adjustment Work Group (PPRAWG) reached a consensus to make population-based diagnosis classification the foundation of the risk adjustment system implemented, and to study factors other than diagnosis likely to predict risk. To guide the risk adjustment evaluation effort, the group developed a list of likely risk factors other than diagnosis for study. They discussed these other factors against a number of criteria, among them: their ability to significantly predict medical service use, the availability of data to test them, and the economic incentives their inclusion creates. Some indicators suggested by the group are routinely collected by DHS for Medical Assistance recipients. The research literature supports including numerous factors in risk adjustment analyses (See Appendix D for more details and specific factors proposed for testing).

> ✓ **Results from the evaluation of factors other than diagnosis will be used in future refinements to the risk adjustment models.**

Unfortunately, a survey to collect a battery of validated direct health and functional status measures did not go into the field as planned, yet these factors remain a topic for future research. It became clear, as survey planning proceeded, that sample sizes permitted by the budget fell short of the statistical power needed to make all the desired comparisons. The survey then refocused upon the disabled population, many with costly ongoing chronic conditions. While redesigning the survey questionnaire to accommodate refocusing, DHS observed that some alternative functional status measures reside in eligibility screening documents for specific disability groups. This insight, projected cost overruns, the need for Institutional Review Board approval of the survey, technical difficulties in identifying proxies for the disabled unable to speak for themselves, and close proximity to the end of the state fiscal year, all contributed to the survey's cancellation. An evaluation of functional status measures such as activities of daily living contained in DHS disability screening documents will take the place of the survey. As a result of this experience:

> ✓ **We will evaluate the feasibility of incorporating activities of daily living measures from DHS screening documents into the risk adjustment data base.**

Screening documents also provide an additional benefit. They hold the potential to complement documented diagnoses claims histories. Often times, the underlying clinical condition responsible for a disability determination does not appear in claims or encounter records. For example, someone classified as developmentally disabled may receive treatment for a clinical condition (e.g., broken limb) with no mention of the disability appearing on the encounter record because the disability had no bearing upon the condition being treated. For groups of beneficiaries without documented prior diagnoses, self- reported health or functional status substitutes (e.g., activities of

daily living) serve as a reliable alternative measure, especially for individuals with chronic disabling conditions newly eligible for Medical Assistance. The Medicare risk-adjustment literature suggests that self-reported health or functional status can substantially increase the predictive accuracy of diagnosis-based models. Efforts to evaluate these specific other factors for predictive ability will continue.

Post-Implementation Work Pan and Issues

Because risk adjustment is a new and evolving science, there will be a need for ongoing analytical work beyond initial implementation. A number of improvements and enhancements are currently planned, and other issues will almost certainly arise as the system is implemented and refined. We expect the evaluation of the risk adjustment system for Minnesota's prepaid public health care programs to proceed on a number of dimensions:

- Monitoring access to care for high cost beneficiaries;
- Monitoring health plan marketing investment by risk differentiated subpopulations;
- Tracking revenues vs. expenditures by health plan and risk differentiated subpopulations;
- Tracking health plan loss ratios by health plan;
- Monitor changes in enrollee satisfaction with their plan and the quality of their care;
- Monitor trends in access to care (e.g., disenrollment rates) for populations eligible for various prepaid public health care programs, and by risk differentiated subpopulations.

In addition to these efforts:

✓ **We will refine the risk adjustment model using encounter data when it becomes available.**

Although we do not anticipate major changes as a result, we intend to evaluate model sensitivity to the use of PMAP encounter data. As indicated previously, it would certainly be preferable to include PMAP data in our initial risk assessment model development. Since the data on which the initial models are based is for the Medical

Assistance populations under FFS care, it is questionable as to whether the health care utilization experience reflected by these data is representative of PMAP utilization experience. As a result, as encounter data becomes available, we will validate the models using PMAP encounter data. However, to do this,

> ✓ **We will develop alternative measures of resource use when using encounter data as FFS data are replaced by encounter data from prepaid health plans.**

In addition, we anticipate resetting the weights for the PMAP/MinnesotaCare populations frequently during the initial stages of implementation. For example, after the first year, significant changes may be necessary to account for changes in coding practices that naturally accompany such a change in payment policy.

> ✓ **We will continue to explore additional factors that might be added to the model to improve its predictive performance.**

We anticipate exploring data available through DHS's disability screening process for items that may be predictive of health care costs. We will also examine combining existing demographic data with other data (for example, combining county or local government statistics and enrollee zip codes).

> ✓ **We will evaluate new versions of each of the risk assessment systems as they are released using Minnesota data to determine whether or not modifications to our initial risk assessment models might be indicated.**

Both ACGs and DPS have undergone significant change over the last year, resulting in enhancements and improvements in the predictive performance of each of these. As the models continue to be enhanced and implemented in settings around the country, further improvements to our risk assessment models may be necessary.

> ✓ **We will make recommendations as a result of lessons learned from implementation as well as the behavioral simulation activity with regard to auditing activities within DHS.**

We have already begun to outline areas of potential auditing interest. Both the implementation of risk adjustment and the transition from FFS claims to encounter data involve new incentives and different places where auditing may be necessary. After initial implementation, and after completion of our behavioral simulation, we anticipate identifying areas where auditing may be warranted.

Proxy Resource Use Measures

DHS does not require submission of provider charges on encounter records although recalibration of risk weights requires a summary measure of resources expended for care. Under the FFS reimbursement system, dollars expended for care can be easily summed from standardized billing claims, but in the prepaid managed care environment no such summary measure is easily obtainable from encounter records. Encounter records enumerate "units of service" provided with each encounter. Days of hospital stay, ambulatory care visits and the number of ancillary services provided exemplify the "units of service" displayed on encounter records.

> ✓ **We will develop reliable and valid alternative measures of health care resource use for use in recalibrating risk adjustment models using encounter data (e.g., physician fee schedules, hospital prospective payment systems).**

To date, there is no consensus about substitute standard dollar proxies to arithmetically associate with encounter record units of service for recalibrating risk adjustment weights. The pool of possible options for resolution of the problem includes:

- Requiring health plans to report their billed charges with encounter records;
- Using the Relative Value Units from the Medicare Fee Schedule together with weights for Diagnosis Related Groups (DRGs) and Ambulatory Patient Groups (APGs) or other schedules to create standard measures of resource use which could be converted to dollar amounts;
- Base risk-adjustment weights upon some other meaningful metric such as the risk distribution of eligible member months and premiums paid or upon units of service.

Based upon discussions with the PPRAWG, staff outlined a research plan for pursuing the second option. The detailed outline appears in Appendix E of the technical appendices. The plan produces an evaluation of proxy resource measures' level of substitutability for fee-for-service billed charges in risk adjustment models. Assuming a favorable evaluation outcome, the resource proxies studied will substitute for allowable billed charges as encounter records become available and their contents become more reliable.

> ✓ **Refinement of the risk assessment models based on encounter data will be done annually as more of the population moves into managed care, and as encounter data becomes more usable and improves in quality.**

CONCLUSION

First, since there is substantial evidence that overall predictive accuracy for risk assessment models based on ACGs and DCGs is comparable, and since ACGs are widely used in Minnesota, we recommend that the risk adjustment mechanism for Minnesota's prepaid public health care programs should be based on an ACG-based risk assessment model. Second, since our preliminary evaluations indicate that an ADG model performs better than an ACG model, we recommend the use of an ADG model, in which unique capitation rates are calculated for each individual in a program/population (See MODEL DEVELOPMENT for further details).

We recommend that the implementation of risk adjustment in prepaid public programs rate setting should take place in two separate stages beginning January 1, 1999. The ***first stage*** is the ***risk assessment and testing*** stage. During this stage of implementation, the *risk of future health care resource use for public health care program recipients is assessed* using encounter data received by DHS, and the impacts of the resulting rates on health plan revenues and expenditures will be evaluated. The ***second stage*** is the ***risk adjustment*** stage in which *the risk of PMAP enrollees will be assessed and used to develop capitation rates that will be effective January 1, 2000.*

The development of a risk adjustment system for public programs is nearing readiness for implementation, in keeping with the first available implementation date of January 1, 1999. We have a number of tasks that remain, but expect that these tasks will be completed within the necessary time frame to allow a relatively smooth transition.

Risk adjustment allows the state to better target payments to health plans (or counties) on the basis of the illness burden. In doing so, access to health insurance and care is expected to increase; and health plans will have a greater incentive to compete on the basis of efficiency, and a lower incentive to compete on the basis of enrollee selection.

End Notes

i. ACG(Ambulatory Care Groups): Weiner, J.P., Dobson, A., Maxwell, S.L., Coleman, M.A., Starfield, B.H., and Anderson, G.F., "Risk-Adjusted Medicare Capitation Rates Using Ambulatory and Inpatient Diagnoses," Health Care Financing Review, Vol. 17, No. 3, Spring, 1996.

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iii. Ellis, R.P., Pope, G.C., Iezzoni, L.I., Ayanian, J.Z., Bates, D.W., Burstin, H., and Ash, A.S., "Diagnosis-Based Risk Adjustment for Medicare Capitation Payments," Health Care Financing Review, Vol. 17, No. 3, Spring, 1996.

iv. Kronick, R. Dreyfus, T, Lee, L., and Zhou, Z., "Diagnostic Risk Adjustment for Medicaid: The Disability Payment System," Health Care Financing Review, Vol. 17, No. 3, Spring, 1996.

v. Section 18, Minnesota Statutes 1996, section 62Q.03, subdivision 5a..

vi. Howell, Embry M., "Medicaid Managed Care Encounter Data: What, Why and Where Next?" *Health Care Financing Review* Summer 1996, Volume 17, Number 4: 87-95.

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McData Committee, *Medicaid-Medicare Common Data Initiative: A core data set for states and managed care plans*, Health Care Financing Administration, Baltimore, Maryland, August 1, 1995.

vii. Weiner, J.P., Dobson, A., Maxwell, S.L., Coleman, M.A., Starfield, B.H., and Anderson, G.F., "Risk-Adjusted Medicare Capitation Rates Using Ambulatory and Inpatient Diagnoses," Health Care Financing Review, Vol. 17, No. 3, Spring, 1996.

viii. Johns Hopkins University, Implementation Guide - Johns Hopkins University ACG Case Mix System, Version 4.0, March, 1997, p. D.55.

ix. Madden, C. W. and Christenson, G., "Risk Adjustment for Capitation Payment - Lessons for Purchasers - Recent Experiences from Washington State in Health Status Based Risk Adjustment," conference sponsored by Washington State Health Care Authority, University of Washington, William M. Mercer, Inc., Seattle, Washington, November 20-21, 1997.

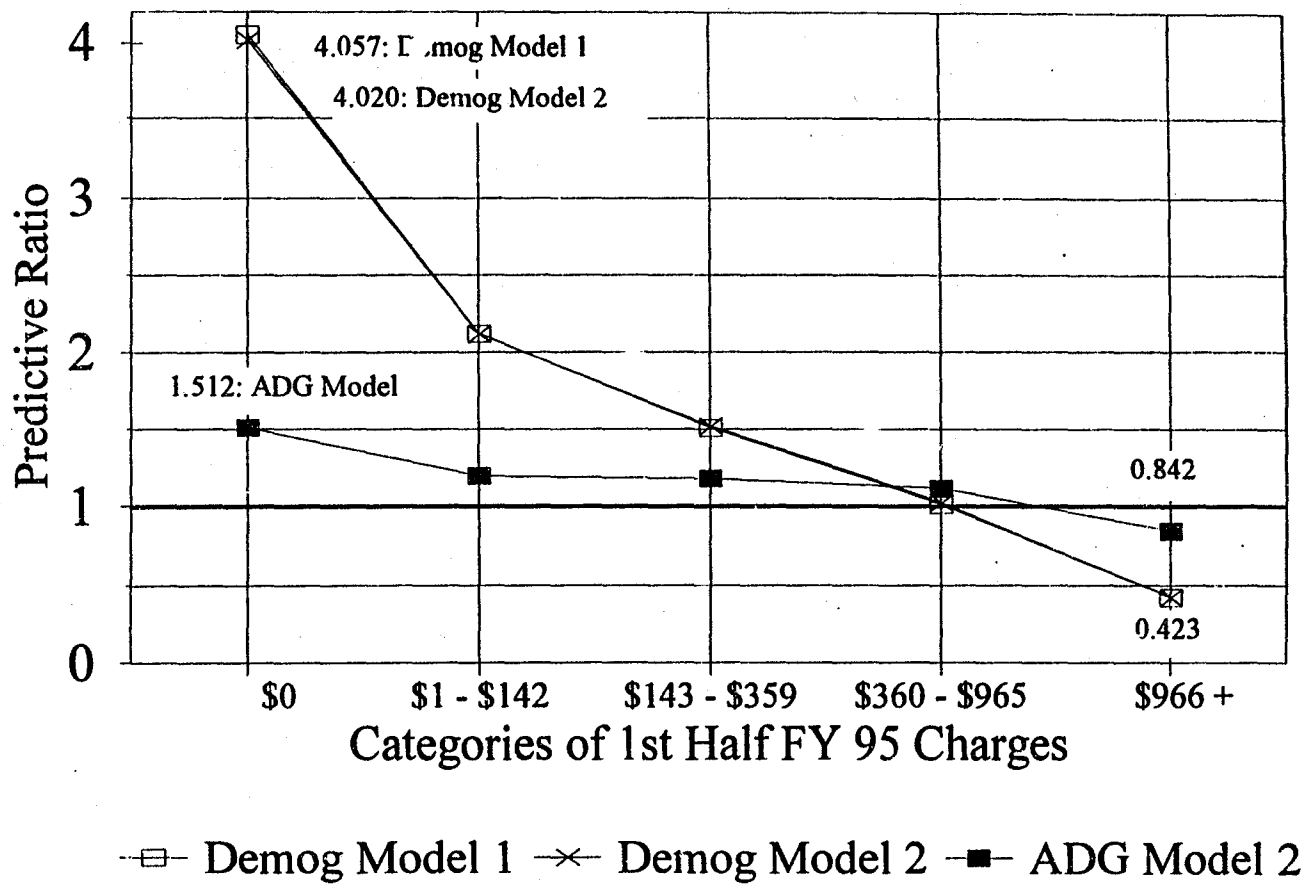
Table 1

Comparing Non-Random Group Predictive Performance of An ACG-Based vs. Demographic Risk Adjustment Models

Risk Assessment Method		Categories of First Half FY '95 Charges					
		$0	$1 - $142	$143 - $359	$360 - $965	$966 +	Overall
Age - Gender Model 1	Avg Pred 2nd Half FY 95 Chg	$990	$985	$1,020	$1,090	$1,206	$1,059
	Avg Act 2nd Half FY 95 Chg	$244	$465	$674	$1,079	$2,849	$1,059
	Prediction Error	$746	$520	$346	$11	($1,643)	$0
	Predictive Ratios	4.057	2.118	1.513	1.010	0.423	1.000
Age - Gender Model 2	Avg Pred 2nd Half FY 95 Chg	$981	$983	$1,027	$1,099	$1,204	$1,059
	Avg Act 2nd Half FY 95 Chg	$244	$465	$674	$1,079	$2,849	$1,059
	Prediction Error	$737	$518	$353	$20	($1,645)	$0
	Predictive Ratios	4.020	2.114	1.524	1.019	0.423	1.000
ADGs	Avg Pred 2nd Half FY 95 Chg	$369	$553	$790	$1,198	$2,400	$1,059
	Avg Act 2nd Half FY 95 Chg	$244	$465	$674	$1,079	$2,849	$1,059
	Prediction Error	$125	$88	$116	$119	($449)	$0
	Predictive Ratios	1.512	1.189	1.172	1.110	0.842	1.000
	Total Recipients	18,389	15,230	16,772	16,858	16,820	84,069

* Notes: Age-gender Model 1: Dependent variable was charges on dollar scale.
Age-gender Model 2: Dependent variable was square root of charges, then predictions converted back to dollar
ADG model: Dependent variable was square root of charges, then predictions converted back to dollars.
"Avg Pred 2nd Half FY 95 Chgs" means average predicted total charges for 2nd half of fiscal year 1995.
"Avg Act 2nd Half FY 95 Chgs" means average actual total charges for 2nd half of fiscal year 1995.
"Prediction Error" is average of predicted 2nd half FY 95 charges minus actual 2nd half FY 95 charges.
"Predictive Ratio" is ratio of average predicted to average actual 2nd half FY 95 charges.
Model based on population of individuals continuously eligible for Medical Assistance during fiscal year 1995 who were: (1) not eligible for Medicare, (2) not living in an institutional setting, (3) and not on spend down at any time during the year. Two recipients with second half FY 95 charges exceeding $500,000 were also excluded.

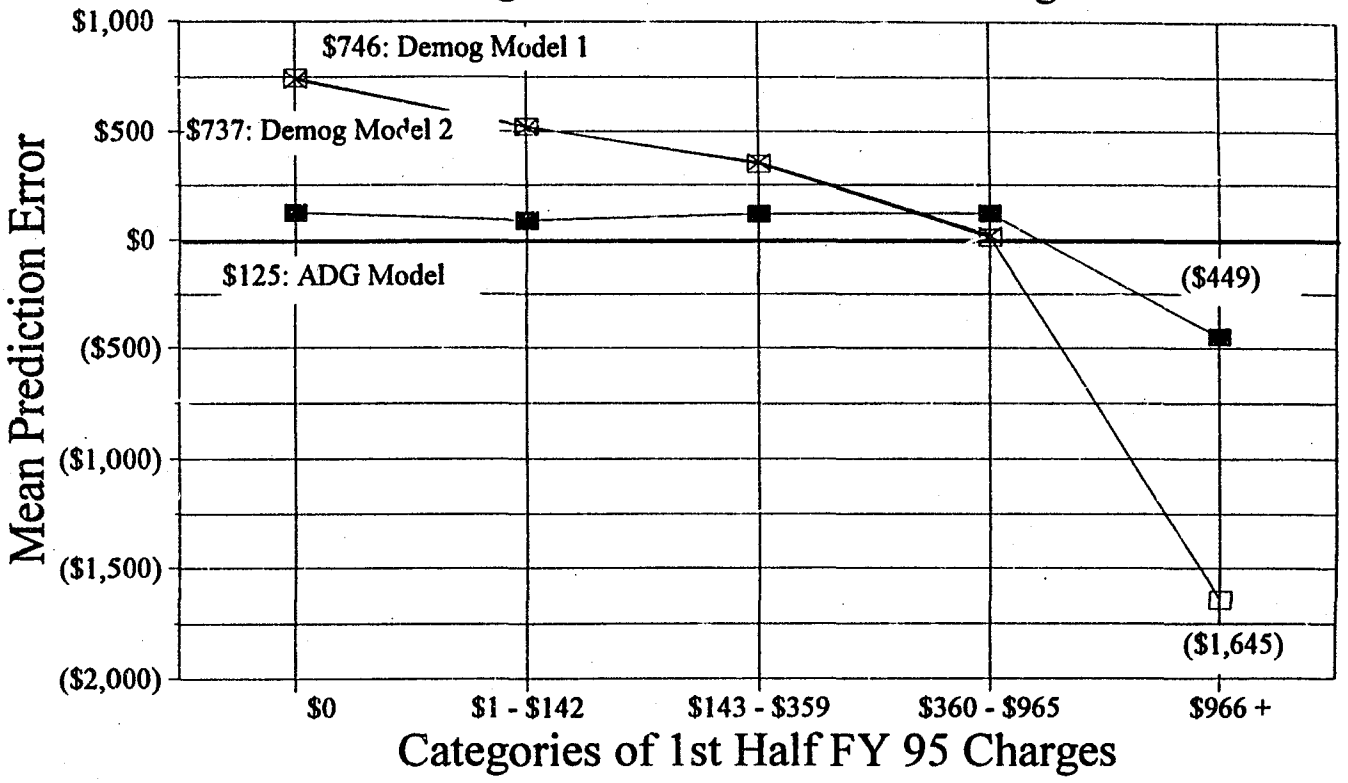
Figure 1a



Note: N = 84,069 Medicaid non-disabled continuously eligible individuals (See Table 1)

Figure 1b

Risk Model Mean Prediction Error By Categories of 1st Half FY 95 Charges



Note: N = 84,069 Medicaid non-disabled continuously eligible individuals (See Table 1)

Table 1c

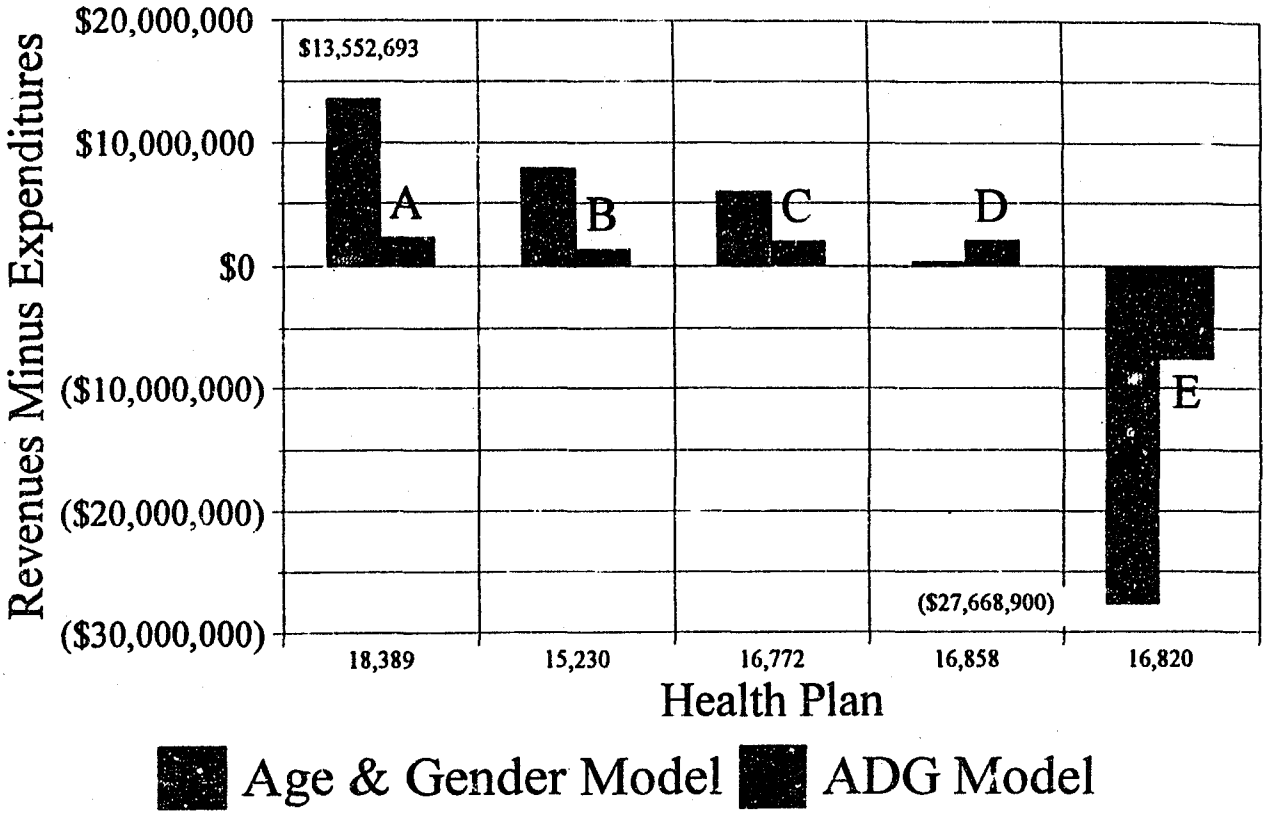
Comparing Health Plan Revenues and Expenditures Under an ADG vs. Demographic Risk Adjustment Model *

Risk Assessment Method		Health Plan A	B	C	D	E	Overall
Age - Gender Model	Total Enrollees	18,389	15,230	16,772	16,858	16,820	84,069
	Avg Risk Score	0.926	0.928	0.970	1.038	1.137	1.000
	Revenues	$18,039,609	$14,971,090	$17,224,844	$18,526,942	$20,251,280	$89,029,071
	Expenditures	$4,486,916	$7,081,950	$11,304,328	$18,189,782	$47,920,180	$89,029,071
	Difference	$13,552,693	$7,889,140	$5,920,516	$337,160	($27,668,900)	$0
ADG Model	Total Enrollees	18,389	15,230	16,772	16,858	16,820	84,069
	Avg Risk Score	0.348	0.522	0.746	1.131	2.266	1.000
	Revenues	$6,785,541	$8,422,190	$13,249,880	$20,195,884	$40,368,000	$89,029,071
	Expenditures	$4,486,916	$7,081,950	$11,304,328	$18,189,782	$47,920,180	$89,029,071
	Difference	$2,298,625	$1,340,240	$1,945,552	$2,006,102	($7,552,180)	$0

* Notes:
Age-gender Model: Dependent variable was square root of charges, then predictions converted back to dollars.
ADG model: Dependent variable was square root of charges, then predictions converted back to dollars.
Average Risk Score = the mean of the ratio of each individuals predicted PEPM charge to the statewide average predicted PEPM charge.
Revenues = total predicted charges for 2nd half FY 95 across all enrollees.
Expenditures = total actual charges for 2nd half FY 95 across all enrollees.
Difference = Revenues - Expenditures.
Model based on population of individuals continuously eligible for Medical Assistance during fiscal year 1995 who were: (1) not eligible for Medicare, (2) not living in an institutional setting, (3) and not on spend down at any time during the year.
Two recipients with second half FY 95 charges exceeding $500,000 were also excluded.

Figure 1c

Balance Sheet by Health Plan Under Demographic vs. ADG Model



Note: Hypothetical health plans defined by categories of first half FY '95 charges. Numbers below each column are numbers of hypothetical enrollees (See Table 1c).

Table 2

Distribution of Minnesota Medicaid Non -Disabled (MND) FFS FY 1995 Population
By ACG 4.0 Based on First Half FY 95 Diagnoses

ACG 4.0 Category	ACG Category Description	Total Eligibles/ Recipients	Percent of Total
100	Acute Minor, Age 1-2	805	1.0%
200	Acute Minor, Age 2-5	3,006	3.6%
300	Acute Minor, Age 6+	5,603	6.7%
400	Acute: Major	2,492	3.0%
500	Likely to Recur, without Allergies	3,297	3.9%
600	Likely to Recur, with Allergies	211	0.3%
700	Asthma	108	0.1%
800	Chronic Medical, Unstable	94	0.1%
900	Chronic Medical, Stable	357	0.4%
1000	Chronic Specialty	71	0.1%
1100	Opthalmological/Dental	1,728	2.1%
1200	Chronic Specialty, Unstable	82	0.1%
1300	Psychosocial, w/o Psychsoc Unstable	1,660	2.0%
1400	Psy-soc, w/ Psy-soc Unst, w/o Psy-soc Stable	81	0.1%
1500	Psy-soc, w/ Psy-soc Unst, w/ Psy-soc Stable	84	0.1%
1600	Preventive/Administrative	4,640	5.5%
1710	Pregnancy: 0-1 ADGs	370	0.4%
1720	Pregnancy: 2-3 ADGs, no major ADGs	819	1.0%
1730	Pregnancy: 2-3 ADGs, 1+ major ADGs	252	0.3%
1740	Pregnancy: 4-5 ADGs, no major ADGs	401	0.5%
1750	Pregnancy: 4-5 ADGs, 1+ major ADGs	296	0.4%
1760	Pregnancy: 6+ ADGs, no major ADGs	166	0.2%
1770	Pregnancy: 6+ ADGs, 1+ major ADG	403	0.5%
1800	Acute Minor and Acute Major	3,170	3.8%
1900	Acute Min & Lkly to Recur, Age 1-2	1,551	1.8%
2000	Acute Min & Lkly to Recur, Age 2-5	2,811	3.3%
2100	Acute Min & Lkly to Recur, Age > 5, w/o All	2,577	3.1%
2200	Acute Min & Lkly to Recur, Age > 5, w/ All	269	0.3%
2300	Acute Minor and Chronic Medical: Stable	357	0.4%
2400	Acute Minor and Eye/Dental	808	1.0%
2500	Acute Min and Psy-soc w/o Psy-soc Unst	973	1.2%
2600	Acute Min and Psy-soc w/ Psy-soc Unst, w/o Psy-soc	43	0.1%
2700	Acute Min & Psy-soc w/ Psy-soc Unst & St	46	0.1%
2800	Acute Major and Lkly to Recur	1,016	1.2%
2900	Acute Min &Maj/Lkly to Recur, Age 1-2	598	0.7%
3000	Acute Min &Maj/Lkly to Recur, Age 2-5	1,004	1.2%
3100	Acute Min &Maj/Lkly to Recur, Age 6-11	551	0.7%
3200	Acute Min &Maj/Lkly to Rec, Age >5, w/o Allergy	1,168	1.4%
3300	Acute Min &Maj/Lkly to Rec, Age >5, w/ Allergy	100	0.1%
3400	Acute Minor/Likely Recur/Eye& Dental	574	0.7%
3500	Acute Minor/Likely Recur/Psychosocial	762	0.9%

Table 2 (continued)

Distribution of Minnesota Medicaid Non -Disabled (MND) FFS FY 1995 Population
By ACG 4.0 Based on First Half FY 95 Diagnoses

ACG 4.0 Category	ACG Category Description	Total Eligibles/ Recipients	Percent of Total
3600	Acute Min &Maj/Lkly to Rec/Eye & Dental	555	0.7%
3700	Acute Min &Maj/Lkly to Rec/Psychosocial	880	1.0%
3800	2-3 Oth ADG Combs, Age < 17	3,186	3.8%
3900	2-3 Oth ADG Combs, Males Age 17-34	208	0.2%
4000	2-3 Oth ADG Combs, Females Age 17-34	1,052	1.3%
4100	2-3 Oth ADG Combs, Age >34	845	1.0%
4210	4-5 Oth ADG Combs, Age < 17, no Maj ADGs	1,406	1.7%
4220	4-5 Oth ADG Combs, Age < 17, 1+ Maj ADGs	656	0.8%
4310	4-5 Oth ADG Combs, Age 17-44, no Maj ADGs	755	0.9%
4320	4-5 Oth ADG Combs, Age 17-44, 1 Maj ADGs	750	0.9%
4330	4-5 Oth ADG Combs, Age 17-44, 2+ Maj ADGs	175	0.2%
4410	4-5 Oth ADG Combs, Age >44, no Maj ADGs	64	0.1%
4420	4-5 Oth ADG Combs, Age >44, 1 Maj ADGs	82	0.1%
4430	4-5 Oth ADG Combs, Age >44, 2+ Maj ADGs	25	0.0%
4510	6-9 Oth ADG Combs, Age <6, no Maj ADGs	180	0.2%
4520	6-9 Oth ADG Combs, Age <6, 1+ Maj ADGs	205	0.2%
4610	6-9 Oth ADG Combs, Age 6-16, no Maj ADGs	321	0.4%
4620	6-9 Oth ADG Combs, Age 6-16, 1+ Maj ADGs	229	0.3%
4710	6-9 Oth ADG Combs, M, Age 17-34, no Maj ADGs	10	0.0%
4720	6-9 Oth ADG Combs, M, Age 17-34, 1 Maj ADGs	32	0.0%
4730	6-9 Oth ADG Combs, M, Age 17-34, 2+ Maj ADGs	31	0.0%
4810	6-9 Oth ADG Combs, F, Age 17-34, no Maj ADGs	229	0.3%
4820	6-9 Oth ADG Combs, F, Age 17-34, 1 Maj ADGs	385	0.5%
4830	6-9 Oth ADG Combs, F, Age 17-34, 2+ Maj ADGs	195	0.2%
4910	6-9 Oth ADG Combs, Age >34, 0-1 Maj ADGs	451	0.5%
4920	6-9 Oth ADG Combs, Age >34, 2 Maj ADGs	180	0.2%
4930	6-9 Oth ADG Combs, Age >34, 3 Maj ADGs	42	0.0%
4940	6-9 Oth ADG Combs, Age >34, 4+ Maj ADGs	10	0.0%
5010	10+ Oth ADG Combs, Age 1-16, no Maj ADGs	15	0.0%
5020	10+ Oth ADG Combs, Age 1-16, 1 Maj ADGs	30	0.0%
5030	10+ Oth ADG Combs, Age 1-16, 2+ Maj ADGs	31	0.0%
5040	10+ Oth ADG Combs, Age >16, 0-1 Maj ADGs	110	0.1%
5050	10+ Oth ADG Combs, Age >16, 2 Maj ADGs	98	0.1%
5060	10+ Oth ADG Combs, Age >16, 3 Maj ADGs	59	0.1%
5070	10+ Oth ADG Combs, Age >16, 4+ Maj ADGs	28	0.0%
5110	No Diagnosis or Only Unclassified Diagnosis	8,491	10.1%
5200	Non-Users	16,368	19.5%
5310	Infants: 0-5 ADGs, no major ADGs	237	0.3%
5320	Infants: 0-5 ADGs, 1+ major ADGs	24	0.0%
5330	Infants: 6+ ADGs, no major ADGs	22	0.0%
5340	Infants: 6+ ADGs, 1+ major ADGs	13	0.0%
9900	Missing Age		0.0%
Total	Across all ACGs	84,069	100.0%

Technical Appendicies A - F

To Accompany

Risk Adjustment and Rate Setting Methods In Public Programs

A Report to the Legislature

January 1998

APPENDIX A

ACG 4.0 TEST FOR THE MINNESOTA MEDICAID NON-DISABLED POPULATION

Purpose

The purpose of this report is to record the results of our test of the ACG 4.0 grouper software using data from fiscal year 1995 (FY95) for the Medicaid-non-disabled population. The version of the software we tested is for a UNIX-based SUN Solaris computer system. We tested the grouper between August 20, 1997, and October 16, 1997. Relevant CSC Healthcare Systems (CSC) provides a number of explicit criteria by which the functioning of the software should be validated with respect to a particular data set. The following is a brief review of the results of a number of tests we performed to evaluate the software against these and other criteria when the grouper was applied to the FY95 fee-for-service (FFS) claims and eligibility data for the Minnesota non-disabled population. CSC staff are copied on this memo, in response to their request for a summary of these tests in their ACG 4.0 implementation instructions.

Background

The initial risk model we expect to estimate will be "prospective" in which we will use the diagnoses for services that occurred during the first half of FY95 (i.e., 7/1/94 through 12/31/94) to explain/predict total non-denied line item charges for services that occurred during the second half of FY95 (i.e., 1/1/95 through 6/30/95) for individuals that were eligible for Medicaid non-disabled programs during FY95. We therefore ***first tested the grouper using the diagnoses for services that occurred during the first half of FY95*** for the population of individuals who were eligible for Medicaid non-disabled programs at any time during FY95, and their age and gender data from their eligibility records. We then calculated "unadjusted" ACG weights based on average charges per person for services that occurred during the second half of FY95 for the subpopulation who were continuously eligible during the entire year.

Second, we also ***tested the grouper using diagnoses for services that occurred over all of FY95*** for the same population for two reasons: to examine the sensitivity of the grouper to using only six months vs. a full year of diagnoses for the same population; and to compare weights based on a concurrent set of ACGs and charges to preliminary "concurrent" weights for a large, group model HMO provided by CSC. Concurrent weights are those produced from a model in which the services underlying the ACGs and charges occurred during the same time period. For this test, we calculated "unadjusted" ACG weights based on the average charges per person for the services that occurred over the entire year, also for the subpopulation who were continuously eligible during the entire year.

1. Selection of Medicaid Non-Disabled "FFS Only" Population for Demographic Data File Development

From earlier tests (See memo dated 9/17/97) we found an unusually large proportion of recipients for whom there were claims but no diagnoses (i.e. ACG 5100, N = 120,129 out of 447,419, about 27 percent). Subsequently, we found that this was for the most part due to the presence of capitation payments for PMAP recipients in the data. We further found that for some of these recipients, there was an early period of FFS claims followed by a series of capitation payments, whereas for others there were some FFS claims that occurred during the same period covered by the capitation payments. Due to the heterogeneity of this subpopulation, we decided to exclude it from the initial FFS population with which we plan to test the grouper and estimate the initial risk adjustment model.

We understand, however, that for the population of eligible individuals transitioning from FFS to PMAP, we may need to include only their FFS activity and program eligibility in the population for which capitation rates must be developed. However, while they could be considered "leavers," they should probably be distinguished as "leavers transitioning from FFS to PMAP" and treated distinctly, because they are probably different from individuals who loose Medicaid eligibility completely during the period. For these initial tests, though, we excluded all individuals for whom there was one or more capitation payments during the year as described below.

Table A1 shows an accounting of individuals eligible at any time in FY95 by whether there was also an eligibility record in MAXIS as of March, 1996. The identification of individuals eligible at some point in FY95 was performed using the Recipient Master File data set. This data set contains a comprehensive record of individuals' Medicaid eligibility history for anyone who has been eligible at any time for Medical Assistance under any program during about the last five years (i.e., using monthly beginning and en ling dates for all periods of program eligibility since about 1991).

From this data set we identified 454,501 individuals who were eligible for Medicaid at some time during FY95. The MAXIS data set contains a record of current eligibility characteristics (e.g., age, gender, household size, income) for all people eligible at the time of the extraction. These data are needed for the "Other Factors" evaluations - the evaluations of the potential effectiveness of eligibility (MAXIS) based data in differentiating population health risk. Of the 454,501 individuals eligible at some time in FY95, there was a MAXIS record for 447,507 of them.

Finally, age and gender data were missing for 88 of these people, resulting in a final count of 447,419 individuals who were eligible for Medical Assistance (MA) in FY95, and for whom there was valid age, gender, and MAXIS data.

Of this population of 447,419, there was one or more capitation payments for 156,531 of these,[1] resulting in a "FFS Only" population of 290,888, which became the population on which both tests focused.

2. Selection of Medicaid Non-Disabled "FFS Only" Claims for Diagnosis Data File Development

We began selecting diagnosis data for grouping by identifying the FFS claims records for which first date of service was within FY 95 from the MMIS II claims records. The initial claims data set contained 8,666,861 records.[2] We then excluded the claims for the PMAP recipients (N = 2,477,152) resulting in a "FFS Only" recipient claims file containing 6,189,709 records. On further study, we found that 29,497 of these records were for services for which first date of service was either one day before or after the beginning or ending date of FY95 (i.e., June 30, 1994 or July 1, 1995). After excluding these records, there were 6,160,212 records included in the FFS claims data set for which first data of service was within FY95.

For the first test, we selected diagnoses from claims for which first date of service was in the first half FY 95.[3] Of the total of 6,160,212 FFS recipient only FY95 claims, 3,096,657 were for services for which first date of service was within the first half of FY95. This was the claims data set used for the development of the diagnoses files for input into the ACG grouper for first test. ***For the second test,*** all 6,160,212 FFS recipient only FY95 claims were used for the development of the diagnoses files for input into the ACG grouper.

We chose not to test the options for differentiating pregnant women on the basis of delivery status, or infants on the basis of low birth weight status for either test.

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[1] Actually, there were 159,539 individuals for whom there was one or more capitation payments in FY 95. However, 3,008 were also excluded due to the absence of a MAXIS record, or age and gender data.

[2] Since providers had one year to submit claims, the data set will not include all services that occurred in FY 95 (i.e., through 6/30/95) until claims for services paid through June 30, 1996, have been included.

[3] For both tests, we excluded the diagnoses from clinical laboratory, diagnostic imaging, and pharmacy claims, but their claims records were retained in the data sets. Lab and diagnostic imaging diagnoses are considered largely rule out, and we found the over 90 percent of the ungrouped diagnosis data from initial runs was due to alphanumeric name-like data recorded in the diagnoses fields on pharmacy claims. In addition, at this point we have not tried to identify and exclude claims for durable medical equipment.

Diagnosis Code Mismatch Rate

Of the total number of unique diagnosis codes per person across person IDs processed by the grouper, the percentage that was not classified into one of the 32 Ambulatory Diagnosis Groups (ADGs) is considered the diagnosis code mismatch rate.[1] Operationally, the total number of unique diagnosis codes per person across IDs is the total number of ungrouped codes for each person ID summed across all IDs, regardless of whether particular codes are redundant from one person to the next.

For the first test, we found a mismatch rate of 1.29 percent, or 7,217 "unique non-grouped codes across IDs" from a total of 557,618 total unique codes across IDs. The number of individuals with ungrouped codes was 6,245 or about 2 percent of the eligible population. In addition, the 7,217 ungrouped codes were accounted for by a total of only 1,314 unique ICD-9 codes across person records.

For the second test, we found a mismatch rate of 1.41 percent, or 14,476 "unique non-grouped codes across IDs" from a total of 1,025,678 total unique codes across IDs. The number of individuals with ungrouped codes was 12,136 or about 4 percent of the eligible population. In addition, the 14,476 ungrouped codes were accounted for by a total of only 1,953 unique ICD-9 codes across person records.

CSC indicates a mismatch rate of five percent (5%) or less is acceptable, which suggests that these rates are not excessive.

The List of Non-Matched Diagnosis Codes

As suggested by CSC, the frequent occurrence of one or two (or a few) non-matched diagnosis codes may indicate the presence of a diagnosis coding problem that can be easily fixed. There were a few diagnosis codes that accounted for 2 or more percent of the ungrouped codes which may suggest a recurring problem for either diagnosis coding or the grouper[4]. The complete list can be made available for those who might be interested.

Evaluate the Distribution of Persons by ACG Category

CSC suggests the user validate the distribution of persons across the age differentiated ACGs against the age distribution for the entire population, and particularly whether there are sufficient numbers of infants identified. Table A2 shows the ACG distribution for each test.

In general, there appears to be a pattern of frequency reductions in acute, less complex ACGs and corresponding frequency increases in more complex, recurrent ACGs as we move from

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[4] e.g., '07819 ', '496 ', '64214 ', '64821 ', '64822 ', '64841', '64891 ', '6989 ','7999 ', 'E885 ', 'E927 ', 'V0381 '

using only six months to a full year's diagnosis history. For example, ACGs 100 - 300 focus on minor acute conditions across age ranges 1-2, 2-5, and 6+, and surprisingly show a noticeable decline in numbers when the full year of diagnoses are included. Correspondingly, ACGs 1800 - 2000 appear to be comparable to ACGs 100 - 300 with the exception that there now appear to be diagnoses for conditions that are "..Likely to Recur..," and, in fact, these frequencies increase markedly when the full year of diagnoses are added. This suggests that for a substantial proportion of the population, multiple types of conditions distinguished by the ACG grouper (e.g., acute vs. chronic or recurrent) may manifest themselves over the course of a year, but not six months.

1. Appropriateness of age distribution

For the first test (ACGs based on first FY 95 diagnoses), there was a total of 5,270 infants across all of the infant ACGs (i.e., 5310, 5320, 5330, and 5340) using the first half FY 95 diagnoses, which is about 2 percent of the 290,888 individuals eligible at some time in FY 95. This compares to the fact that there were 12,030 infants (about 4%) identified across the entire year.

And, for the second test, we found a total of 10,769 infants across the infant ACGs when we used all relevant FY 95 diagnoses, or about 3.7 percent of the 290,888 individuals eligible at some time in FY 95. The remaining 1,114 infants were found in ACG 5200 (Non-Users), or about 9 percent of the eligible infants in the population. This seems reasonable if we consider that the population includes all individuals who were found to be eligible at anytime time (e.g., even one month) during FY 95. In other words, it seems plausible that some infants can go for a month or two without a health care encounter. If some portion of these only became eligible late in the year, this could account for the absence of a claim record.

The age distributions across other selected age differentiated ACGs look reasonable.

2. Appropriateness of mental illness distribution

For the first half FY 95 test, there were 4,836 persons classified into mental illness ACGs 1300, 1400, and 1500 or about 1.7 percent of the population. We have no reason to believe this to be an unreasonable number of mental illness cases for this population. For the second test which included diagnoses for services occurring across the entire year. However when we did this, the total number of persons classified into ACGs 1300, 1400, and 1500 *dropped* to 4,203, but the numbers in the ACGs that include both pyscho-social and physical diagnoses (i.e., ACGs 2500, 2600, 2700, and especially 3700) increased substantially from the test using the first half FY 95 diagnoses (i.e., from 3,691 to 5,574). This could be accounted for if some proportion of the individuals with exclusively psycho-social diagnoses over the first half of the year (i.e., in this case about 13%) experience physical diagnoses as well across the entire year and get distributed accordingly into more complex ACGs that include psycho-social codes by the grouper.

This result suggests the possibility that *six months worth of diagnosis experience may not be sufficient to characterize a population's true health status as well as the diagnosis experience of a full year.*

3. Appropriateness of numbers of persons in ACGs 5100 and 5200

ACG 5200

For the first half FY 95 test, there were 142,147 persons classified into ACG 5200 the non-users or individuals eligible in FY 1995 for whom there were no claims in the first half of FY '95. This number represents about 49 percent of the 290,888 individuals who were eligible for Medical Assistance (MA) in fiscal year 1995, and for whom there was valid age and gender data. This proportion appears high relative to estimates from ACG developers and other users in the range of 15 to 35 percent. However, for the second test in which all relevant diagnoses for services occurring across the entire year were included, the number of persons in ACG 5200 dropped to 106,603 which is about 37 percent of the population, a more reasonable number. This result also suggests that *a full year (versus six months) of diagnosis experience may be necessary when measuring the health status of a population using diagnosis-based risk assessment models.*

ACG 5110

For both tests, the proportions of persons classified into the No Diagnoses or Only Unclassified Diagnoses category (ACG 5110) appear to be relatively small (i.e., 20,976 out of 290,888 or about 7 percent when using the first half FY95 diagnoses, and 18,301 or about 6 percent when the diagnoses for the full year). These proportions appear reasonable.

Evaluating ACG Weights

CSC recommends users perform a ***preliminary evaluation of relative weights by ACG*** generated from the users local data by comparing them to those developed from other data sets ***to assess the validity of the ACG assignment process.*** We compared the ACG weights generated from this Medicaid non-disabled data set to those provided by CSC from a large group model HMO.[5] ***Neither set of weights should be considered representative of normative values by ACG category, nor should they be viewed as weights that will be used in rate setting. Many other adjustments to the weights during modeling will take place, and a number of payment policy decisions (e.g., trending) will influence the role of ACG weights in rate setting.***

Two sets of weights were generated from this data set. The *first set is based on a "concurrent" calculation of total relevant charges for paid services provided during the entire year across the*

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[5] The weights for the large group model HMO are based on a population that was continuously eligible for a full year.

ACGs obtained from the diagnoses associated with services provided during the same period for the continuously eligible subpopulation (N = 123,883 See Table A3).[6] This was done because the method used to calculate the weights for the large group model HMO provided by CSC is also based on a concurrent resource use calculation and ACG assignment process. Thus, the charges that are the basis of these weights result from basically the same services from which the diagnoses used for each person's ACG assignment were extracted. Therefore, in this respect the methods of calculating these sample ACG weight are comparable across the two populations. While we expect to use a prospective model for developing risk adjustment models for possible use in capitation rate setting, for testing the grouper, we wanted to start with concurrent unadjusted weights for a continuously eligible population as recommended by CSC to evaluate the validity of our data relative to that from a large, commercial group model HMO.

As recommended by CSC, the (unadjusted) ACG weights were calculated as the ratio of the average total FY 1995 charges for each ACG to the average total FY 1995 charges across all ACGs.[7] Birth/delivery related services were excluded to accommodate a payment policy decision to "carve out" delivery related services from capitation rates. The operational logic underlying the carve out is documented in the memo by DHS staff dated September 29, 1997 (See Attachment).

In Table A3, the data underlying the weight development for this population are shown, and the two sets of weights are compared. For the most part, the discrepancies between the two sets of weights are small (e.g., less than 1.0). However, there are some differences worth noting. For example, using the criterion of a discrepancy greater than 1.0, the Medicaid individuals classified into psychosocial (i.e., 1300 - 1500, 2500 - 2700) and pregnancy (i.e., 1710 - 1770) ACGs appear to have somewhat higher weights (i.e., have had a higher per capita utilization volume, charges) relative to the rest of the population than their counterparts in the commercial HMO population. In addition, for the individuals in many of the ACGs distinguished by the presence of 1 or more Major ADGs (e.g., 4520, 4720, 4730, 5070, 5320, and 5340), the Medicaid population appears to have substantially higher weights.

These results suggest that for the Medicaid population, psychological conditions and pregnancies may be somehow different from those in a commercial HMO population (e.g., less prenatal care, more late term care with complications; psychological conditions may be more severe in the Medicaid vs. the commercial population), or that health care was provided systematically differently in the two populations (e.g., psychological conditions treated by more intensively in the Medicaid population).

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[6] Monthly Medicaid program eligibility history data was merged with the demographic data for this population for classifying eligibility continuity within FY 95.

[7] The HMO weights for the pregnancy ACGs are the average of the delivery status specific weights provided by CSC. CSC did not provide weights for pregnancy ACGs irrespective of delivery status.

The second set of weights *is based on a **"prospective"** weight calculation in which* the *ACGs obtained from all relevant **first half FY95** diagnoses are used to account for the charges for services provided for during the **second half of FY95** for the same continuously eligible population* (See Table A4). This was done to correspond to the prospective nature of the expected rate setting process.

Basically, the same sets of ACGs appear to show the largest differences between the Medicaid and large HMO population. However, again, using the criterion of a discrepancy in the weights exceeding 1.0, we found that when using only six months of diagnoses, differences exceeded 1.0 for about 60 percent of the ACGs, whereas differences of this magnitude appeared for only about 45 percent of the ACGs when using diagnoses over a full year. This indicates that the Minnesota Medicaid weights that are based on the diagnosis history over the full year are more consistent with the sample weights provided by CSC for a large HMO population than those based on a diagnosis history over only six months.

CONCLUSION

Taken together, the results of the test suggest that the diagnosis mismatch rate is low relative to the threshold for concern established by CSC. The distribution of persons by ACG, however, suggests that more complex conditions (i.e., combinations of or interactions between conditions, comorbidities) are more likely to manifest themselves over the course of a year rather than six months. In addition, comparing the unadjusted ACG weights revealed substantial discrepancies which we suspect may be due to (1) the comparison of non-comparable populations - a FFS Medicaid population vs. a large commercial HMO population, and/or (2) the use of diagnosis histories covering a period that may be insufficient to characterize population health status.

We conclude that while the grouper appears to working as it should, the ***unadjusted weights comparison should be considered very preliminary***, since the populations on which they are based are probably are quite different both in terms of the method of financing (i.e., FFS vs. capitation) and socioeconomic status (i.e., fully employed working age vs. Medicaid probably younger). In addition, although the weights have been adjusted by eligibility continuity, they have not been controlled for other factors that may affect them such as Medicare eligibility, institutional status, or spend down status. As a result, ***the weights should NOT be considered representative of normative values by ACG category, and should NOT be viewed as the weights that will be used in rate setting.***

End Notes

1. Johns Hopkins University, "Implementation Guide - Johns Hopkins University ACG Case-Mix Adjustment System, Version 4.0," March, 1997, pp. 44-55.

Table A1

Identification of Medicaid Non-disabled Eligible in Fiscal Year 1995
Crossclassification of Eligibility in Fiscal Year 1995 (FY '95)
by Whether or Not
Individual was Eligible at Time of MAXIS Extraction (March, 1996)

			Eligible Any Time in FY 1995		
			Yes	No	Row Totals
Eligible in MAXIS 3/96	Yes	Count	447,507	0	447,507
		Row Pct	100.0%	0.0%	100.0%
		Col Pct	98.5%	0.0%	98.5%
		Tot Pct	98.5%	0.0%	98.5%
	No	Count	6,994	NA	6,994
		Row Pct	100.0%	NA	100.0%
		Col Pct	1.5%	NA	1.5%
		Tot Pct	1.5%	NA	1.5%
Column Totals		Count	454,501	0	454,501
		Row Pct	100.0%	0.0%	100.0%
		Col Pct	100.0%	0.0%	100.0%

Notes: Records of eligibility for Medical Assistance were provided from two sources: (1) a MAXIS extraction as of March, 1996, and (2) the MMIS II Recipient Master File. In the MAXIS extraction there is a record of current eligibility characteristics for all individuals eligible at the time of the extraction (N = 447,507). The Recipient Master File data provides a record of the dates for all periods of eligibility for anyone who has ever been eligible for Medical Assistance under any program. There was a total of 454,501 individuals identified as being eligible for a Medicaid non-disabled program at some point during FY 1995. The difference in the number of individuals identified in these data sets represents the 6,994 individuals for whom there is a record of eligibility for Medicaid in FY '95, but no MAXIS record as of March, 1996. There were zero (0) individuals for whom there was a MAXIS record, but no eligibility history. The cell indicating no MAXIS record and no eligibility history is Not Applicable.

Table A2

Distribution of Minnesota Medicaid Non -Disabled (MND) FFS FY 1995 Population
By ACG 4.0

ACG 4.0 Categ	ACG Category Description	ACGs Based on First Half FY 95 Diagnoses: Total FY 95 Eligibles/ Recipients	ACGs Based on First Half FY 95 Diagnoses: Percent of Total	ACGs Based on FY 95 Diagnoses: Total FY 95 Eligibles/ Recipients	ACGs Based on FY 95 Diagnoses: Percent of Total
100	Acute Minor, Age 1-2	1,709	0.6%	1,253	0.4%
200	Acute Minor, Age 2-5	5,717	2.0%	5,319	1.8%
300	Acute Minor, Age 6+	11,339	3.9%	11,570	4.0%
400	Acute: Major	5,845	2.0%	5,552	1.9%
500	Likely to Recur, without Allergies	6,912	2.4%	6,781	2.3%
600	Likely to Recur, with Allergies	447	0.2%	419	0.1%
700	Asthma	247	0.1%	228	0.1%
800	Chronic Medical, Unstable	248	0.1%	232	0.1%
900	Chronic Medical, Stable	850	0.3%	804	0.3%
1000	Chronic Specialty	145	0.0%	127	0.0%
1100	Opthalmological/Dental	3,785	1.3%	4,126	1.4%
1200	Chronic Specialty, Unstable	163	0.1%	174	0.1%
1300	Psychosocial, w/o Psychsoc Unstable	4,155	1.4%	3,530	1.2%
1400	Psy-soc, w/ Psy-soc Unst, w/o Psy-soc Stable	406	0.1%	397	0.1%
1500	Psy-soc, w/ Psy-soc Unst, w/ Psy-soc Stable	275	0.1%	276	0.1%
1600	Preventive/Administrative	10,006	3.4%	8,134	2.8%
1710	Pregnancy: 0-1 ADGs	2,529	0.9%	2,924	1.0%
1720	Pregnancy: 2-3 ADGs, no major ADGs	3,049	1.0%	3,788	1.3%
1730	Pregnancy: 2-3 ADGs, 1+ major ADGs	1,031	0.4%	1,370	0.5%
1740	Pregnancy: 4-5 ADGs, no major ADGs	1,064	0.4%	1,739	0.6%
1750	Pregnancy: 4-5 ADGs, 1+ major ADGs	1,012	0.3%	1,699	0.6%
1760	Pregnancy: 6+ ADGs, no major ADGs	346	0.1%	1,069	0.4%
1770	Pregnancy: 6+ ADGs, 1+ major ADG	996	0.3%	2,862	1.0%
1800	Acute Minor and Acute Major	6,176	2.1%	7,497	2.6%
1900	Acute Min & Lkly to Recur, Age 1-2	3,049	1.0%	3,513	1.2%
2000	Acute Min & Lkly to Recur, Age 2-5	4,852	1.7%	6,963	2.4%
2100	Acute Min & Lkly to Recur, Age > 5, w/o All	4,762	1.6%	6,582	2.3%
2200	Acute Min & Lkly to Recur, Age > 5, w/ All	467	0.2%	575	0.2%
2300	Acute Minor and Chronic Medical: Stable	673	0.2%	689	0.2%
2400	Acute Minor and Eye/Dental	1,461	0.5%	2,353	0.8%
2500	Acute Min and Psy-soc w/o Psy-soc Unst	1,880	0.6%	2,187	0.8%
2600	Acute Min and Psy-soc w/ Psy-soc Unst, w/o ? P	112	0.0%	109	0.0%
2700	Acute Min & Psy-soc w/ Psy-soc Unst & St	131	0.0%	149	0.1%
2800	Acute Major and Lkly to Recur	2,102	0.7%	2,152	0.7%
2900	Acute Min &Maj/Lkly to Recur, Age 1-2	1,056	0.4%	1,927	0.7%
3000	Acute Min &Maj/Lkly to Recur, Age 2-5	1,631	0.6%	3,401	1.2%
3100	Acute Min &Maj/Lkly to Recur, Age 6-11	836	0.3%	1,737	0.6%
3200	Acute Min &Maj/Lkly to Rec, Age >5, w/o A	2,322	0.8%	3,490	1.2%
3300	Acute Min &Maj/Lkly to Rec, Age >5, w/ A	198	0.1%	358	0.1%
3400	Acute Minor/Likely Recur/Eye& Dental	966	0.3%	1,933	0.7%
3500	Acute Minor/Likely Recur/Psychosocial	1,385	0.5%	2,251	0.8%

Table A2 (continued)

Distribution of Minnesota Medicaid Non -Disabled (MND) FFS FY 1995 Population
By ACG 4.0

ACG 4.0 Categ	ACG Category Description	ACGs Based on First Half FY 95 Diagnoses: Total FY 95 Eligibles/ Recipients	ACGs Based on First Half FY 95 Diagnoses: Percent of Total	ACGs Based on FY 95 Diagnoses: Total FY 95 Eligibles/ Recipients	ACGs Based on FY 95 Diagnoses: Percent of Total
3600	Acute Min &Maj/Lkly to Rec/Eye & Dental	1,001	0.3%	1,925	0.7%
3700	Acute Min &Maj/Lkly to Rec/Psychosocial	1,568	0.5%	3,129	1.1%
3800	2-3 Oth ADG Combs, Age < 17	5,837	2.0%	6,985	2.4%
3900	2-3 Oth ADG Combs, Males Age 17-34	[illegible]	0.3%	991	0.3%
4000	2-3 Oth ADG Combs, Females Age 17-34	2,24[illegible]	0.8%	2,380	0.8%
4100	2-3 Oth ADG Combs, Age >34	1,847	0.6%	1,979	0.7%
4210	4-5 Oth ADG Combs, Age < 17, no Maj ADGs	2,453	0.8%	4,472	1.5%
4220	4-5 Oth ADG Combs, Age < 17, 1+ Maj ADGs	1,114	0.4%	1,869	0.6%
4310	4-5 Oth ADG Combs, Age 17-44, no Maj ADGs	1,485	0.5%	2,162	0.7%
4320	4-5 Oth ADG Combs, Age 17-44, 1 Maj ADGs	1,630	0.6%	2,083	0.7%
4330	4-5 Oth ADG Combs, Age 17-44, 2+ Maj ADG	421	0.1%	531	0.2%
4410	4-5 Oth ADG Combs, Age >44, no Maj ADGs	130	0.0%	191	0.1%
4420	4-5 Oth ADG Combs, Age >44, 1 Maj ADGs	191	0.1%	227	0.1%
4430	4-5 Oth ADG Combs, Age >44, 2+ Maj ADGs	84	0.0%	113	0.0%
4510	6-9 Oth ADG Combs, Age <6, no Maj ADGs	297	0.1%	971	0.3%
4520	6-9 Oth ADG Combs, Age <6, 1+ Maj ADGs	410	0.1%	1,007	0.3%
4610	6-9 Oth ADG Combs, Age 6-16, no Maj ADGs	561	0.2%	1,817	0.6%
4620	6-9 Oth ADG Combs, Age 6-16, 1+ Maj ADGs	435	0.1%	1,158	0.4%
4710	6-9 Oth ADG Combs, M, Age 17-34, no Maj A	36	0.0%	101	0.0%
4720	6-9 Oth ADG Combs, M, Age 17-34, 1 Maj AD	102	0.0%	294	0.1%
4730	6-9 Oth ADG Combs, M, Age 17-34, 2+ Maj A	119	0.0%	262	0.1%
4810	6-9 Oth ADG Combs, F, Age 17-34, no Maj AD	398	0.1%	973	0.3%
4820	6-9 Oth ADG Combs, F, Age 17-34, 1 Maj AD	710	0.2%	1,421	0.5%
4830	6-9 Oth ADG Combs, F, Age 17-34, 2+ Maj AD	361	0.1%	657	0.2%
4910	6-9 Oth ADG Combs, Age >34, 0-1 Maj ADGs	760	0.3%	1,501	0.5%
4920	6-9 Oth ADG Combs, Age >34, 2 Maj ADGs	345	0.1%	573	0.2%
4930	6-9 Oth ADG Combs, Age >34, 3 Maj ADGs	102	0.0%	177	0.1%
4940	6-9 Oth ADG Combs, Age >34, 4+ Maj ADGs	30	0.0%	32	0.0%
5010	10+ Oth ADG Combs, Age 1-16, no Maj ADGs	27	0.0%	234	0.1%
5020	10+ Oth ADG Combs, Age 1-16, 1 Maj ADGs	51	0.0%	297	0.1%
5030	10+ Oth ADG Combs, Age 1-16, 2+ Maj ADGs	74	0.0%	229	0.1%
5040	10+ Oth ADG Combs, Age >16, 0-1 Maj ADGs	198	0.1%	874	0.3%
5050	10+ Oth ADG Combs, Age >16, 2 Maj ADGs	189	0.1%	731	0.3%
5060	10+ Oth ADG Combs, Age >16, 3 Maj ADGs	118	0.0%	405	0.1%
5070	10+ Oth ADG Combs, Age >16, 4+ Maj ADGs	78	0.0%	225	0.1%
5110	No Diagnosis or Only Unclassified Diagnosis	20,976	7.2%	18,301	6.3%
5200	Non-Users	142,147	48.9%	106,603	36.6%
5310	Infants: 0-5 ADGs, no major ADGs	4,235	1.5%	7,990	2.7%
5320	Infants: 0-5 ADGs, 1+ major ADGs	636	0.2%	1,085	0.4%
5330	Infants: 6+ ADGs, no major ADGs	158	0.1%	826	0.3%
5340	Infants: 6+ ADGs, 1+ major ADGs	241	0.1%	868	0.3%
9900	Missing Age	0	0.0%	0	0.0%
Total	Across all ACGs	290,888	100.0%	290,888	100.0%

NOTICE: CHARGES AND WEIGHTS ARE PRELIMINARY AND NOT FOR USE IN RATE SETTING

Table A3

Comparison of Relative Weights by ACG 4.0 For Continuously Eligible FY 95
from FY 1995 Minnesota Medicaid Non -Disabled (MND) FFS Data vs. Data from a Large Group Model HMO *
Concurrent **

ACG 4.0 Categ	ACG Category Description	Average Total 95 Charges	Total FY '95 Eligibles/ Recips	Relative Weight: MND	Relative Weight: Lg HMO	Difference f - e
a	b	c	d	e	f	g
100	Acute Minor, Age 1-2	$624	433	0.360	0.103	-0.257
200	Acute Minor, Age 2-5	$504	2,360	0.291	0.057	-0.234
300	Acute Minor, Age 6+	$503	4,892	0.290	0.110	-0.180
400	Acute: Major	$1,009	1,772	0.582	0.279	-0.303
500	Likely to Recur, without Allergies	$541	2,590	0.312	0.141	-0.171
600	Likely to Recur, with Allergies	$410	156	0.236	0.161	-0.075
700	Asthma	$411	75	0.237	0.106	-0.131
800	Chronic Medical, Unstable	$1,619	57	0.934	0.280	-0.654
900	Chronic Medical, Stable	$809	261	0.467	0.102	-0.365
1000	Chronic Specialty	$410	47	0.236	0.086	-0.150
1100	Opthalmological/Dental	$412	1,480	0.238	0.081	-0.157
1200	Chronic Specialty, Unstable	$563	60	0.325	0.215	-0.110
1300	Psychosocial, w/o Psychsoc Unstable	$2,424	1,435	1.398	0.125	-1.273
1400	Psy-soc, w/ Psy-soc Unst, w/o Psy-soc St	$4,907	60	2.830	0.167	-2.663
1500	Psy-soc, w/ Psy-soc Unst, w/ Psy-soc St	$6,711	80	3.870	0.117	-3.753
1600	Preventive/Administrative	$385	2,879	0.222	0.054	-0.168
17'^	Pregnancy: 0-1 ADGs	$977	179	0.563	2.532	1.969
17.	Pregnancy: 2-3 ADGs, no major ADGs	$1,876	,14	1.082	2.861	1.779
173u	Pregnancy: 2-3 ADGs, 1+ major ADGs	$2,151	200	1.240	3.971	2.730
1740	Pregnancy: 4-5 ADGs, no major ADGs	$2,798	522	1 614	3.623	2.009
1750	Pregnancy: 4-5 ADGs, 1+ major ADGs	$3,334	425	1.923	4.417	2.494
1760	Pregnancy: 6+ ADGs, no major ADGs	$4,773	467	2.753	4.622	1.869
1770	Pregnancy: 6+ ADGs, 1+ major ADG	$8,131	1,173	4.689	6.857	2.167
1800	Acute Minor and Acute Major	$1,451	3,516	0.837	0.531	-0.306
1900	Acute Min & Lkly to Recur, Age 1-2	$1,228	1,739	0.708	0.234	-0.474
2000	Acute Min & Lkly to Recur, Age 2-5	$923	3,880	0.532	0.177	-0.355
2100	Acute Min & Lkly to Recur, Age > 5, w/o All	$906	3,554	0.522	0.305	-0.217
2200	Acute Min & Lkly to Recur, Age > 5, w/ All	$977	326	0.563	0.392	-0.171
2300	Acute Minor and Chronic Medical: Stable	$875	305	0.505	0.205	-0.300
2400	Acute Minor and Eye/Dental	$811	1,260	0.468	0.207	-0.261
2500	Acute Min and Psy-soc w/o Psy-soc Unst	$2,559	1,235	1.476	0.233	-1.243
2600	Acute Min and Psy-soc w/ Psy-soc Unst, w/o	$5,287	32	3.049	0.228	-2.821
2700	Acute Min & Psy-soc w/ Psy-soc Unst & St	$8,803	59	5.077	2.300	-2.777
2800	Acute Major and Lkly to Recur	$1,449	890	0.836	0.699	-0.137
2900	Acute Min &Maj/Lkly to Recur, Age 1-2	$2,875	1,134	1.658	0.864	-0.794
3000	Acute Min &Maj/Lkly to Recur, Age 2-5	$2,214	2,176	1.277	0.568	-0.709
3100	Acute Min &Maj/Lkly to Recur, Age 6-11	$1,921	1,169	1.108	0.807	-0.301
3200	Acute Min &Maj/Lkly to Rec, Age >5, w/o	$2,368	1,753	1.366	1.129	-0.237
3300	Acute Min &Maj/Lkly to Rec, Age >5, w/ A	$2,161	206	1.246	1.378	0.132
3400	Acute Minor/Likely Recur/Eye& Dental	$1,283	1,172	0.740	0.397	-0.343
3500	Acute Minor/Likely Recur/Psychosocial	$3,106	1,412	1.791	0.461	-1.330

* Weights for the large commercial group model HMO were taken from Table 3 in "Implementation Guide - The Johns Hopkins University ACG Case-Mix Adjustment System," Version 4.0, March, 1997.

** All relevant FY 95 services used for both ACG assignment and total charge calculation.

Table A3 (continued)

ACG 4.0 Categ a	ACG Category Description b	Average Total 95 Charges c	Total FY '95 Eligibles/ Recips d	Relative Weight: MND e	Relative Weight: Lg HMO f	Difference f - e g
3600	Acute Min &Maj/Lkly to Rec/Eye & Dental	$4,413	1,140	2.545	2.010	-0.535
3700	Acute Min &Maj/Lkly to Rec/Psychosocial	$5,278	1,979	3.044	1.240	-1.804
3800	2-3 Oth ADG Combs, Age < 17	$2,330	3,958	1.344	0.334	-1.010
3900	2-3 Oth ADG Combs, Males Age 17-34	$3,757	241	2.167	0.531	-1.636
4000	2-3 Oth ADG Combs, Females Age 17-34	$1,476	898	0.851	0.460	-0.391
4100	2-3 Oth ADG Combs, Age >34	$1,779	728	1.026	0.598	-0.428
4210	4-5 Oth ADG Combs, Age < 17, no Maj AD	$3,366	2,995	1.941	0.684	-1.257
4220	4-5 Oth ADG Combs, Age < 17, 1+ Maj AD	$4,762	1,208	2.746	1.241	-1.505
4310	4-5 Oth ADG Combs, Age 17-44, no Maj A	$1,991	1,065	1.148	0.828	-0.320
4320	4-5 Oth ADG Combs, Age 17-44, 1 Maj AD	$3,170	944	1.828	1.540	-0.288
4330	4-5 Oth ADG Combs, Age 17-44, 2+ Maj A	$6,639	187	3.829	2.994	-0.835
4410	4-5 Oth ADG Combs, Age >44, no Maj ADG	$1,506	91	0.869	0.813	-0.056
4420	4-5 Oth ADG Combs, Age >44, 1 Maj ADGs	$3,694	82	2.130	1.840	-0.290
4430	4-5 Oth ADG Combs, Age >44, 2+ Maj AD	$4,771	30	2.751	4.604	1.853
4510	6-9 Oth ADG Combs, Age <6, no Maj ADGs	$4,866	666	2.806	1.533	-1.273
4520	6-9 Oth ADG Combs, Age <6, 1+ Maj ADGs	$9,482	675	5.468	3.282	-2.186
4610	6-9 Oth ADG Combs, Age 6-16, no Maj AD	$4,326	1,299	2.495	1.341	-1.154
4620	6-9 Oth ADG Combs, Age 6-16, 1+ Maj AD	$11,265	818	6.497	4.014	-2.483
4710	6-9 Oth ADG Combs, M, Age 17-34, no Maj	$6,164	46	3.555	2.071	-1.484
4720	6-9 Oth ADG Combs, M, Age 17-34, 1 Maj	$8,721	125	5.029	2.055	-2.974
4730	6-9 Oth ADG Combs, M, Age 17-34, 2+ Maj	$17,418	83	10.045	6.183	-3.862
4810	6-9 Oth ADG Combs, F, Age 17-34, no Maj	$3,794	574	2.188	1.607	-0.581
4820	6-9 Oth ADG Combs, F, Age 17-34, 1 Maj A	$5,117	795	2.951	2.437	-0.514
4830	6-9 Oth ADG Combs, F, Age 17-34, 2+ Maj	$9,571	336	5.520	5.446	-0.074
4910	6-9 Oth ADG Combs, Age >34, 0-1 Maj AD	$4,667	927	2.691	2.499	-0.192
4920	6-9 Oth ADG Combs, Age >34, 2 Maj ADGs	$9,137	305	5.269	5.781	0.512
4930	6-9 Oth ADG Combs, Age >34, 3 Maj ADGs	$17,045	87	9.830	12.170	2.340
4940	6-9 Oth ADG Combs, Age >34, 4+ Maj AD	$25,382	5	14.638	20.349	5.711
5010	10+ Oth ADG Combs, Age 1-16, no Maj AD	$9,092	171	5.243	6.201	0.958
5020	10+ Oth ADG Combs, Age 1-16, 1 Maj ADG	$22,967	213	13.245	5.270	-7.975
5030	10+ Oth ADG Combs, Age 1-16, 2+ Maj AD	$77,242	146	44.546	22.870	-21.676
5040	10+ Oth ADG Combs, Age >16, 0-1 Maj AD	$8,856	564	5.107	3.974	-1.133
5050	10+ Oth ADG Combs, Age >16, 2 Maj ADG	$13,866	462	7.997	6.456	-1.541
5060	10+ Oth ADG Combs, Age >16, 3 Maj ADG	$23,685	232	13.659	13.627	-0.032
5070	10+ Oth ADG Combs, Age >16, 4+ Maj AD	$81,656	109	47.091	27.833	-19.258
5110	No Diagnosis or Only Unclassified Diagnosis	$312	5,342	0.180	0.137	-0.043
5200	Non-Users	$0	46,013	0.000	0.000	0.000
5310	Infants: 0-5 ADGs, no major ADGs	$2,838	199	1.637	2.778	1.141
5320	Infants: 0-5 ADGs, 1+ major ADGs	$4,031	16	2.325	12.347	10.022
5330	Infants: 6+ ADGs, no major ADGs	$6,107	60	3.522	3.416	-0.106
5340	Infants: 6+ ADGs, 1+ major ADGs	$15,482	34	8.928	14.794	5.866
9900	Missing Age	.	0	0.000	.	0.000
Total	Across all ACGs	$1,734	123,883	1.000		

* Weights for the large commercial group model HMO were taken from Table 3 in "Implementation Guide - The Johns Hopkins University ACG Case-Mix Adjustment System," Version 4.0, March, 1997.

** All relevant FY 95 services used for both ACG assignment and total charge calculation.

Table A4

Comparison of Relative Weights by ACG 4.0 for Continuously Eligible FY 95
from FY 1995 Minnesota Medicaid Non -Disabled (MND) FFS Data vs. Data from a Large Group Model HMO *
Prospective **

ACG 4.0 Categ	ACG Category Description	Average Total 2nd Half 95 Charges	Total FY '95 Eligibles/ Recips	Relative Weight: MND	Relative Weight: Lg HMO	Difference f - e
a	b	c	d	e	f	g
100	Acute Minor, Age 1-2	$919	819	1.049	0.103	-0.946
200	Acute Minor, Age 2-5	$608	3,095	0.694	0.057	-0.637
300	Acute Minor, Age 6+	$676	5,771	0.772	0.110	-0.662
400	Acute: Major	$1,032	2,596	1.178	0.279	-0.899
500	Likely to Recur, without Allergies	$725	3,393	0.828	0.141	-0.687
600	Likely to Recur, with Allergies	$808	219	0.922	0.161	-0.761
700	Asthma	$851	114	0.971	0.106	-0.865
800	Chronic Medical, Unstable	$3,396	101	3.877	0.280	-3.597
900	Chronic Medical, Stable	$901	373	1.029	0.102	-0.927
1000	Chronic Specialty	$533	75	0.608	0.086	-0.522
1100	Opthalmological/Dental	$521	1,800	0.595	0.081	-0.514
1200	Chronic Specialty, Unstable	$749	83	0.855	0.215	-0.640
1300	Psychosocial, w/o Psychsoc Unstable	$1,851	2,226	2.113	0.125	-1.988
1400	Psy-soc, w/ Psy-soc Unst, w/o Psy-soc St	$2,803	103	3.200	0.167	-3.033
1500	Psy-soc, w/ Psy-soc Unst, w/ Psy-soc St	$4,414	122	5.039	0.117	-4.922
1600	Preventive/Administrative	$500	4,833	0.571	0.054	-0.517
1710	Pregnancy: 0-1 ADGs	$1,119	375	1.277	2.532	1.255
1720	Pregnancy: 2-3 ADGs, no major ADGs	$1,859	827	2.122	2.861	0.739
1730	Pregnancy: 2-3 ADGs, 1+ major ADGs	$1,581	253	1.805	3.971	2.166
1740	Pregnancy: 4-5 ADGs, no major ADGs	$2,098	406	2.395	3.623	1.228
1750	Pregnancy: 4-5 ADGs, 1+ major ADGs	$2,260	300	2.580	4.417	1.837
1760	Pregnancy: 6+ ADGs, no major ADGs	$3,089	170	3.526	4.622	1.096
1770	Pregnancy: 6+ ADGs, 1+ major ADG	$5,439	408	6.209	6.857	0.648
1800	Acute Minor and Acute Major	$1,012	3,275	1.155	0.531	-0.624
1900	Acute Min & Lkly to Recur, Age 1-2	$1,203	1,587	1.373	0.234	-1.139
2000	Acute Min & Lkly to Recur, Age 2-5	$857	2,890	0.978	0.177	-0.801
2100	Acute Min & Lkly to Recur, Age > 5, w/o All	$871	2,645	0.994	0.305	-0.689
2200	Acute Min & Lkly to Recur, Age > 5, w/ All	$777	276	0.887	0.392	-0.495
2300	Acute Minor and Chronic Medical: Stable	$1,100	365	1.256	0.205	-1.051
2400	Acute Minor and Eye/Dental	$860	828	0.982	0.207	-0.775
2500	Acute Min and Psy-soc w/o Psy-soc Unst	$2,259	1,161	2.579	0.233	-2.346
2600	Acute Min and Psy-soc w/ Psy-soc Unst, w/o	$4,264	47	4.868	0.228	-4.640
2700	Acute Min & Psy-soc w/ Psy-soc Unst & St	$4,500	56	5.137	2.300	-2.837
2800	Acute Major and Lkly to Recur	$1,104	1,051	1.260	0.699	-0.561
2900	Acute Min &Maj/Lkly to Recur, Age 1-2	$1,974	616	2.253	0.864	-1.389
3000	Acute Min &Maj/Lkly to Recur, Age 2-5	$1,290	1,047	1.473	0.568	-0.905
3100	Acute Min &Maj/Lkly to Recur, Age 6-11	$763	567	0.871	0.807	-0.064
3200	Acute Min &Maj/Lkly to Rec, Age >5, w/o	$1,685	1,200	1.924	1.129	-0.795
3300	Acute Min &Maj/Lkly to Rec, Age >5, w/ A	$1,692	102	1.932	1.378	-0.554
3400	Acute Minor/Likely Recur/Eye& Dental	$1,099	587	1.255	0.397	-0.858
3500	Acute Minor/Likely Recur/Psychosocial	$2,200	889	2.511	0.461	-2.050

* Weights for the large commercial group model HMO were taken from Table 3 in "Implementation Guide - The Johns Hopkins University ACG Case-Mix Adjustment System," Version 4.0, March, 1997.

** ACG Assignment Based on First Half FY 95 and Charge Calculation Based on Second Half FY 95.

NOTICE: CHARGES AND WEIGHTS ARE PRELIMINARY AND NOT FOR USE IN RATE SETTING

Table A4 (continued)

ACG 4.0 Categ a	ACG Category Description b	Average Total 2nd half 95 Charges c	Total FY '95 Eligibles/ Recips d	Relative Weight: MND e	Relative Weight: Lg HMO f	Difference f - e g
3600	Acute Min &Maj/Lkly to Rec/Eye & Dental	$2,621	580	2.992	2.010	-0.982
3700	Acute Min &Maj/Lkly to Rec/Psychosocial	$3,073	982	3.508	1.240	-2.268
3800	2-3 Oth ADG Combs, Age < 17	$2,122	3,682	2.422	0.334	-2.088
3900	2-3 Oth ADG Combs, Males Age 17-34	$3,048	239	3.479	0.531	-2.948
4000	2-3 Oth ADG Combs, Females Age 17-34	$1,784	1,081	2.037	0.460	-1.577
4100	2-3 Oth ADG Combs, Age >34	$1,855	880	2.118	0.598	-1.520
4210	4-5 Oth ADG Combs, Age < 17, no Maj AD	$2,392	1,638	2.731	0.684	-2.047
4220	4-5 Oth ADG Combs, Age < 17, 1+ Maj AD	$4,118	731	4.701	1.241	-3.460
4310	4-5 Oth ADG Combs, Age 17-44, no Maj A	$2,059	772	2.350	0.828	-1.522
4320	4-5 Oth ADG Combs, Age 17-44, 1 Maj AD	$3,173	783	3.622	1.540	-2.082
4330	4-5 Oth ADG Combs, Age 17-44, 2+ Maj A	$4,845	183	5.531	2.994	-2.537
4410	4-5 Oth ADG Combs, Age >44, no Maj ADG	$2,427	66	2.771	0.813	-1.958
4420	4-5 Oth ADG Combs, Age >44, 1 Maj ADGs	$4,572	85	5.219	1.840	-3.379
4430	4-5 Oth ADG Combs, Age >44, 2+ Maj AD	$2,901	26	3.312	4.604	1.292
4510	6-9 Oth ADG Combs, Age <6, no Maj ADGs	$4,707	198	5.373	1.533	-3.840
4520	6-9 Oth ADG Combs, Age <6, 1+ Maj ADGs	$13,156	240	15.018	3.282	-11.736
4610	6-9 Oth ADG Combs, Age 6-16, no Maj AD	$3,684	385	4.205	1.341	-2.864
4620	6-9 Oth ADG Combs, Age 6-16, 1+ Maj AD	$6,359	299	7.259	4.014	-3.245
4710	6-9 Oth ADG Combs, M, Age 17-34, no Maj	$1,570	14	1.792	2.071	0.279
4720	6-9 Oth ADG Combs, M, Age 17-34, 1 Maj	$9,646	37	11.011	2.055	-8.956
4730	6-9 Oth ADG Combs, M, Age 17-34, 2+ Maj	$7,397	35	8.444	6.183	-2.261
4810	6-9 Oth ADG Combs, F, Age 17-34, no Maj	$2,617	235	2.987	1.607	-1.380
4820	6-9 Oth ADG Combs, F, Age 17-34, 1 Maj A	$3,519	393	4.017	2.437	-1.580
4830	6-9 Oth ADG Combs, F, Age 17-34, 2+ Maj	$6,145	202	7.015	5.446	-1.569
4910	6-9 Oth ADG Combs, Age >34, 0-1 Maj AD	$3,462	461	3.952	2.499	-1.453
4920	6-9 Oth ADG Combs, Age >34, 2 Maj ADGs	$5,227	196	5.967	5.781	-0.186
4930	6-9 Oth ADG Combs, Age >34, 3 Maj ADGs	$7,181	46	8.197	12.170	3.973
4940	6-9 Oth ADG Combs, Age >34, 4+ Maj AD	$7,208	10	8.228	20.349	12.121
5010	10+ Oth ADG Combs, Age 1-16, no Maj AD	$6,105	17	6.969	6.201	-0.768
5020	10+ Oth ADG Combs, Age 1-16, 1 Maj ADG	$12,936	33	14.767	5.270	-9.497
5030	10+ Oth ADG Combs, Age 1-16, 2+ Maj AD	$30,060	40	34.315	22.870	-11.445
5040	10+ Oth ADG Combs, Age >16, 0-1 Maj AD	$7,155	116	8.168	3.974	-4.194
5050	10+ Oth ADG Combs, Age >16, 2 Maj ADG	$11,218	105	12.806	6.456	-6.350
5060	10+ Oth ADG Combs, Age >16, 3 Maj ADG	$12,491	62	14.259	13.627	-0.632
5070	10+ Oth ADG Combs, Age >16, 4+ Maj AD	$18,365	33	20.965	27.833	6.868
5110	No Diagnosis or Only Unclassified Diagnosis	$552	8,859	0.630	0.137	-0.493
5200	Non-Users	$71	52,185	0.081	0.000	-0.081
5310	Infants: 0-5 ADGs, no major ADGs	$1,266	242	1.445	2.778	1.333
5320	Infants: 0-5 ADGs, 1+ major ADGs	$880	25	1.005	12.347	11.342
5330	Infants: 6+ ADGs, no major ADGs	$1,402	22	1.600	3.416	1.816
5340	Infants: 6+ ADGs, 1+ major ADGs	$1,484	14	1.694	14.794	13.100
9900	Missing Age	.	0	0.000	.	0.000
Total	Across all ACGs	$876	123,883	1.000		

* Weights for the large commercial group model HMO were taken from Table 3 in "Implementation Guide - The Johns Hopkins University ACG Case-Mix Adjustment System," Version 4.0, March, 1997.

** ACG Assignment Based on First Half FY 95 and Charge Calculation Based on Second Half FY 95.

State of Minnesota

Office Memorandum

To: Participants in DHS/MDH Risk Adjustment Database/Model Evaluation

From: Carole Aszmann (DHS) 215-0126

EMAIL: Carole.Aszmann@state.mn.us

Date: September 29, 1997

Re: Operational definition of pregnancies from the September 12, 1997 meeting with DHS staff

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DHS staff met on September 12th, 1997 to make a decision how to operationally define pregnancy/delivery related services so that they can be excluded from the charge measurement period risk models for the MA non-disabled population.

As a result of that meeting the following exclusions were identified for the charge measurement period:

1. All inpatient services associated with deliveries. Inpatient services shall be identified on the basis of the claim input form indicator = 'C' (inpatient), and the first and last date of service associated with that claim will define the inpatient stay period.

    1.1. The recipient age must be greater than 9 years.

    1.2. The diagnosis code must be equal to one of the following:

        1.2.1. 650 or 677

        1.2.2. 651.xy through 659.xy (where x = 0 through 9 and y = 0 through 2)

        1.2.3. 670.xy through 676.xy (where x = 0 through 9 and y = 0 through 2)

        1.2.4. V27.x (where x = 0 through 9)

2. CRNA and all other anesthesia services occurring during the delivery inpatient stay. The procedure code must be equal to any one of the following:

    2.1. 00100 through 01990

    2.2. 01999

    2.3. 10000 through 69999 with the modifier equal to one of the following; 47, AA, AB, AC, AD, AE, QJ, QK, QL, QO, QQ, QS, QX, QZ, Z2, Z3 or Z4

3. Radiology services occurring during the delivery inpatient stay. The procedure code must be equal to one of the following:

   3.1. 70000 through 79999

   3.2. Q0092

   3.3. R0070 through R0076

4. Pathology services occurring during the delivery inpatient stay. The procedure code must be equal to any one of the following:

   4.1. 36415

   4.2. 80000 through 89999

   4.3. 99000 through 99001

   4.4. 99195

   4.5. G0001

   4.6. G0026 through G0027

   4.7. G0050 through G0060

   4.8. P2031

   4.9. P3000 through P3001

   4.10. P9010 through P9024

   4.11. P9603 through P9615

   4.12. Q0091

   4.13. Q0095 through Q0102

   4.14. Q0111 through Q0116

   4.15. Q0126

   4.16. X5328

   4.17. Y8020 through Y9000

The excluded physician claims related to pregnancy/delivery are defined as meeting at least one of the following conditions:

1. Bundled procedure code of 59400, 59510, 59610 or 59618.

2. (Unbundled procedure code of 59409, 59410, 59514, 59515, 59612, 59614, 59620 or 59622) AND date of service within or equal to delivery inpatient stay.

3. (Procedure code of 59425, 59426 or 59430) AND date of service within the preceding 9 months of the delivery inpatient stay.

4. Diagnosis code in the range of V22 through V24.2 AND date of service within the preceding 9 months of the delivery inpatient stay AND a procedure code in one of the following ranges:

   4.1. 99201 through 99215

   4.2. 99221 through 99233

   4.3. 99241 through 99245

   4.4. 99301 through 99353

APPENDIX B

RISK ADJUSTED RATE SETTING FOR MEDICAID NON-DISABLED:

INSTRUCTIONS FOR DATABASE DEVELOPMENT AND IMPLEMENTATION

Introduction

The following are instructions for and a demonstration of the application of a risk adjusted method of calculating capitation rates for persons enrolled in non-disabled Medical Assistance (MA) programs. This rate setting method is based on an individualized (vs. group) method of setting rates (i.e., a monthly capitation rate will be set for each MA eligible person rather than for groups of eligible persons with similar characteristics). The method requires: (1) a small set of person level input data extracted from a larger database of individuals enrolled in non-disabled MA programs; and (2) the application of the optimal risk adjustment model for this population.

Input Database

The person level data necessary to calculate capitation rates using the proposed model is a database containing one record per person in which the data elements are the classification of each individual into one of four possible age categories, two gender categories, and values for thirty-two (32) health status classification variables known as Ambulatory Diagnostic Groups (ADG's). For each eligible individual, age and gender information from the Minnesota Department of Human Services (DHS) eligibility records are used to create the relevant age and gender classifications. In addition, the values for the health status variables, ADG's, must be generated by executing the Ambulatory Care Groups (ACG) classification software.[i]
The ACG software classifies the unique ICD-9-CM[ii] diagnosis codes assigned to individuals over a given period of time by health providers and available on health care claim/encounter forms into one or more of thirty-two (32) possible ADG categories[1].

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[1]Thirty-four categories are actually created but ADG 15 and ADG 19 are not useful in the development of the model or capitated payments as they are constants (i.e., no

The individual's ADG classification pattern is then combined with age and gender information to re-classify individuals into one and only one of 94 possible ACG categories[2]. It is important to note that an individual can be classified into one or more ADG category (i.e., the classification is not mutually exclusive), whereas he/she is only assigned one ACG value.

The developers of ACGs recommend that users employ either the 94 mutually exclusive variables created from the ACG software (using reference category ACG 5200: non users), or the thirty-two (32) non-mutually exclusive binary variables created as part of the calculation of ACG values. Due largely to its superior predictive accuracy over other tested models, we are recommending and will illustrate the use of ADG's throughout this document.

The ACG software requires the user to develop two input data files. The first of these files is a demographic file which contains three elements including (1) an identification number for each individual with a valid period of eligibility, (2) that person's age, and (3) that person's gender. The second data file contains the diagnosis information and must include (1) an identification number on every record for each individual with a health care claim/encounter that matches the identification number for the same individual in the demographic file and (2) all the ICD-9-CM diagnosis codes on every claim/encounter record attributable to the individual.[3] The diagnosis input data file can include more than one record per person, reflecting that fact that individuals often have more than one health care encounter or claim over a given period of time (e.g., a year or six months). Accordingly, the ACG software can accommodate as many diagnoses records for each individual as are provided on that individual's collective health claim/encounter forms over a given period of time.

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variation).

[2]Our ACG model only contains 82 ACG variables because we are proposing a model which does not distinguish among pregnancies of differing delivery status, or infants of varying birth weight.

[3] There are nine (9) places on a UB-92 claims form reserved for ICD-9 values. ACG software can accept more or less than nine (9) diagnoses on every record but due to the limitation of space on the UB-92, the maximum number of diagnoses on any given claim form is usually nine (9). If the claim is submitted on a HCFA-1500 form there are a maximum of four (4) diagnosis recorded.

From those data files, ACG software produces a database of ADG variables which, when combined with age and gender information, can be used in the calculation of capitated health care payments. The format of this database needed to calculate payment rates is shown for five people who were MA non-disabled recipients in FY95 in Table 1. These five individuals represent a small and non-representative sample of the 84,069 individuals that comprised the population used to develop (estimate) the optimal risk model[4], but were selected and reproduced here to illustrate required database specifications and a rate setting methodology.

Table 1

Example Database for Calculating ACG/ADG-Based Rates for Medicaid Non-Disabled Population

Demographic Information*

Person ID	AGE 0-1	AGE 2-15	AGE 16-49	FEMALE
1	0	0	1	1
2	0	0	1	1
3	0	1	0	1
4	0	0	1	1
5	0	0	1	0

*Note that the variables AGE 50+ and Male are not included and serve as reference categories in the model (see page 10 & 11 for more information).

ADG Information

Person ID	ADG01	ADG02	ADG03	ADG04	ADG05	ADG06
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	1	0	0	0	0	0
5	1	0	0	0	0	0
Person ID	ADG07	ADG08	ADG09	ADG10	ADG11	ADG12
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0

[4] Specifically, these rates are based on a model developed from a population of persons who were: (1) continuously eligible for Medical Assistance during FY 1995, (2) not eligible for Medicare during FY 1995, (3) not on spend down status at any time during FY 1995 and (4) not living in an institutional setting in FY95.

Table 1- con't

Example Database for Calculating ACG/ADG-Based Rates for Medicaid Non-Disabled Population

ADG Information- con't

Person ID	ADG13	ADG14	ADG15	ADG16	ADG17	ADG18
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
Person ID	ADG19	ADG20	ADG21	ADG22	ADG23	ADG24
1	0	0	0	0	0	0
2	0	1	0	1	0	0
3	0	0	0	0	0	0
4	0	1	0	0	0	0
5	0	1	0	0	0	0

Person ID	ADG25	ADG26	ADG27	ADG28	ADG29	ADG30
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	1	1	0	1	0
5	0	0	0	0	0	0

Person ID	ADG31	ADG32	ADG33	ADG34
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	1	0	0	0
5	0	0	0	0

Note: See Table 3 for descriptions of Demographic & ADG category variables.

Model Estimation and Rate Calculation

In Table 2 we demonstrate the calculation of rates for the same five individuals shown in Table 1. This example not only shows the development of rates by adjusting payment to reflect health risk, but also includes an adjustment based on a hypothetical payment policy decision concerning regional adjustment[5]. Accordingly, you must assume that the five individuals constitute the MA non-disabled population in some local area of the state. The model on which the calculations are based uses FY 1995 diagnosis classifications and health care charge data for the estimation population to develop the optimal risk adjustment model for the MA non-disabled population (as discussed in the main report).

The risk adjustment model proposed here for calculating capitation rates for Minnesota's prepaid public health care programs is a ***square root model***[iii]. The model is based on the ADG classifications in which the square root of total health care charges observed over some period of time (in this case the second half of FY95) are regressed on the linear additive combination of demographic (age and gender) and ADG classification variables observed over some prior period (in this case the first half of FY95) to predict the square root of future health care charges.[6] These results are then converted back into the original dollar scale, which become the basis for risk adjusted capitation rates.

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[5] It is important to note, that this same method used to adjust for region, could also be used to make payment adjustments for a variety of policy decisions in addition to or in place of a regional adjustment. Regional adjustment was merely the policy decision selected to illustrate the method.

[6] The model proposed here calculates rates based on the fee-for-service (FFS) diagnosis and health care charges of a population of persons enrolled in MA in FY 1995. The model is developed using multiple regression analysis, which is a statistical method that analyzes relationships among two or more variables. More specifically, regression analysis is a statistical method that seeks to explain variation in a dependent variables (in this case second half of FY 1995 total allowable medical charges) by using information about a set of independent variables (in this case age, gender, and prior diagnoses). The results are used to predict the future health care charges for each person, based on their individual configuration of age, gender, and diagnosis classifications.

Table 2

Example Calculations for Setting ADG-Based Rates for Medical Assistance Non-Disabled Individuals

	a	b	c	d	e
	Actual Local PEPM Charges	Predicted Local Charges 2nd Half FY 1995 (6 mos)	Predicted Local PEPM Charges (col b / 6)	Individual Risk Weight	Normalized Local PEPM Rates
Person ID					
1	$25.01	$432.83	$72.14	0.409	$60.07
2	$290.35	$714.39	$119.07	0.675	$99.15
3	$13.67	$358.87	$59.81	0.339	$49.81
4	$91.73	$1,822.26	$303.71	1.721	$252.92
5	$129.23	$634.26	$105.71	0.599	$88.03
Mean	$110.00	$792.52	$132.09	0.749	$110.00
Total	$549.99	$3,962.61	$660.44		$549.99
Mean Predicted PEPM MN Charge	$176.45 N=84,069				

Notes:

1. Column a, are the actual per enrollee per month (PEPM) charges for each individual observed in our data observed over a 6 month period (second half of FY 95).
2. Column b, are the individual predicted total 6 month charges from the individual prediction examples on pages 9 - 17. Column c is this value expressed as a monthly prediction (col b /6).
3. Column d, individual risk weights calculated by the ratio of each individual's local predicted PEPM charge (col c) to the statewide mean of predicted PEPM Charges (i.e., col c / $176.45).
4. Risk index for local area is the mean of the local individual risk weights (mean of column d) which is 0.749 and serves as the case mix index for the local area.
5. Local area Conversion Factor (CF) = statewide PEPM target amount (i.e., in this case the mean local PEPM charges) / case mix index for local area. CF for this local area = $110.00 / 0.749 or $146.86
6. Normalized individual rates (column) are a product of the CF and the individual risk weight.

This means that, from among the models we considered, the square root model is least likely to produce incentives for risk selection (i.e., prediction errors across the non-random groups are not uniformly different).

In addition, this method of rate setting also enables risk adjusted rates to be further modified ***based on explicit payment policy decisions independent of health risk*** (e.g., trending, legislatively mandated adjustments, etc.). These additional modifications are achieved by multiplying a ***Conversion Factor (CF)*** by the relative risk weights for each person to set rates for each individual in a given program population.

Table 2 represents the calculation of a normalized payment rate for the five individual examples used throughout this appendix. The values in column a, are the ***actual*** per eligible per month (PEPM) allowed charges for each individual observed in the data observed over the six month period of the last half of FY95.[7] The values in column b, are the individual ***predicted*** total six month charges calculated by using the individual charge prediction equation for which examples and discussion are provided on pages 9-17. Column c is this same value expressed as a monthly prediction rather than a six month prediction (i.e., col b / 6). The result in column c, is the predicted PEPM for each individual.

The risk weight for each person (column d) is the ratio of the predicted PEPM charge to the predicted monthly average PEPM charge across the entire model estimation population (i.e., statewide) of 84,069 non-disabled MA enrollees (i.e., col c / $176.45). An aggregate case-mix index for this area is then calculated by taking the average of these five local risk weights (i.e., 0.749). This reflects that, in the aggregate, the risk of future payments for this region is about 25 percent lower than the statewide average. Using this case mix index, a local area ***conversion factor*** (CF) can be created by dividing the PEPM target amount (i.e., in this example the mean local PEPM charges) by the case mix index for local area. CF for this local area = $110.00 / 0.749 or $146.86. **The purpose of establishing a distinct CF_r for each region (r) is to ensure that plans serving a region get rates commensurate with their aggregate risk in the region, while holding aggregate payments in each region constant.**[8] These aggregate payment amounts for each region are determined by payment policy decisions, and are not subject to risk adjustment. Therefore, the risk adjustment model as implemented in this rate calculation method is not used to differentiate regional differences in risk.

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[7] Total eligible billed charges over the six month period divided by six (6).

[8] Aggregate payments in each region are held constant by matching a selected PEPM target amount derived from total payments and numbers of eligible individuals in each region, which is data that is typically taken from prior eligibility and fee-for-service databases administered by DHS.

The "Normalized PEPM Local Rates" for each individual in the local region, (column e), are calculated by simply multiplying the CF by the individual risk weight for each person.

Calculation of the Individual Predicted Charges for Use in Rate Calculation

All thirty-two (32) ADG variables along with the specific age and gender categories constitute the risk factors used to estimate the square root of predicted charges.[iv] The nature of the process by which the results of this square root model are used to calculate rates theoretically creates weights that reflect both (a) the independent effect of each risk factor, and (b) the (interaction) effects of the occurrence of each risk factor with every other risk factor (i.e., the effects of multiple medical conditions). While this feature of the model is attractive from the standpoint that it accounts for some of the clinical complexities of the occurrence of multiple clinical conditions, (the unique contribution of multiple conditions to the risk of future utilization), it means that it becomes impractical to attempt to estimate relative risk weights in dollar units attributable to each individual risk factor. Therefore, *this rate calculation method consists of a formula/equation which calculates a predicted annual charge amount* ***for each individual*** based on each individual's values on the demographic and ADG variables, and the weights assigned to each of those on the square root scale as shown in example equation 1.

Example Equation 1.

$$\textit{Individual Predicted Charges (6 Months)}_{IPChg6M} = (3.85533 + \Sigma(\beta_k * X_{ki}))^2 + \hat{\epsilon}_i^2$$

where:

β_k = *weight assigned variable k*

X_{ki} = *value of variable k for individual i*

$\hat{\epsilon}_i^2$ = *individual prediction error*

More specifically, the weights (β_k) are the regression coefficients from the model for which the dependent variable is the square root of all allowable medical charges from the 2nd half of FY 1995 (a six month period from January 1/95 through June 30/95). The independent variables used in the equation, their estimated weights, and variable names, descriptions, and valid values are shown in Table 3. The weights reflect the change in the square root of charges that can be attributed to (1) whether or not the individual has been assigned to each ADG category, and (2) the age and gender of the enrollee.[9] The constant of 3.85533 reflects the baseline risk (on the square root scale) of the individuals representing the lowest cost reference group (e.g., males who are 50 years of age or older

[9]A value of '1' indicates the individual has been assigned to a particular ADG, age, or gender category whereas a value of '0' indicates the individual has not.

with no ADG classification assignment) against which the effects of all other risk factors are compared in estimating the model. This constant is added to the sum of the products of each risk factor weight and the binary (0,1) value for each variable ($\Sigma\beta_k * X_{ki}$), and then squared. This result is then added to the individual prediction error formula to complete the calculation of the predicted six month total charges for each person (Table 2, col b). Please see end note iv for more specific breakdown of the model and prediction equation.

Table 3

Description and Weights of Variables in the Model

Variable	Description	Possible values (X)	Weight (β)
Demographic			
AGE0_1	Age is less than or equal to 1 years.	Binary (0,1)	10.627608
AGE2_15	Age is between 2 and 15 years	Binary (0,1)	6.771324
AGE16_49	Age is between 16 and 49 years.	Binary (0,1)	8.855728
AGE50+	Age is greater or equal to 50 years.	reference group	NA
MALE	Sex of enrollee is male	reference group	NA
FEMALE	Sex of enrollee is female.	Binary (0,1)	.106942
ADG Classification			
ADG01	Time Limited:Minor	Binary (0,1)	2.617597
ADG02	Time Limited: Minor-Primary Infections	Binary (0,1)	3.947499
ADG03	Time Limited: Major	Binary (0,1)	4.552992
ADG04	Time Limited: Major-Primary Infections	Binary (0,1)	2.601157
ADG05	Allergies	Binary (0,1)	1.697144
ADG06	Asthma	Binary (0,1)	4.933944
ADG07	Likely to Recur: Discrete	Binary (0,1)	4.7668
ADG08	Likely to Recur: Discrete-Infections	Binary (0,1)	3.748031
ADG Classification			
ADG09	Likely to Recur: Progressive	Binary (0,1)	13.433895
ADG10	Chronic Medical: Stable	Binary (0,1)	7.088884
ADG11	Chronic Medical: Unstable	Binary (0,1)	14.134304
ADG12	Chronic Specialty: Stable-Orthopedic	Binary (0,1)	6.317461

Variable	Description	Possible values (X)	Weight (β)
ADG13	Chronic Specialty: Stable-Ear, Nose,Throat	Binary (0,1)	4.822435
ADG14	Chronic Specialty: Stable-Eye	Binary (0,1)	2.332499
ADG16	Chronic Specialty: Unstable-Orthopedic	Binary (0,1)	8.983414
ADG17	Chronic Specialty: Unstable-Ear, Nose,Throat	Binary (0,1)	7.892253
ADG18	Chronic Specialty: Unstable-Eye	Binary (0,1)	6.929755
ADG20	Dermatologic	Binary (0,1)	1.831502
ADG21	Injuries/Adverse Effects: Minor	Binary (0,1)	3.215825
ADG22	Injuries/Adverse Effects: Major	Binary (0,1)	3.937134
ADG23	Psychosocial: Time Limited, Not Severe	Binary (0,1)	7.939290
ADG24	Psychosocial: Persistent/Recurrent, Stable	Binary (0,1)	12.268425
ADG25	Psychosocial: Persistent/Recurrent, Unstable	Binary (0,1)	15.193615
ADG26	Signs/Symptoms: Minor	Binary (0,1)	2.910425
ADG27	Signs/Symptoms: Uncertain	Binary (0,1)	4.239802
ADG28	Signs/Symptoms: Major	Binary (0,1)	5.754097
ADG29	Discretionary	Binary (0,1)	5.195475
ADG30	See and Reassure	Binary (0,1)	2.112040
ADG31	Prevention/Administrative	Binary (0,1)	2.546723
ADG32	Malignancy	Binary (0,1)	25.973881
ADG33	Pregnancy	Binary (0,1)	7.709001
ADG34	Dental	Binary (0,1)	6.083961
CONSTANT			3.855333

Individual Examples of Predicted Charge Calculations

Table 1 (page 4) illustrates one possible spreadsheet that can be used to calculate capitated payments based on the new payment system. Other purchasing entities may want to organize and process their data differently to perform similar calculations (e.g., create an database of similar records for each eligible or enrolled individual). In other words, what is offered here is just a spreadsheet representation of the example calculations that one would need to reproduce for each eligible (enrolled) individual for whom DHS (or other purchasing entity) may wish to calculate a rate.

There are five example cases in the spreadsheet with their demographic and ADG information on pages 4 and 5. The variable names are the same as those in Table 3.

The characteristics of the first case/individual are summarized in the table below.

Case #1 information	Corresponding variable values (X)
Demographics	
Female	FEMALE=1
Age	AGE16_49=1
ADG Categories	
None	

To obtain the Individual Predicted Charges for the last 6 Months of FY95 for this individual (IPChg6M), the variables given above along with there corresponding weights (from Table 3) need to be inputted into example equation 1. Since for many individuals (including this one) many ADG risk factors do not occur, so the value of those variables = 0, and the equation simplifies to:

$IPChg6M_i = (3.855333 + .106942 * FEMALE + 8.855728 * AGE16\_49)^2 +$ prediction error formula

Substituting values for this case yields,

$IPChg6M_i = (12.818003)^2 + (211.418571 + (-4.473295 * 12.818) + (.696612 * 164.30))$
$= 164.30 + 268.53$
$=$ \$432.83 (See Table 2, col b, Person ID 1)

The characteristics of the second case/individual from table 1 are summarized from in the table below.

Case #2 information	Corresponding variable values (X)
Demographics	
Female	FEMALE = 1
Age	AGE16_49 = 1
ADG Categories	
Dermatologic	ADG20 = 1
Injuries Adverse Effects	ADG22 = 1

To obtain the predicted 6 month (second half of FY95) charges for this individual (IPChg6M), we again use example equation 1 and substitute the appropriate variable values and weights.

$IPChg6M_2$ = (3.855333 + .106942 * FEMALE + 8.855728 * AGE16_49 + 1.831502 * ADG20 + 3.937134 * ADG22)^2 + prediction error formula
= 345.46 + (211.418571 + (-4.473295 * 18.5864) + (.696612 * 345.46))
= 345.46 + 368.93
= $ 714.39 (see Table 2, col b, Person ID 2)

The third case (like the first) contains no diagnosis, so the predicted annual payment depends on only demographic characteristics. The risk factors for this individual are summarized below.

Case #3 information	Corresponding variable values (X)
Demographics	
Female	FEMALE = 1
Age	AGE2_15 = 1
ADG Categories	
None	

The predicted 6 month charge for individual 3 is calculated to be the following.

$IPChg6M_3$ = (3.855333 + .106942 * FEMALE + 6.771324 * AGE 2_15)^2 + prediction error

formula

= 115.21 + (211.418571 + (-4.473295 * 10.73360) + (.696612 * 115.21))
= 115.21 + 243.66
= $358.87 (see Table 2, col b, Person ID 3)

The fourth case/individual has a somewhat more complicated medical history. Her summary information from table 1 is presented in the following table.

Case #4 information	Corresponding variable values (X)
Demographics	
Female	FEMALE = 1
Age	AGE16_49 = 1
ADG Categories	
Time Limited Minor	ADG01 = 1
Dermatologic	ADG20 = 1
Signs/Symptoms: Minor	ADG26 = 1
Signs/Symptoms: Uncertain	ADG27 = 1
Discretionary	ADG29 = 1
Prevention/Administrative	ADG31 = 1

To obtain the predicted 6 month (second half of FY95) charges for this individual (IPChg6M), we substitute the appropriate variable values and weights into our prediction equation.

$$\begin{aligned} IPChg6M_4 &= (3.855333 + .106942 * FEMALE + 8.855728 * AGE16\_49 + \\ &\quad 2.617597 * ADG01 + 1.831502 * ADG20 + 2.910425 * ADG26 + \\ &\quad 4.239802 * ADG27 + 5.195475 * ADG29 + 2.546723 * ADG31)^2 + \text{prediction error formula} \\ &= 1034.24 + (211.418571 + (-4.473295 * 32.15953) + (.696612 * 1034.24)) \\ &= 1034.24 + 788.02 \\ &= \$1,822.26 \text{ (see Table 2, col b, Person ID 4)} \end{aligned}$$

The fifth and final case in our example data is a male (reference category) between 16 and 49 with only two ADG classifications (ADG01 & ADG20). The information for this individual from table 1 is summarized in the following table.

Case #5 information	Corresponding variable values (X)
Demographics	
Age	AGE16_49 = 1
ADG Categories	
Time Limited: Minor	ADG01 = 1
Dermatologic	ADG20 = 1

By substituting the weights from Table 3 according to this person's age, gender and ADG classification history into the prediction equation, the predicted six month charges for this person are:

$IPChg6M_5$ = (3.855333 + 8.855728 * AGE16_49 + 2.617597 * ADG01 + 1.831502 * ADG20)^2

+ prediction error formula

= 294.47 + (211.418571 + (-4.473295 * 17.16016) + (.696612 * 294.47))

= 294.47 + 339.79

= $634.26 (see Table 2, col b, Person ID 5)

End Notes

i. Weiner, J., Dobson, A., Maxwell, S.L., Coleman, K., Starfield, B., and Anderson, G.F., "Risk-Adjusted Medicare Capitation Rates Using Ambulatory and Inpatient Diagnoses," Health Care Financing Review, Vol. 17, No. 3, Spring, 1996.

ii. International Classification of Diagnoses, 9th Revision, Clinical Modification

iii. Our thanks to Willard Manning Ph.D. and Mike Finch Ph.D. of the Health Services Research and Policy division of the University of Minnesota for their participation in the creation and refinement of the square root model .

iv. The square root model takes the following form:

$$\sqrt{Y_i} = \alpha + \chi_{ki} * \beta_k + \epsilon_i, \qquad \text{where } i = 1, ..., N. \quad \text{and } k = 1, ..., K \qquad (A)$$

In equation (A), i indicates each individual who is part of the population of individuals (N) eligible for PMAP participation in the state; k represents each variable or risk factor in the model; β is a vector of 36 parameters or risk weights to be estimated, one for each risk factor in the model (i.e., 32 ADG classification variables and 4 demographic variables); χ_{ki} is a vector of 36 binary values (0 or 1) for the independent variables for each individual observed during the first half of FY 1995; and $\sqrt{Y_i}$ is the square root of total charges for the second half of FY 1995.

To calculate rates using this model would require the development of a database that contains the a matrix of n * k values for the independent variables, representing each individual's value on each risk factor in the eligible population over a six month period (Similar to the matrix of data presented in Table 1).

Then, this data is used to calculate predicted total charges on the square root scale in the subsequent six months. In our example, the square root of charges is predicted by regressing observed charges in the last half of FY95 on the 36 risk factors from the first half of FY95.

The predicted square root of charges are then retransformed back into the untransformed total charge dollars, for each individual, according to the following formula:

$$E(\hat{y}_i / \chi_{ki}) = \left[\alpha + \sum_{j=1}^{k} \chi_{ki} \hat{\beta}_k \right]^2 + \hat{\epsilon}_i^2 \qquad (B)$$

where:

$E(\hat{y}_i / \chi_{ki})$ = *Expected value of individual charges given the values on k variables*

α = *constant value representing the baseline value*

X_{ki} = *value of variable k for individual i*

β_k = *weight assigned k variables*

$\hat{\epsilon}_i^2$ = *individual prediction error formula*

The "individual prediction error formula" (shown below) is calculated from the coefficients and a constant from a regression equation (α) in which the variance of the prediction errors on the square root scale is regressed on both the predicted square root of charges *and* the square of the predicted square root of charges (i.e., a quadratic function of the predicted square root of charges) as indicated in equation C below. This means that the predicted charge for each individual is augmented at an accelerating rate as the predicted charges from the original risk assessment model increase.

$$\hat{\epsilon}^2 = \alpha + \beta_1 \hat{y}_i + \beta_2 \hat{y}_i^2 \qquad (C)$$

Specifically, the individual prediction error formula (C) is comprised of three terms:

α	is the constant from the prediction error variance regression equation
$\beta_1 \hat{y}_i$	is the predicted square root of charges for each individual multiplied by its regression coefficient
$\beta_2 \hat{y}^2_i$	is the square of the predicted square root of charges for each individual multiplied by its regression coefficient

Therefore, by re-examining equation (B), the predicted charges on the untransformed scale for any individual - $\hat{y}_i$ - given the vector of 36 independent variables (k) is given by the sum of: (1) the square of the predicted square root of total charges (i.e., the square of the sum of α and ($\chi_{ki} * \beta_k$) from (A)), and (2) an additional amount that is a non-linear accelerating function of the degree to which the variance of the prediction error increases as predicted charges from A increase (i.e., from equation (C)).

APPENDIX C

RISK ADJUSTED PREPAID MANAGED CARE RATE SETTING IMPLEMENTATION AND ANALYSIS ISSUE DEFINITIONS

WORKING DOCUMENT, JANUARY, 1998

Purpose

In preparation for implementation of risk adjustment payments, Minnesota Department of Health (MDH) and Department of Human Services (DHS) staff met on May 8, 1997, and May 15, 1997, to outline issues relating to risk adjustment, rate-setting, and the interface between them. The purpose of these meetings was to develop a consensus on identifying the issue, assigning agency responsibility, and either resolve immediately or decide on a time table to resolve. The issues listed below were discussed at the Public Programs Risk Adjustment Work Group (PPRAWG) meetings, to allow for stakeholder input. These issues were ones identified by staff and/or members of the PPRAWG. The discussion below is intended to briefly summarize the issue and outline the resolution or plan for resolution.

Regional Adjustment Factor

Issue: Once risk adjustment is implemented, will there still be a need for regional differences in the rates between Hennepin County, other metro and non-metro? Are there specific policy issues (i.e., negotiated rate differentials) that can be significantly informed by the risk assessment process? DHS/MDH responsibility.

Status of Resolution: DHS staff presented an example Prepaid Medical Assistance Program (PMAP) rate calculation spreadsheet. Staff reviewed the part of the rate setting process reflected in the spreadsheet, and made a number of points relevant the relationships between "risk adjustment" and payment policy making. First, it was emphasized that they define the standardization or normalization of rates to be the process of converting risk adjusted rates into "budget neutral rates" for which the "budget" is defined as the total statewide fee-for-service (FFS) payments (i.e., across all rate cells) through the use of a "conversion factor." It was also pointed out that after rates are so normalized, other payment policy decisions are implemented (e.g., adjusting the conversion factors by region so that rural rates are at least 85 percent of Twin City rates). It was emphasized that the role of risk adjustment is to provide the "Risk-Adjusted Rate Relationship(s)", and once the "standardization" step is performed, it is the role of DHS to establish the payment policy decisions that will be implemented.

Group vs. Individual Payment

Issue: Whether or not to pay plans a monthly capitation rate for each individual based on the predicted charges for each individual enrollee, or pay plans an aggregated rate for all enrollees in each possible rate cell. This is not a substantive difference, as the aggregated rate could be an averaging of the health plan's individual rates. There was discussion that since risk adjustment is intended to better reflect differences in risk among enrollees, payment at the aggregate level would obscure the differences across patients.

Status of Resolution: Pay plans a rate for each individual.

External Weights to Validate Minnesota Weights

Issue: Obtaining weights for risk adjusted payment systems in other states, or weights obtained through other risk adjustment health services research and compare with weights produced by MDH analysis for a comparative reliability check. MDH/DHS responsibility.

Status of Resolution: (1) obtain Ambulatory Care Group (ACG) weights from other sources (e.g., Maryland and Washington State Medicaid weights, MedCenters, Buyers Health Care Action Group (BHCAG), Blue Cross commercial) for comparison to MN weights; (2) obtain Metropolitan Health Plan (MHP) and other inpatient encounter data in the form of diagnoses and demographic ASCII files needed as input files by ACG grouper.

Other Factors

Issue: Examine the significance of incremental predictive accuracy gained or lost by including demographic, social and individual risk variables other than age, gender and eligibility type in diagnosis-based risk models. These factors will also be evaluated for their utility as risk adjusters for beneficiaries with no prior claims history.

Status of Resolution: We are examining a set of other factors that is available in the Maxis (enrollment) data files for possible inclusion in the first implementation round. Other factors will be studied later, for possible inclusion in later years.

Communications on Payment/Risk Adjustment Systems to Stakeholders

Issue: Can we coordinate communication/discussion with stakeholders on risk adjustment and rate setting issues ?

Status of Resolution: DHS rate setting staff agreed to include relevant payment policy issues on upcoming PPRAWG meeting agendas as a forum for public consideration. In addition, at the conclusion of the 1997 session, the legislature directed that MDH and DHS prepare a joint report on risk adjustment and rate setting and hold a hearing on this prior to session. MDH and DHS

staff worked together to prepare the report, and the PPRAWG participated in reviewing and commenting on the report. The public hearing was held on December 17, 1997, at the Capitol View Conference Center.
Although the hearing was scheduled for 2:00 p.m. to 5:00 p.m., since only one individual desired to testify, it ended at about 2:30 p.m. (See Appendix F).

Risk Weights/Model

Issue: The models for each program need to be developed and provided to plans in conjunction with plan negotiations. It is MDH's responsibility to develop the weights/model. When do/does the weights/model need to be made available in order to be used in the negotiation process?

Status of Resolution: The final weights/model should be available to plans at least six months prior to their implementation. This balances the need to have the weights/model in advance, and still allows that the data used to set/specify the weights/model are not too far removed from the time in which they will be used.

Children vs. Adults

Issue: Stakeholders have been raising the prospect of separate models. Where has this been coming from? Do we want to differentiate? This is a DHS/MDH responsibility.

Status of Resolution: ACGs accommodates this, therefore, no need to use separate models for PMAP. Since ACG 4.0 differentiates into specific ACGs on the basis of age categories or ADG models include explicit age categories, separate models for children vs. adults are not planned at this time.

Ambulatory Diagnosis Groups (ADGs) vs. ACGs vs. Risk Adjusted Categories (RACs)

Issue: Will the rate setting system be based on a "mutually exclusive" rate cell like model or an individual "multiple condition" model from which an individualized rate for each enrollee can be calculated? This is a DHS/MDH responsibility.

We will compare on explicit criteria (e.g., predictive accuracy, stakeholder acceptability). Partly, this is a false distinction, because even an individualized multiple condition model could be differentiated into rate cells, but as the number of possible diagnosis categories increases, the number of rate cells increases exponentially to the point where it can become unmanageable.

Status of Resolution: Since the relative merits of these options are driven substantially by the relative aggregate predictive accuracy of these options, it was decided to postpone this decision pending the findings from the evaluations of these options with respect to aggregate predictive accuracy and other specified criteria.

Acute vs. Long Term Care (LTC) in Risk Adjustment

Issue: How do we want to differentiate and handle LTC, by sub-population or services (i.e., living in institutional setting (y/n) and/or LTC services (y/n))? Should the answer to this question be under PMAP or the Demonstration Projects for People with Disabilities ?

Status of Resolution (12/11/97): DHS has recommended that the application of the payment system developed for the Minnesota Senior Health Options (MSHO) project to the mandated PMAP expansion to include long term care coverage for people aged 65 and older. In practice, this coverage will include all services currently provided under the Elderly Waiver program, as well as 365 days of nursing facility liability. The basic design of the MSHO payment system distinguishes people who:

- Reside in a nursing facility at the time of enrollment (no nursing facility liability for the managing entity and PMAP/Institutional + Other Demographic rate);
- Have resided in a nursing facility for at least six months but the plan of care is to move them back to a community setting with alternative services (PMAP/Institutional + Other Demographics and 2X the "Nursing Facility Certifiable" payment established for the project); payment to continue for one year from the point of return to community;
- Reside in the community but are assessed through Preadmission Screening and determined to be "at risk" of nursing or boarding care facility admission (PMAP/Community + Other Demographics and 1X the "Nursing Facility Certifiable" payment established for the project); and
- Reside in the community (PMAP/Community + Other Demographics and Nursing Facility Liability payment).

The MSHO project also includes a Medicare rate prepaid to the health plan in addition to the prepaid Medical Assistance capitation. This prepayment of Medicare is part of the federal waiver approving the MSHO project. This Medicare capitation is not available to persons not enrolled in the MSHO project but the other payment system features are anticipated to work well for the expansion of long term care coverage under PMAP.

It has long been maintained that while diagnosis can markedly improve the predictability of health care cost differences in acute care, diagnoses are not as useful when applied to long term care costs. The payment system described above relies on the assessment of functional limitation rather than diagnoses to determine the likelihood of need for long term care services. It is currently used by several health plans who are participating in the project, and is based on an assessment process and tool utilized statewide by county preadmission screeners to

recommend nursing facility admission as well as determine eligibility for community-based alternatives to nursing facility admission. Furthermore, functional assessment information is entered into the data system where it is available for use in payment rate assignment, as well as for future analysis. The extension of this payment method to the expansion of PMAP presents an opportunity to examine the usefulness of functional assessment information for payment purposes for a larger population that expected to become enrolled in the MSHO project, and could be examined in addition to diagnostic information about people over time, perhaps improving the predictive performance of either method alone.

Births/Pregnancies

Issue: How will payment be determined? This is a DHS/MDH responsibility.

ACG 4.0 accommodates infants by creating Major Ambulatory Category (MAC) 26 from recipients with date of birth within the risk assessment period which is further subdivided by number of major ADGs and then (at users discretion) by whether or not birth weight is less than 2500 grams. ACG 4.0 defines pregnancies on basis of explicit pregnancy evident ICD-9s as ADG 33 which becomes MAC 12. MAC 12 is further subdivided on basis of total number of ADGs, presence of major ADGs, and whether or not delivery occurred within assessment period.

Status of Resolution: Exclude the inpatient charges associated with deliveries and all non-Obstetric (OB) MD professional services that occurred during the inpatient delivery stay. OB MD services related to the pregnancy will be excluded from the charge measurement process. Deliveries would be paid separately.

Conversion factor

Issue: What policy issues will be external to the risk adjustment process on which adjustments to aggregate rates and/or total PMAP budget will be based (e.g., percent discount, Medical Education and Research Costs (MERC), Disproportionate Share Adjustment (DPA), benefit package, e.g., LTC)? This is a DHS responsibility.

Rates for new enrollees

Issues: What to pay plans for new enrollees and how long to wait before risk adjusting plans for new members with no encounters? Should initial payment be the "well cell" or an average payment based on age and gender? What is sufficient time for plans to submit a patient history that can be used for risk adjustment? This is a DHS/MDH responsibility.

Status of Resolution: We are considering paying an average rate for new enrollees until there is a diagnosis, or until the enrollee has been enrolled for six months.

Billed Charges vs. Alternative Measures of Resources Use

Issue: Evaluate the utility of employing standardized alternative measures of resource use in risk adjustment models to: 1) assess the level of "noise" in the models due to local provider pricing strategies and reimbursement policy; 2) and as a proxy for charges if and when health plan encounter records no longer contain charge elements. This is a DHS/MDH responsibility.

Status of Resolution: MDH has obtained Relative Value Units (RVU's) as well as Diagnosis Resource Groups (DRGs) and Ambulatory Patient Groups (APGs) and begun the process of evaluating the differences between using charges and using RVUs/DRGs/APGs as the measure of expenditure. Currently, DHS is not requiring plans to provide charges in the encounter data. And, although some health plans have indicated that they could provide charge data, others have expressed concern about inter-provider differences in charges for the same services.

Frequency of Recalibrating Weights

Issue: How often should risk adjustment weights/models be recalibrated to reflect changes in costs due to changes in technology and treatment methods; quarterly, bi-annually, annually? Since initial weights will be developed with FFS data, recalibration will be needed as soon as sufficient PMAP encounter data becomes available, but how frequently thereafter? This is a MDH responsibility.

Status of Resolution: Past discussions indicate that we will likely recalibrate weights/models annually, at least in the first few years, as we make improvements to the models, and as different populations move into PMAP.

Frequency of Rate Cell/Risk Factor Assessment

Issue: How often DHS will assign people to specific risk adjustment categories; monthly, quarterly, bi-annually ? Information requirements (i.e., quickly available diagnoses and procedure codes) are more demanding with shorter assignment periods. This is a DHS responsibility.

Status of Resolution: DHS has indicated that data will be available on a monthly basis for reassessing rate cell/risk factor assignment. Others indicate that monthly re-assessment may be too frequent, and may not be practical. The group did not come to a firm decision on this, but consensus seemed to be that quarterly may be more practical and desirable.

APPENDIX D

RISK-ADJUSTING MEDICAL ASSISTANCE

CAPITATION PAYMENTS: PREDICTORS OF MEDICAL SERVICE

USE OTHER THAN PRIOR DIAGNOSIS

Policy Background and Problem Statement

Capitated managed care arrangements in public programs continue to expand in Minnesota as the Prepaid Medical Assistance Program (PMAP) extends to counties not initially covered in the Medicaid 1115 Demonstration Waiver. PMAP implementation occurs on a county-by-county basis and currently includes 17 counties in Minnesota: Dakota, Hennepin, Ramsey, Anoka, Washington, Carver, Scott, Wright, Itasca, Stearns, Benton, Sherburne, St. Louis, Carlton, Lake, Cook, and Koochiching counties. Enrollment for Becker, Clay, Faribault, Isanti, Kandiyohi, Mahnomen, Martin, Norman, and Swift counties began between June 1 and September 1, 1997. Beneficiaries excluded from PMAP, the blind, disabled under age 65, recipients of the Refugee Assistance Program, recipients residing in state institutions, and designated others, continue to receive care in the traditional Medical Assistance fee-for-service mode.[1]

Current capitation rates for PMAP rely upon averaging of 1993 allowable fee-for-service billed charges within thirty-four rate cells defined by age, gender, geographic location, Medicaid program eligibility category, Medicare eligibility and institutional status. 1993 rate cell amounts are then adjusted for inflation over time. With potentially sicker individuals moving into the PMAP population, demographically-based risk assessment approaches like this can be enhanced by taking into account prior aggregate population health services use, allowable billed charges, and diagnosis-based data from administrative records to calculate indirect health status adjustments. The 1995 Minnesota Legislature authorized development of a risk adjustment system using state-of-the-art methods for state Medical Assistance, General Assistance Medical Care and MinnesotaCare programs to enhance the predictive accuracy of the current model. MinnesotaCare law requires that the risk adjustment system adopted consider enrollee population demographics, health conditions, and other factors related to poverty, cultural or language barriers, or other special needs of the public program population. These statutes give the Departments of Health and Human Services responsibility for developing the risk-adjustment system for Medical Assistance, General Assistance Medical Care and MinnesotaCare enrollees. Valid and reliable risk-adjustment methods developed for the Minnesota public medical care programs seek to achieve the following policy goals:

- Individuals with special needs have access to needed services;
- Those who specialize in caring for these populations receive adequate compensation;
- Health plans compete upon cost-effective practices, not risk avoidance;
- No health plan becomes profitable due to biased selection.[ii]

The Federal agency overseeing the Medicare program, the Health Care Financing Administration (HCFA), continues to invest substantial research dollars toward accomplishing similar refinements for its base capitation rate, the Adjusted Average Per Capita Cost (AAPCC). Newhouse et al.[iii] reason that the lower bound of cost variance explained for adequate risk-adjustment in Medicare lies somewhere between 20 - 25%. The current AAPCC formula explains approximately 1 percent of the variance in actual spending.

Minnesota can benefit from this Federal research which, though while conducted on the Medicare population, has a high degree of relevancy for Medicaid managed care initiatives. As of January 1, 1997 13 percent of the total Medicare population had enrolled in managed care plans while 35 percent of all Medicaid beneficiaries nationwide were in managed care plans as of June 30, 1996[iv]. In Minnesota, approximately 37 percent of the eligible Medical Assistance beneficiaries receive benefits through managed care plans.[v]

Currently at the Department of Health, in collaboration with the Department of Human Services, two risk assessment systems are under evaluation, one for the non-disabled, non-institutionalized Medical Assistance (MA) population (ACGs), and another for the disabled (DPS)[vi]. Both systems employ demographic and clinical diagnosis data in predicting the risk of future medical care expense for homogeneous groups defined by the classification of administrative data. Prediction models derived from the analysis produce sets of relative weights potentially useful for adjusting the monthly capitation payments DHS will make to health plans on behalf of each eligible beneficiary. The development of Ambulatory Care Groups for risk adjusting Medicare capitation payments has benefited from HCFA funding and the use of HCFA's National Claims History files. Disability Payment System risk categories were derived from Medical Assistance data obtained from Colorado, Michigan, Minnesota, Missouri, New York, Ohio, and Wisconsin.

A key assumption underlying risk assessment systems being evaluated by MDH centers upon inclusion of factors in the prediction models considered *immutable*.[vii] These are factors beyond health plans' and providers' control, such as age, gender, and race. Such factors cannot be altered to influence use of health services. Incidences of diseases identified through administrative records likewise are considered to be immutable. The challenge for this component of the risk adjustment work is to identify other immutable factors likely to improve the predictive power of risk models.

While these approaches reflect the current state-of-the-art and a step up from the current demographic-based system, these approaches only go so far. The risk assessment systems under evaluation do not address how to adjust capitation rates for eligible beneficiaries with no clinical diagnosis history of record. Without some indication of the health status of these individuals, premiums flowing to health plans for the newly disabled or chronically ill will fall out of sync with their medical expenses resulting in health plan financial losses. Furthermore, neither risk assessment system explains all the variance of immutable risk confronting health plans, especially that flowing from socioeconomic circumstances.

This study of risk prediction factors other than diagnosis has two general goals:

- To identify and evaluate whether immutable risk predictors other than prior diagnosis and demographics significantly improve predictions of future medical service use;
- To identify factors predictive of medical services use for the proportion of enrollees with no prior diagnosis history.

Factors in addition to prior use and clinical diagnosis considered for study inclusion must also meet the following criteria:[viii]

- Should strongly predict utilization;
- Should be easy to collect without significant cost or administrative difficulty;
- Should be easy to monitor and difficult to manipulate by providers or plans;
- Should not provide incentives for inefficient or ineffective care.

Relevance of Other Risk Factors Studied To Date

Epstein and Cumella[ix] conducted one of the first literature reviews of potential predictors for inclusion in further adjusting the Medicare AAPCC. They examined more than 40 previous studies and classified candidate predictors into six broad groups:

- Perceived health status;
- Functional health status;
- Prior utilization;
- Clinical descriptors;
- Sociodemographic characteristics;
- Additional predictors.

The most recent listing of AAPCC enhancing risk predictors evaluated for the Medicare population to date include:[x]

- Demographic variables included in the AAPCC, age, sex, institutional and work statuses;
- Prior use of acute-care hospital and physician services;

- Morbidity indicators constructed from acute-care hospital data;
- Disability-related Medicare eligibility before age 65;
- Self-reported health status, including diagnoses and self-ratings of health;
- Disability level as measured by limitations in the activities of daily living;
- Medical risk factors including physiologic measures and laboratory test results;
- Cost-weighted disease-specific mortality rates.

The groupings Epstein and Cummella labeled "prior utilization" and "clinical descriptors" and some of the recent factors evaluated by HCFA are consistent with the current MDH risk assessment modeling approach based upon historical administrative records. Measures of "perceived" or "self-reported health status" are not captured in the current Medical Assistance case management system nor are standard measures of "functional status." Activities of Daily Living-like measures are collected for specific groups of individuals in order to determine functional support levels likely to be necessary for their care, but not everyone applying for Medical Assistance is assessed in this way. DHS does not capture physiologic measures nor specific lab test results in its data base, therefore, the focus of this study falls primarily upon readily available socioeconomic, demographic, and program eligibility data contained in DHS records.

The Influence of Managed Care

Epstein and Cumella's broad groupings were based upon research conducted at a time when health care was primarily financed through fee-for service arrangements and makes no consideration of managed care. *Managed care* is an integrated approach to the financing and/or delivery of health care employing specific structural elements (managed care features) intended to ensure that only needed and appropriate services are sought, delivered, and covered.[xi]

Docteur et al. [xii] point out that under managed care, obtaining services is a two-stage process. Individuals first select among the plans available to them taking into account plans' structural and financial characteristics. Individual perceptions of plan characteristics are conditioned by:

- Individuals' knowledge of managed care;
- Previous experience with managed care and attitudes related to that experience;
- Existing physician relations and care-seeking behaviors;
- Socioeconomic and demographic characteristics;
- Health and/or disability status and special needs.

Once a plan is chosen, people seek care within the structure established by their plan, which may include unique care-delivery processes and rules for care seeking. These unique delivery processes and care seeking rules may well have a significant influence upon not only individual and population health status but functional status, utilization patterns, as well as the range of clinical descriptors reported.

One of the appealing ideals of managed care is its philosophy of prevention and the close coordination of care to improve the health status of enrolled populations. Because health care financing and delivery are integrated, plans are incentivized to provide quality and timely care because they must deal with the preventable costs of illness and disability should they not. This stands in stark contrast to fee-for-service economic incentives believed to increase episodic acute care service volumes through making diagnoses and treating the identified conditions. For managed care incentives to work in plans' and members' favor, it is important for beneficiaries to remain in a plan for an extended period of enrollment. Thus, member satisfaction with the plan and the associated delivery system is an objective plans are likewise incentivized to pursue.

But the eligibility requirements for continuing to receive Medical Assistance may run contrary to these worthwhile managed care ideals. The effect of enrollment continuity will receive significant attention in this study in that program eligibility is clearly beyond the control of health plans and likely a highly immutable factor for risk assessment.

A second result of the spread of managed care is that managed care organizations differ in the degree to which they have been able to achieve the levels of operational and clinical integration necessary to meet make the paradigm shift a reality. Education both of beneficiaries and providers is a significant ongoing challenge for managed care organizations. Their educational success accelerates or impedes establishment of efficient and effective disease management, demand management, and population health management programs. Some of the effectiveness of managed care relies, to a larger extent than in the fee-for-service system, upon its ability to teach members to improve their own health status, strive toward wellness, manage their health issues, and take more responsibility for their own care. This is another aspect of managed care's influence on the bio-medical paradigm.

Traditional fee-for-service medicine taught that individuals are not responsible for the things that happen to them (disease) and that the resolution of what ails them is also beyond their control and understanding. To achieve managed care's ideals, each beneficiary should establish an ongoing stable relationship with an equally stable network of providers. This means that the relationship should be long-term rather than short-term and that factors upsetting the link should be minimized. These ideals, goals and practices may play a role in the creation of new vulnerable groups.

Some of the same groups identified as vulnerable under fee-for-service Medical Assistance may be at additional risk within MA managed care (PMAP). Minorities, some elderly, some disabled, those living in Health Professional Shortage Areas, or in urban poverty areas may continue to be at risk given that their reasons for vulnerability are unaffected by the managed care system. On the other hand, some may well benefit from having regular, timely, coordinated, high quality care. But Docteur et. al. [xiii] reason that two general categories of beneficiaries may be at additional risk in managed care delivery systems. One, those who may not receive adequate care from health plans responding inappropriately to cost-containment

incentives, such as enrollees with chronic medical conditions requiring ongoing resource-intensive care, and two, those who have difficulty navigating systems of care because of medical, psychological, economic, sociological or other reasons.

For individuals in the first vulnerable group, health plans behaving in this manner have chosen not to travel the high ground of improved health status and, provision of high quality cost-effective care. Their practices are clearly mutable, but for plans on the high road, many enrollee medical, psychological, sociological and economic characteristics are immutable. Hence, the importance of identifying factors beyond prior use of medical services and diagnoses likely to contribute to future medical service use for such groups. This study will focus upon as many of these characteristics as possible as well as the impact of enrollment dynamics.

Socioeconomic Characteristics

A large body of research literature indicates that socioeconomic status explains a significant proportion of variance in population health status. Low social class, for example, correlates with increased rates of infectious disease, including tuberculosis, rheumatic fever, influence, pneumonia and other respiratory diseases. In comparison with upper socioeconomic groups, lower socioeconomic groups have higher infant mortality rates and overall mortality rates as well as lower life expectancy. [xiv] Higher levels of education, in contrast to income or occupational status, appear to be one of the strongest predictors of positive health status.[xv] Socioeconomic status also highly correlates with ethnicity, race, religion, and nativity. This finding is not surprising given that in the United States as well as other countries worldwide, ethnic, religious and/or minority groups frequently occupy the lowest socioeconomic strata.

Socioeconomic measures describe the factual, objective attributes of health system users by linking a broad array of factors that determine the status of a person in the community. The availability and objectivity of socioeconomic indicators confer a distinct measurement advantage. Beyond the most basic measures, numbers of people, their age and gender lie social status characteristics which describe the social status of an individual in the community, his or her ability to command resources to cope with problems, and whether the environment of the local community is likely to be healthy or unhealth While originally intended for low-income populations, Medical Assistance expansions to those up to 275% of the Federal Poverty Guideline provide medical coverage for numerous employed but uninsured individuals, especially children with working parents. If generalizations from the literature hold, health status should vary with education and income for the populations in the study and, subsequently, health services use.

Readily available data for the risk adjustment project and this analysis originate within the DHS Medical Assistance program eligibility computer files (MAXIS) and the MMIS-II fee-for-service claims data base. PMAP encounter records are not available for analysis at the time of this writing. Socioeconomic variables readily available for initial testing include the following:

Age
Gender
Race as perceived by county case workers according to the following categories:

- Asian or Pacific Islander
- Black, not Hispanic
- Hispanic
- Native American (American Indian or Alaskan Native)
- White, not Hispanic

Marital Status reported to county case workers according to the following categories:

- Never Married
- Married, Living with Spouse
- Married, Separated, Living Apart
- Legally Separated
- Divorced
- Widowed

Nationality/Citizenship/Immigration Status
Education, Last Grade Completed reported to county case workers:

- Pre 1st grade or never attended
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Grade 6
- Grade 7
- Grade 8
- Grade 9
- Grade 10
- Grade 11
- High School Diploma or GED
- Some Post Secondary Education
- High School Plus Certificate
- Four Year College Degree
- Graduate Degree

Retrospective Gross Income
Type of occupation using standard Federal job categories
Living arrangements as reported by county case workers:

- Independent, in Community
- Homeless
- Foster Care
- Hospice
- Resident Facility, Institution or Other Group Living Arrangement
- Roomer/Boarder
- Live in Attendant
- Roomer
- Adult or MSA Foster Care
- IV-E Foster Care
- Non-IV-E Foster Care

Residential mobility - count of change of residence
Household size - count of adults and children in household
Program Identification - eligibility for the following programs

- Cash 1
- Cash 2
- Aid to Families with Dependent Children
- Refugee Cash Assistance
- Family General Assistance
- Emergency Assistance Program (EA, EGA, EMSA)
- Food Stamps
- Medical Assistance Program (Medicaid and General Assistance Medical Care)
- Minnesota Family Investment Plan

Urban/rural place of residence

Enrollment Dynamics

Closely linked to the fluctuations of socioeconomic characteristics are the dynamics of Medical Assistance eligibility. Numerous studies indicate that the majority of individuals meeting the definition of poverty experience such circumstances for only short periods of time while a minority remain persistently poor and in need of ongoing medical benefits. Eligibility for various programs within Medical Assistance is linked to definitions of poverty and poverty-based program guidelines influence both short-term and long-term population health plan enrollment definitions.[xvi]

Financing the health care of a group of individuals who need assistance getting through a temporary fiscal crisis is quite different from caring for those impoverished over the long-run. Short-term enrollees tend to be at different stages of life than long-term enrollees with the very young and the old disproportionally eligible for the program for longer periods of time. This is an important consideration for risk adjustment. Long-term enrollment incentivizes plans to provide quality and timely care because they must deal with the preventable costs of illness and disability. Short-term enrollment translates into less of an incentive for establishing ongoing therapeutic relationships and the provision of preventative care. Thus, rapid turnover in eligibility runs counter to managed care incentives, compromises establishment of stable relationships with providers, and may increase costs in the long run.

Effective use of managed care requires that enrollees understand that they have a restricted network of providers, that care begins with a primary care provider who will provide or authorize necessary treatment, and that preventative care is important to overall enrollee health. Unfortunately, each managed care system has its own set of rules and procedures governing these processes. A substantial plan and agency investment in education and orientation is required for members to use the system. Each time a plan enrolls a new member, both the agency and the plan incur enrollment costs. But more importantly, this bimodal eligibility distribution (short-term versus long-term) creates problems in attempting to evaluate data about

the program. For example, Short et al. observe that the longer the time frame of reference, the greater the number of short-term enrollees in relation to long-term enrollees. Over representation of long-term enrollees occurs when focusing upon a given point in time. These differences make analyses highly complex and require different research strategies.

Analytical Challenges and Strategies

Because development of prediction models based upon indirect health status measures derived from clinical descriptors and prior utilization continues, *Phase 1* of the analysis entails evaluating the independent ability of readily available measures of factors other than diagnosis to predict future medical care utilization. *Phase 2* evaluates the ability of these factors to add significant predictive power to prior utilization/clinical descriptor-based risk-adjustment models. *Phase 3* examines the contingent effects of short-term versus long-term enrollment continuity and is expected to require a significant investment in time to adequately complete given resources available. *Phase 4* consists of reporting the findings and facilitating implementation of any findings in the future versions of risk adjustment formulas.

Phase 1 proceeds in the following manner and relies upon immediately available measures from the DHS eligibility data base. Readily available measures are evaluated first in order to have as much information available as resources allow for risk adjustment implementation January 1, 1999. Measures not immediately available and requiring additional computer programming to add them to the data base gain later input into the analysis.
Phase 1-A: Testing includes the variables: *age, gender, race, socioeconomic status (years of education completed, retrospective income, program type, and living arrangements)* independent of diagnosis and prior medical service utilization.
Phase 1-B: Addresses: *marital status, household size, and urban vs rural place of residence* independent of diagnosis and prior medical service use.
Phase 1-C: Adds in tests: *US citizenship status, nationality of origin, immigrant status, residential mobility and federal job category* when they become available in the analysis data base.

Phase Two repeats the analyses above but includes prior use and clinical descriptor measures as developed by MDH for risk adjustment. Equation results containing prior use clinical descriptors are compared with equations containing prior use clinical descriptors plus the other factor measures. If addition of factors other than diagnosis (prior use and clinical descriptors) produces a significant difference, such factors qualify for further analysis and future inclusion in risk adjustment equations used to set relative rates for payment adjustments.

Phase 3 requires development of a classification framework descriptive of enrollment dynamics and continuity in Minnesota Medical Assistance. Changes in eligibility criteria to extend inclusion to specific populations mandated by the legislature or Congress must be factored in to valid in today's environment. This will require an extensive analysis of the DHS Medical Assistance eligibility data over a three year period.

Phase 3-A: will specify systems to identify patterns of MA eligibility and plan enrollment continuity.
Phase 3-B: results in operational definitions for program short-term and long-term eligibility.
Phase 3-C: will refine the definitions to include enrollment continuity within health plans.
Phase 3-D: will seek to identify patterns of cross-over between categories, if any.
Phase 3-E: Development of a classification framework for analysis.
Phase 3-F: Application of the enrollment continuity framework to the results of Phase 1 and Phase 2 and reanalysis as necessary.

Phase 4 consists of reporting the results of the study, disseminating the information developed, and implementation of the results into future versions of the risk adjustment formulas. Consideration will also be given to the implications of findings for other risk adjustment endeavors within the state.

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APPENDIX E

PROXY RESOURCE MEASURES FOR MANAGED CARE ENCOUNTER RECORDS

OVERALL EVALUATION PLAN

Policy Background & Problem Statement

Capitated managed care arrangements in public programs continue to expand in Minnesota as the Prepaid Medical Assistance Program (PMAP) extends to counties not initially covered in the Medicaid 1115 demonstration waiver. PMAP implementation occurs on a county-by-county basis and currently includes 17 counties in Minnesota: Dakota, Hennepin, Ramsey, Anoka, Washington, Carver, Scott, Wright, Itasca, Stearns, Benton, Sherburne, St. Louis, Carlton, Lake, Cook, and Koochiching counties. Enrollment for Becker, Clay, Faribault, Isanti, Kandiyohi, Mahnomen, Martin, Norman, and Swift counties began between June 1 and September 1, 1997. Beneficiaries excluded from PMAP, the blind, disabled under age 65, recipients of the Refugee Assistance Program, recipients residing in state institutions, and designated others, continue to receive care in the traditional Medical Assistance fee-for-service mode.[i]

Current capitation rates for PMAP rely upon averaging of 1993 allowable fee-for-service billed charges within thirty-four rate cells defined by age, gender, geographic location, Medicaid program eligibility category, Medicare eligibility and institutional status. 1993 rate cell amounts are then adjusted for inflation over time. With potentially sicker individuals moving into the PMAP population, demographically-based risk assessment approaches like this can be enhanced by taking into account prior aggregate population health services use, allowable billed charges, and diagnosis-based data from administrative records to calculate indirect health status adjustments.

The 1995 Minnesota Legislature authorized development of a risk-adjustment system using state-of-the-art methods for state Medical Assistance, General Assistance Medical Care and MinnesotaCare programs to enhance the predictive accuracy of the current model. MinnesotaCare law requires that the risk-adjustment system adopted consider enrollee population demographics, health conditions, and other factors related to poverty, cultural or language barriers, or other special needs of the public program population. These statutes give the Departments of Health and Human Services responsibility for developing the risk-adjustment system for Medical Assistance, General Assistance Medical Care and MinnesotaCare enrollees. Valid and reliable risk-adjustment methods developed for the Minnesota public medical care programs seek to achieve the following policy goals:

- Individuals with special needs have access to needed services;
- Those who specialize in caring for these populations receive adequate compensation;
- Health plans compete upon cost-effective practices, not risk avoidance;
- No health plan becomes profitable due to biased selection.[ii]

Currently the Department of Health and Department of Human Services seek to incorporate risk-adjustment methods into the premium rate-setting process, one for the non-disabled and another for the disabled.[iii] Both approaches to risk assessment and prediction rely upon data elements found in administrative medical service claims such as diagnoses, allowed billed charges, age and gender. These data appear in fee-for-service physician, hospital inpatient and outpatient, pharmacy, and other allied provider claims paid by DHS for warrant dates falling within a two-year eligibility window. Both methods categorize the claims longitudinally to describe the risk mix of the population enrolled in Minnesota Medical Assistance.

The issue underlying this study occurs because the shift from fee-for-service to capitated managed care payments changes the flow of dollars. Money now flows as monthly premiums prepaid to health plans instead of DHS directly reimbursing providers for specific services after they are provided. This change means providers' billing for medical services no longer makes sense. However, to support ongoing risk adjustment, rate-setting, utilization, access, quality analysis, future planning, and studies of small high policy interest populations, the Health Care Financing Administration (HCFA) requires waivered states to collect "encounter" records instead of claims.[iv]

Encounter records describe each contact a beneficiary has with the health care system while enrolled in a specific health plan. Data elements entered in the record highly resemble those on a fee-for-service claim but with one major difference, no charges appear in the record. DHS has specified the content, computer file formats, submission processes, and timelines health plans serving the PMAP population must follow in submitting encounter records to the agency. The system developed by DHS utilizes standard uniform formats common to all plans. Encounter data have been flowing into the system since PMAP began.

The need to consider applying proxy resource measures to encounter records arises because a measure of resource use (dollar amounts) is required for ongoing risk model refinement and updating. As mentioned above, managed care encounter records display no dollar amounts but include units of service provided, revenue codes, CPT-4 or ICD-9 procedure codes, patient demographic information and ICD-9 diagnosis codes, and drug codes for pharmacy records. What, then, are reasonable dollar proxies to use as resource measures for the services provided? Dollar amounts are preferred because they provide a common metric across differing units and types of service.

Alternative Health Care Resource Utilization Measures

Data items appearing in encounter records, i.e. units of service such as hospital admissions, hospital inpatient days, physician office or clinic visits, ambulatory care visits, procedure volumes, ancillary service counts, etc., underlie traditional fee-for-service pricing and charges. They provide wide latitude for creation and application of health care utilization measures. For example, Parente et al.[v] in profiling resource use by primary-care practices, developed a set of measures for hospital and ambulatory services. They calculated three hospital utilization measures: admissions per patient; average length of stay; and average physician visits per admission. Total number of visits to providers, number of visits to specialists or other physicians, number of laboratory tests, and number of imaging services represented ambulatory service measures. Cost estimates were computed by applying DRG relative weights to the hospital measures and HCFA's Resource Based Relative Value Scale (RBRVS) to ambulatory care measures. This study demonstrates that units of service measures can be linked to standard resource amounts and a dollar proxy calculated.

Following Parente et al.'s lead, six options for calculating proxy resource measures linked to encounter record units of service are to:

1) Use existing DHS fee schedules (DRG categories, physician schedule, etc.);
2) Derive a set of weights from DHS fee-for-service data;
3) Use standard Medicare fee schedules;
4) Use other state's Medicaid fee schedules;
5) Purchase commercially available fee schedules;
6) Mix and match the above.

Utilizing the "mix and match" strategy, the large majority of DHS encounter record units of service can potentially link up with existing fee schedules in the ensuing ways.

1) For physicians, the Medicare, Part B Physician Fee Schedule (RBRVS).
2) For hospital inpatients, apply All Patient Diagnosis Related Groups (AP-DRGs) with Medicaid relative weights developed for Washington state.
3) For hospital outpatients, apply Ambulatory Patient Groups (APGs) with relative weights derived from the Medicaid population in Iowa.
4) For clinical diagnostic laboratory tests, use the Medicare fee schedule for lab services.
5) For pharmacy services, use the DHS Medical Assistance drug fee schedule.
6) For services provided by psychiatrists, clinical psychologists and social workers, apply the Medicare fee schedule for psychiatrists.
7) For anesthetists, certified nurse anesthetists, and anesthesia assistants, use the Medicare fee schedule for anesthesia.
8) For surgery in an ambulatory surgery center, use the Medicare ASC fee schedule.
9) For durable medical equipment, use the Medicare DME fee schedule.

Linking substitute external fee schedules to the units of service on encounter records seems relatively straightforward, but assigning the relative values then calculating the dollar proxy poses a significant data processing challenge given the many types of providers, the variety of services provided, record formats, and the large number of encounter records. Calculating a dollar proxy for each type of encounter requires processing the records as if they were paid under the reimbursement system for which the alternative fee schedule was developed.

For example, a hospital inpatient encounter record's diagnosis and procedure codes, patient's age, gender and discharge status must first be scanned by the grouping software for appropriate AP-DRG assignment. Once AP-DRG classification occurs, a relative weight associated with each service is multiplied by an adjusted standard amount then other adjustment factors added to obtain the proxy dollar measure. The calculated proxy amount appends to the hospital encounter record and the entire computer file reported into the risk classification schema, then analysis can begin and the proxy measures applied.

A Strategy for Evaluating Proxy Resource Measures

MDH proposes evaluating the utility of proxy resource measures by: 1) correlating billed charges from DHS fee-for-service claims with the proxy; 2) comparing predictive power results between the charge-based model and the proxy-based model. Instead of implementing a proxy measure for each and every type of encounter record, MDH proposes evaluating only those services comprising the largest proportion of DHS medical expenses in the following order:

physician services;
hospital inpatient services;
and hospital ambulatory services.

Physician proxy measures derive from the relative value units (RVU) associated with each CPT-4 code found in the 1998 Medicare, Part B physicians' Fee Schedule. Once code matching takes place and RVUs assigned, a computational algorithm calculates the dollar amount using th Medicare formula for each procedure. If an encounter record contains more than one procedure, a summation of all appended proxies completes the record total. Correlation of record total proxy dollars with actual paid billed charges comprises the first component of the analysis. If the correlation is high, then the predictive power of equations built upon either paid billed charge or the proxy dollar amount should appear relatively equivalent.

3M Health Information Systems has agreed to provide no-cost PC software AP-DRG hospital inpatient grouping software licenses plus sets of category-specific relative weights from Washington State for this analysis. As with physician records, correlation of record total proxy dollars with actual paid billed charges comprises the first component of the analysis. If the correlation is high, then the predictive power of equations built upon either allowed billed charge or the proxy dollar amount should appear relatively equivalent.

Expected differences between the two measures will arise, however, because the proxies derive from national fee schedules and national practice styles. Local pricing and practice styles diverge from the national levels for several reasons. In general, medical costs in Minnesota rank below the national average and because of the influence of managed care, practice styles tend toward the conservative and efficient.

MDH will undertake this research as workloads and available resources permit.

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APPENDIX F

RISK ADJUSTMENT HEARING

DECEMBER 1997

Gini Weslowski, Minnesota Department of Health, Health Economics Program:

I would like to welcome you to a public hearing on Risk Adjustment.
I will start by introducing those at the table, and talk about the process of the meeting.
Dave Knutson will talk briefly about what is being done with Risk Adjustment then the floor will be opened for public testimony.

Staff Present:
Gini Weslowski, MDH, Health Economics Program
Jason Wyley, DHS, Managed Care Rate Setting
Paul Olson, DHS, Managed Care Rate Setting
Dave Knutson, Director of Health Systems Studies, Institute for Research and Education
Greg Gifford, MDH, Health Economics Program
Kevan Edwards, MDH, Health Economics Program

There is a sign-up sheet for everyone present to sign.

The purpose of the hearing is to obtain public testimony and public input on the draft Risk Adjustment report that the staff have been working on for the past few months that covers the Risk Adjustment process over the past year and a half. There are copies available if needed.

The members were asked to convene this hearing by the Legislature, Senator Berglin in particular, who wanted to have the opportunity for the public to provide direct testimony on the recommendations in the report prior to the Legislative session starting.

In addition to today's hearing there are a variety of ways that public input has already been involved in the report process. If there are any persons that have written testimony it can be handed in at the end of the week following the hearing. It will still have time to be incorporated into the draft as it is not due to Legislature until January 15th, 1998.

Risk Adjustment has been worked on for several years, and one of the things that should be pointed out about the report is that it includes many unresolved issues as you will be able to see when you read through it. I think that's both good and bad, but there has been some frustration voiced with these several unresolved issues. These issues have been discussed at length with our advisory committee and consultants, and tentative decisions were made when looking at a January 1998 implementation date. Given that we've had the legislature move back the

implementation and put a year delay in, many of those decisions were moved back from, because we had the opportunity to study those issues further.

(Gini asks attendees) If you are going to be testifying today, please consider letting the members know if there are certain decisions that you feel need to be made sooner even if it means we don't take advantage of this extra time to further evaluate them. Let us know what those things are, because we have been trying to make certain decisions now so that people have some comfort with the direction that we're going and taking advantage of whatever time that we have to continue to evaluate and think of new and different ideas.

Dave Knutson, Institute for Research and Education:

Thanks Gini. Yes, as I look out into the room this is going to be pretty basic, but I don't know all of you and I think it's important to establish the basic principles of how all of this work is based.

First of all, after a policy decision has been made to replace a fee-for-service sort of piece work payment system with a risk based payments system (i.e. capitation) incentives are turned around dramatically, obviously, and that's part of the reason to create the incentives for efficiency, but a lot of other incentives are unleashed as well. For example, in a risk based payment system those who provide services and who bear risk are strongly incented to avoid higher risk populations. Capitation systems are really not sensitive enough to create a fair payment for those who attract high risk people. So, the problem with coming up with a payment amount is foremost as we move to capitation.

Traditional actuarial methods, which have been effectively employed here in the demonstration project are used typically throughout managed care and the insurance field and only explain a small portion of the sort of predictable variation and resources that one might see in the population. This leaves a lot of room for financial problems to occur because of selection bias, whether it's anti-selection or selection because a plan happens to attract high risk populations because of special programs, or "creaming," as it's called, because plans have successfully marketed or structured themselves to avoid high risk populations. There are new systems now that have been developed in the last few years that allow us to use health status informatic in this case diagnosis codes, to better assess the illness for a population. And in using that in a payment system we can far more accurately pay a risk-bearing provider or health plan for the actual risk of the population that it has enrolled. That is the whole point here. We want to have a capitation system that pays for the kinds of risk of a population so that the incentives are really directed toward competition, if you will, or management efforts directed towards improving the effectiveness and the efficiency of care rather than management efforts directed toward avoiding high risk populations. It is the introduction of health status information to the traditional actuarial models that is the innovation here. The systems, as they say, that have been developed and tested by academic centers initially and have been tested in our use by purchasers around the country are those systems that we have evaluated and finally have made a recommendation about here.

That is fundamentally what this is about. It's about creating a more accurate payment system and one that achieves the kind of incentives that we have in mind when we decide to move public programs into managed care.

Gini Weslowski, Minnesota Department of Health, Health Economics Program:

Open up floor for testimony. The testimony will be incorporated into the report, both written and that spoken at the hearing.

Mark Hudson, Ucare Minnesota:

We wanted to get just a couple of points across. First of all, we're very pleased with the updated draft of the report we think that it makes a lot of sense. There were a few things that we wanted to point out and at least get on the list to talk about.

In risk adjustment public programs is our business, because it is going to be very important to us and we think that a process done right would be very, very helpful to both ourselves as well as the providers and I think a lot of the ground work that's laid out in here is really going in the right direction.

We are anxious as an aside to see the information that your putting together on the disabled project, because clearly for the disabled pilots that are going on, that's in the area of the market place that we see Risk Adjustment is essential to even getting the effort going.

Just a couple of general comments. One is verification of the encounter data submission processes and working through fast with DHS. Our plan has spent several hundred thousand dollars getting encounter data to the DHS. We're certainly not done, but we are very committed to getting the process done and I think we're working through a lot of the operational issues with DHS, but I think the report talks about the deadlines for the health plans, and I think all we're trying to say is that "Let's keep that in mind and I think that both sides have been working very diligently on a very, very complex process." I think that we need to keep that in the back of our minds, because were still waiting for the first sort of feedback in the quality control aspect from DHS. We've submitted a lot of information but nothing has been compiled and been utilized for any purpose... the devil is sort of the detail. There is a lot of work that is going to need to be done in that effort. Those of us that are responsible know that we're waiting to hear from DHS early next year on what is going to have to change for the year 2000 compatibility. If you think of the start date in the year 2000 compatibility and the issues involved with that we just need to be realistic and realize that there is an awful lot of effort that needs to take place.

We also are a little bit concerned with using the ADGs versus ACGs. We understand the higher degree of predictability, but there is some administrative complexity that is introduced and I think all we want to do is say, "Let's keep looking at it and lets see what's going to go on." We don't have an opinion one way or the other, but let's not take ACGs off the table given there is still a lot of work in testing to go on simply because it looks like in initial modeling ADGs have

higher degrees of predictability. There may be some potential advantages administratively to ACG's, and again we may be swayed the other way. All we're saying is, "Let's not reach that conclusion so soon and take it off the table," because there may be some advantages.

We're also concerned about.....most of you are familiar that the DPA Medical Education elements in health plans specific rates are being sort of removed from the rates and they think that there will be an impact, or could potentially be an impact, in some of your analysis due to using fee for service data on what the results of pulling out DPA meant and there's a question on medical education. We just need to again look at that and see how that may impact things. Some of the high DPA hospitals are exactly some of the same hospitals that some of the very complex cases are going to be in and some of the very sick members are going to be in. We need to keep that going.

The last issue, we're concerned, and there isn't a conclusion reached, but there is some discussion on use of charge data from providers to develop the cost base, because we have quite a variability in charge data for the same types of codes. We are have large community clinics that try to keep their charges relatively low. We may be unique in that variably, maybe everyone has that variability, but we have some concern potentially about just relying on charge data from an equity standpoint. There's different charge data used in greater Minnesota than in the metro area, and not all the charge data is necessarily supported. There's a rational relationship with cost, but there are some concerns that we have with that.

The last issue, which is somewhat related to that, is to not forget the tie in the socioeconomic issues that have not been totally explored. We've gone in and found that in some of our demographic groups, southeast Asians as an example, we have lower costs. You can say that maybe that's good and we've looked at it and say maybe that's bad. They're not getting immunizations, they're not getting mammograms, they're not getting some other things and we're going out and doing the things and there's actually a cost, an extra effort that we need to do as a health plan to be able to get those things done. That's why I think that I want to make sure that we don't lose sight of the socioeconomic factor and what can be done there.

No others requested to testify. The hearing was adjourned at about 2:30pm.

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As required by Minnesota Statute 3.197: This report cost approximately $71,750 to prepare including staff time, printing and mailing expenses.

Minnesota Department of Health
Health Economics Program
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