MEDICAID FORECASTING PRATICES[1]
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August 15, 2015

COMPARING MEDICAID FORECASTS

Applied forecasting literature includes numerous studies in which different approaches are compared through simulated forecasting such as the M-competition, the M-2 Competition, and the M-3 Competition (Makridakis, *et. al.*, 1982; Makridakis *et. al.*, 1989; Hibon and Makridakis, 1997). Less frequently, studies compare different actual forecasts of the same data series (Ashley, 1988); however, because of the small number of such multiple forecasts, there is limited opportunity to evaluate sources of variation.

State government forecasting provides an opportunity for studying a large number of forecasts of similar series to determine the effects of different variables on forecasting practice. Often, many states forecast similar series, such as tax revenue, nursing home bed need, prison population, or educational enrollment. While some characteristics of these series differ from state to state other characteristics may be similar. For example, the unit of analysis may be similar between states – each state might be interested in dollars of revenue, a count of children at each age cohort, and so forth. Also, the series in each state may experience the similar social and political perturbances at about the same time. The study of these such forecasts may provide insight about variables that affect applied forecasting.

This paper examines forecasting activities among Medicaid agencies in the fifty United States, Washington, D.C., and five U.S. territories (American Samoa, Guam, Puerto Rico, Northern Mariana Islands, and Virgin Islands). Most frequently, studies of state or local forecasting practice focus on revenue forecasting (Rodgers and Joyce, 1996; Bretschneider and Schroeder, 1988; Bretschneider. *et. al.*, 1989). There are several reasons why comparison of state Medicaid forecast practice may be better than comparison of state revenue forecasting practices. First, there is no consistent reporting of state revenue estimates. States make forecasts when it suits them and report them in a manner that is satisfactory to their governors or legislatures. Collection of data through national organizations such as the National Association of State Budget Officers is not so rigorous as to assure that reported data are comparable. In contrast, Medicaid agencies must report their expenditure esti-mates to the federal government using the federally specified HCFA-37 form once a quarter beginning roughly 30 months before the end of each federal fiscal year.[2]

Second, determining the accuracy of state revenue forecasts relies on the validity of state reported differences between planned and actual expenditure. States may be politically motivated to report these data in a favorable manner. By contrast, Medicaid forecasts, can be compared with accounting data as reported on a federal report known as the HCFA-64. While these data may not be bias free,[3] biases are likely to be small and similar from state to state.

MEDICAID FORECASTING BACKGROUND

Medicaid is a federal and state funded health care financing program. The federal government contributes 50% to 83% of the cost of the program in each state, with states contributing the balance. Medicaid is the largest human services program in state budgets, accounting for 19.2% of total state spending in 1995. It is second only to education in share of state general funds, and has the largest share of federal transfer payments to states (National Association of State Budget Officers, 1996). Medicaid is an entitlement program: once states establish rules about who is enrolled and what is covered they are barred from refusing to enroll eligible individuals or from refusing to pay for covered services due to funding shortfalls. Medicaid pays for health care through vendor payments to health care suppliers (called "providers" by some states). Beneficiaries present their Medicaid cards to enrolled suppliers who deliver services and submit claims to state Medicaid agencies. The state Medicaid agencies pay for these services based on "provider agreements," which set payment conditions. As a result, the Medicaid agency is usually the last to find out about the service. For these reasons, Medicaid budgeting is highly dependent on forecasting.

Because the Medicaid program is funded with both state and federal funds, there are two levels of government who use Medicaid forecasts for budgeting. Practices at these levels of government can be somewhat different. In a typical state government, a Medicaid administering agency makes a forecast that is submitted to an

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[2] The number of quarters from first reporting a fiscal year to the end of that year has varied from time to time.

[3] States may not anticipate retrospective adjustments in the HCFA-37 although they appear in HCFA-64. Another disadvantage of comparing state forecasting practice using HCFA-37 data is that states may be more interested in their own budgets than in the reporting of their expectations to the federal government. So, the HCFA-37 may not capture the state's best forecast.

executive budget office for review. Sometimes the executive budget office makes its own independent forecast which may be combined with, or substituted for, the Medicaid agency's forecast (JLARC, 1997). This forecast is then submitted to the state legislature in the legislative budget process. The legislature may make another forecast or may choose to rely on the executive forecast. There can be various mixed practices, for example, a legislative agency may participate in selecting the executive forecast.

The federal government uses the state forecasts in a different way. The states submit their estimates to the Health Care Financing Administration (HCFA), the federal agency responsible for administering the Medicaid grants to states, each quarter using a federal form, the HCFA-37 (formerly the HCFA-25). Forecasts reported on this form are combined to produce national estimates. The federal government adjusts these estimates: (a) to account for new federal policy making that the states could not have known about when making their estimates; and (b) to correct for perceived patterns of errors occurring in past forecasts (Trapnell, 1991). The federal government uses these corrected forecasts to estimate federal Medicaid outlays for the next future federal budget year. Estimates for years beyond those reported in the HCFA-37 are made by the HCFA Office of Actuary using algorithms developed by a contractor prior to 1980 (Trapnell, 1991). In the federal budgeting practice, HCFA budget estimates originating either from the states or the Office of Actuary are subject to scrutiny by OMB and CBO.

In the late 1980s and early 1990s Medicaid agencies experienced several years of significant forecast error. In 1991 HCFA was criticized for unprecedented overages in the Medicaid budget (HHS NEWS, 1991; Executive Office of the President and Department of Health & Human Services, 1991). At that time, the federal government concluded that state forecasting was a significant source of forecasting error (HHS NEWS, 1991). Medicaid and related health care forecasting and cost estimation have been the center of continued disagreement and concern throughout the 1990s (Rich, 1991; Firshein, 1993; Doran, Roesenblatt, and Yamamoto, 1994; Office of Technology Assessment, 1994; Holahan and Liska, December, 1996; Ratner, 1997; Scanlon, 1997; Holahan and Liska, 1997).

EMPIRICAL STUDIES OF MEDICAID PRATICE

"Forecasting Techniques and Budgetary Issues of State Medicaid Programs" (McKusick, 1980) examines the forecasting practices of 10 state Medicaid programs. Data are gathered from site visits. McKusick observes, "Although each state's estimating techniques are unique, there are patterns that are common to most methodologies." These common patterns include:

- States attempt to estimate demand for service, and pay little attention to supply of service.
- Most state forecasts are prepared on a cash budgeting basis although some forecast accruals and convert to a cash basis.
- In many circumstances, reimbursement rate increase decisions are known prior to budgeting and can be used as an aid to expenditure forecasting.
- Many states have poor quality data sources, but they compensate through inventive use of forecasting techniques.
- Forecasting is understaffed in many states, leaving "many critical forecast issues . . . unanalyzed."
- Few states relate economic conditions to enrollment. Where they do, such analyses may be primarily produced for other governmental functions.
- State Medicaid budget estimates are "determined by the political process," with frequent reliance on supplemental appropriations.
- States forecast no more than a two years horizon.
- States rely on trend analysis, rather than "looking for the underlying driving forces in medical costs."
- Some state forecasts submitted to the HCFA are consistent with their state budget estimates, while others are "the best guess of the analyst."

McKusick describes specific practices in each of 10 states (California, Illinois, Maryland, Massachusetts, Michigan, Pennsylvania, Rhode Island, Texas, Virginia and Wisconsin). Details are not summarized here. The matters he addresses include: the participants in forecasting, the general forecasting approach (e.g., California divides the forecast into current services and policy modifications), number of periodic observations available to the forecast model, level of data (annual, monthly, etc.), sources of data, forecasting techniques used, degree of data decomposition, frequency of forecasting, the state budget calendar, ability to produce data reports for the federal government, relative size of the Medicaid program (to other Medicaid programs nationwide), breadth of Medicaid coverage, and components of Medicaid coverage. Some of the techniques observed include: use of regression or systems of regression models, analysis of "historical trends," use of a weighted average of inflation factor, use of judgment, use of graphing techniques, use of nursing home bed supply information, and use of negotiated rates (Texas).

Because of the interaction with the political process,

McKusick expects that states are motivated to underestimate expenditures; however, he observes, "[We] are puzzled that the aggregate of all state estimates should have proven accurate in the past since many have incentives to estimate low and none appear to have incentives to estimate high."

McKusick does not attempt to establish a relationship between these observations and relative forecasting accuracy.

"Better Management for Better Medicaid Estimates," (Executive Office of the President, 1991) reports that from 1980 to 1990 the overall average error of state estimates is -0.3%; however, the federal government is concerned because of error and expected error for 1990 through 1992 as shown in Table 1.

Table 1		
Year	Error	Comment
1990	-9.2%	Actual
1991	-18.0%	Expected
1992	-16.0%	Expected

HCFA determined that in 1990, 19 states had errors greater than 10% and 4 (Alabama, Kansas, Arizona and Massachusetts) had errors greater than 20%. Error rates for the largest states grew from below 5% in 1990 to an unweighted average of 17% in 1991 as follows: Texas – 27%, New York – 17%, and California – 7%, for a gross total of $2.1 billion.

A HCFA/OMB task force visited nine large states that account for approximately 50% of all Medicaid expenditure in 1991 and 1992 (Alabama, California, Florida, Maryland, Massachusetts, New York, Ohio, Pennsylvania, and Texas). They found: "Mis-estimates in these States appear to be due primarily to changes in Federal . . . policies . . . . Only about one-third of the mis-estimates were attributable to problems in the States' estimating processes. Economic trends appear to play a lesser role." Programmatic sources of cost increase include health care inflation, court orders, and use of provider taxes and refundable donations. Specific observations about state processes include:

- Some States have well qualified personnel and employ sophisticated estimating models; others do not.
- States that link Medicaid estimating to their State budget processes appear to produce more accurate estimates than those that do not.
- Many States do not take reporting to the Federal Government . . . seriously, and

thus do not provide accurate, complete or timely estimates.
- Many States do not provide the Federal Government with the assumptions used in making estimates. No distinction is made between baseline estimates and program estimates.
- Technical problems include differences in fiscal years and State use of accrued versus cash budgeting. (Executive Office of the President, 1991)

Some of these observations involve communication problems between the state and federal governments. Observations that appear to account for forecasting accuracy include (1) the assertion that forecaster qualification varies, and (2) the observation that states who link state and federal budgeting seem to provide the federal government better forecasts. Evidence is not presented.

Gordon R. Trapnell examined Medicaid forecasting in the early 1990s and produced two reports (Trapnell, 1991; Trapnell, 1994). The 1991 study reports empirical findings. It serves two purposes, one is to explain particular forecast errors occurring in 1991 and 1992 (as anticipated in 1991). The other is to provide some insight into the federal use of state forecasts. While this discussion reveals some familiarity with particular practices of some states, it does not show comparison of actual practices and their forecasting casting consequences among the states. Trapnell's data collection method is not revealed, it appears that he relies primarily on information already in the hands of HCFA. His observations regarding state practices are as follows:[4]

- Variation in forecasting accuracy may relate to composition of Medicaid beneficiary enrollment.
- State legislators may choose to implement new polices that are underestimated, that is, where political pressure for policies is high in relation to the determined costs.
- States may defer spending at the end of a state fiscal year to ensure that state fiscal year estimates are correct. This can happen because many states budget on a cash basis rather than an accrual basis.
- Data available for forecasting in some states may be of poor quality or may not be reconciled with actual expenditure experience.
- Past federal action may discourage states from revealing their true estimates. In particular, in 1982 the federal government penalized states whose actu-

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[4] Trapnell attributes some of these observations to McKusick's study.

al expenditures exceeded their forecasts. As a consequence, states may be motivated to overstate their estimates.

- There is wide variety in the sophistication of state forecasting from "trended forward total aggregate spending by type of service" to "fully specified econometric model . . . . refitted quarterly."
- Only a few states fully disaggregate data by the type of service and type of beneficiary.
- Locus of responsibility varies among the states, with Medicaid agencies preparing some forecasts, while budget officials preparing others.
- There is "some correlation between how well officials understood the programs and the details incorporated in the cost estimates."
- State forecasts improve as the horizon between forecast and the end of the fiscal year diminish.
- States may not reconcile state and federal fiscal year reporting (most state fiscal years are from July to June, while the federal fiscal year is from October to September).

Table 2				
Region 1	**Region 2**	**Region 3**	**Region 4**	**Region 5**
Connecticut	New Jersey	D.C.	Alabama	Illinois
Maine	New York	Delaware	Florida	Indiana
Massachusetts	Puerto Rico	Maryland	Georgia	Michigan
New Hampshire	Virgin Islands	Pennsylvania	Kentucky	Minnesota
Rhode Island		Virginia	Mississippi	Ohio
Vermont		West Virginia	North Carolina	Wisconsin
			South Carolina	
			Tennessee	
Region 6	**Region 7**	**Region 8**	**Region 9**	**Region 10**
Arkansas	Iowa	Colorado	American Samoa	Alaska
Louisiana	Kansas	Montana	Arizona	Idaho
New Mexico	Missouri	North Dakota	California	Oregon
Oklahoma	Nebraska	South Dakota	Guam	Washington
Texas		Utah	Hawaii	
		Wyoming	Northern Mariana	
			Nevada	

Trapnell's analysis of state variation is limited to two paragraphs of his report in which he compares regional aggregate variation between the HCFA-37 and HCFA-64 reports. He finds that states in Region 1 (states in each region are shown in Table 2) consistently underestimates its expenditures, states in Region 2 generally overestimate expenditures and states in Region 9 are usually very accurate. Trapnell's report makes no effort to account for these variations in accuracy. However, the most obvious characteristic of regions Trapnell mentions as having consistent patterns of accuracy are that they are dominated by a single state. New York accounts for about 85% of federal expenditures in Region 2 and California accounts for a similar amount in Region 9. In Region 1, Massachusetts[5] accounts for about

60% of federal expenditures. It is likely that the explanation for the various forecasting results in these three regions will be found at these three states.

Michele Insco of the Colorado state government conducted a Medicaid budget survey and circulated results to participating states in May, 1992 (Insco, 1992). This study consists of charts demonstrating factors that might affect forecast accuracy or expenditure values. Some variables charted include: state population, percent change in Medicaid expenditure from FY 91 to FY 92, characteristics of the Medicaid program including various policy factors of current interest in 1992, basis of accounting, and beginning/ending dates of state fiscal year. Some of the characteristics reported include the percent of poverty at which pregnant women and certain children meet eligibility criteria, experience with Boren

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[5] Massachusetts has two Medicaid agencies, the smaller of which is about 2% of the program. This analysis excludes the smaller agency.

Amendment lawsuits,[6] percentage of births in the state covered by Medicaid, coverage of certain optional populations, etc. There is no accompanying written report to interpret these charts. By implication, these variables are thought to bear a relationship to expenditures and forecast accuracy.

The Human Services Finance Officers sponsored a survey of Medicaid budget estimation methods by Deborah J. Lower (1993). Lower reports that her survey is an extension of the Insco survey and is aimed at "determining what techniques were being used in other states to assist them in responding to legislative and executive branch questions." Lower surveyed the 50 US States and D.C., and reports a response rate of 84% (43 states). Lower's study focuses on identifying practices rather than determining sources of variation. Lower does not attempt to evaluate the relationship between these practices and forecast success. Practices she finds are as follows.

General:
- States use their own forecasts as compared with contracting out forecasting functions.
- Staff time required to complete the HCFA-37 ranged from 0.1 to 15 FTE and averaged at 1.6 FTE. (The phrasing of this question appears to limit the this response to completion of the form, and may exclude time required for forecasting.)
- The HCFA-37 may be completed in differing categories than state budget forecasts.
- Technical background of staff completing the HCFA-37 or related forecasts includes actuarial science, accounting, budget, statistics, program/policy analysis, economics, management analysis and demographics.
- Budget office staff ranged from 1 to 44 employees and averaged at 7.8 FTE.
- Primary responsibility for the Medicaid budget is with budget or finance agencies in 17 states and program or departmental administrators or staff 25 states.
- Twenty-six states report formal relationships between budget and finance staff and program staff.
- Program staff have access to expenditure data in 35 states.

- Some states report that program staff do not have adequate technical skills for forecasting.
- States report that Medicaid accounts for 4% to 52% of state budgets, averaging at 15.96%.
- Forty states report the existence of written gubernatorial guidance in budget preparation.

Caseload Projections:
- Thirty-seven states use data concerning eligibility (enrolled beneficiaries).
- Thirty-one states evaluate population categories.
- Twenty-seven states evaluate federal mandates for impact on enrollment.
- Twenty-three states use "program specific information."
- Five states evaluate the impact of "retroactive eligibility."[7]
- Twenty-eight states report that they forecast based on cash data (expenditures on date of claims payment).
- Eight states report that they forecast based on accrual (service date) data.
- Four states report use of both cash and accrual data.
- Six states report lack of access to "extract data."
- Lag time between service date and payment date is variable between states and between service categories.
- The predominant periodicity of data is monthly.
- The average length of a forecasted data series is 5 years.

Utilization
- Nineteen states report estimating utilization directly from enrolled beneficiaries.
- Twelve states report using an intermediate determination of service recipients.
- Eleven states report use of both techniques.
- Eighteen states use seasonal adjustments for some services.

Price Level
- States uses price indexes such as CPI or local indexes.
- States evaluate the impact of lawsuits.
- Historical patterns may not be evaluated.
- Thirty-seven states evaluate price level change by service type.
- Twenty-one states evaluate price level change

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[6] The Boren Amendment is language in Title XIX of the Social Security Act that allows states to pay institutional health care providers for efficient delivery of health care. It is widely held that the amendment was originally passed to allow states to avoid paying excessive amounts to hospitals and nursing homes. However, courts have interpreted it to prohibit states from paying hospitals and nursing homes too little. The Boren Amendment was repealed in 1997.

[7] Retroactive eligibility is the awarding of eligibility for a period that is in the past.

by eligibility category.

- Eight states evaluate price level change by other demographic categories.

Frequency of forecasts:

- Sixteen states report updating forecasts quarterly.
- Ten states report updating forecasts "as needed."

Software Usage includes:

- Spreadsheets (Lotus, Excel, Quattro Pro)
- Statistical software (SAS, SPSS)
- Forecast software (Forecast Pro)
- Mainframe forecasting programs (five states)

Program features:

- Fifteen states report no HMO enrollment.
- Other states report enrollment from 553 to 384,377 (Lower does not provide bases for percentage calculations).
- Twenty-two states report involvement in Boren Amendment lawsuits.
- Of thirty-two states reporting data, the percentage of births reimbursed through Medicaid ranged from 14% to 56% and averaged at 36.4%.

Data sources used by states to estimate impacts of new policies include:

- Program information (41 states)
- Information from other states (40 states)
- Census data (36 states)
- Insurance company consultation (14 states)
- Providers, actuaries, health or research data, and historical patterns.

Difficulties states report include:

- Last minute program and policy changes.
- Accuracy of population growth estimates
- Accuracy of utilization estimates.
- Budgetary constraints (state restrictions vs. federal mandates).
- Data validity.
- Technological advancements.
- Variation in lag between service date and payment date.
- Retroactive adjustments.

It is difficult to compare these empirical studies because of the small number of agencies studied and differences in specific matters observed. Yet, some topics persist. McKusick, Executive Office of the President (EOP), Insco, and Lower look into whether forecasts concern cash expenditures or intermediate accruals, and

each finds variation in state practices. McKusick, EOP, and Lower find variation in staff capacities. McKusick and Trapnell find a relation between Medicaid forecasting and the political environment. McKusick, Trapnell, and Lower find variation in techniques used, degree of data disaggregation, data quality, and locus of forecasting responsibility. Also, they find that many states attempt to account for policy making that affects Medicaid expenditures. McKusick and EOP find that some states treat federal forecast reporting differently than state purpose forecasting.

On most commonly discussed matters, findings are consistent across the various studies. It is not possible to determine change over time. For example, McKusick's data are too vague and his sample too small for comparison with Lower.

NORMATIVE APPROACHES TO MEDICAID FORECASTING

Three HCFA guidelines for forecasting are examined: (1) Charts from a presentation on forecasting, (2) normative guidelines in "Better Management for Better Medicaid Estimates" (1991), and (3) HCFA-37 reporting expectations.

HCFA (1990)[8] recommends structuring the Medicaid forecast using of the formula:

$$E(y+1) = (1 + P) \text{ x } (1 + U) \text{ x } (1 + C)$$

or

$$E(y+1) = E(y) \text{ x } (1 + -P) \text{ x } (1 + -U) \text{ x } (1 + -C)$$

where, $E(y+1)$ is the future year expenditure, P is the projected price, U is the projected utilization,[9] C is the projected enrollment of beneficiaries,[10] $E(y)$ is the current year expenditure, and $-$ denotes year to year change calculated as $((\text{Year 2}) - (\text{Year 1}))/(\text{Year 1})$. These formulae are sometimes called the PUC model (**P**rice, **U**tilization, and **C**aseload),[11] Sometimes the first version is called the direct method and the second is called the incremental method. They provide a structure for calculat-

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[8] These guidelines are demonstrated in charts and tables, with limited narrative discussion.

[9] With Medicaid, utilization can have several meanings. HCFA offers two definitions: Service unit per enrolled beneficiary and claims frequency. HCFA recommends the earlier definition. This utilization is a combination of two factors: ratio of beneficiaries using services (sometimes called "recipients") to beneficiaries enrolled and ratio of service units to recipients. Sometimes "utilization" is used to refer to one or the other of these component concepts.

[10] HCFA recommends that caseload be measured in average monthly enrolled beneficiaries per year.

[11] Sometimes, owing to a rearrangement of the variables, this model is called the CUP model.

ing expenditures within each expenditure category. Although HCFA suggests that the direct method is more accurate, some of their material seems to recommend the use of the indirect method; perhaps because it is thought that the it is less difficult to find data supporting the indirect method. HCFA also recommends adjusting forecasts to reflect cash flow factors (lag between service date and payment date), decomposition of data into groups of homogeneous sub-populations, calculation of marginal-to-core ratios,[12] and the use of demographic data to help identify marginal and core groups.

Normative guidelines in "Better Management for Better Medicaid Estimates" (1991) are primarily directed at HCFA. State oriented recommendations include: requiring states to provide baseline (no policy change) estimates, listing of assumptions underlying these baseline estimates, and requiring separate estimate of expected changes. It is not clear whether the framers of these guidelines intend that states will make better forecasts using these guidelines, or merely that HCFA will have a better change to discovering poor forecasts.

The HCFA-37 does not explicitly require states to use any particular approach for forecasting. Nevertheless, the form calls for the state to report on various forecast elements in a manner that is consistent with the direct method PUC model along with separate reporting of base line and expected changes. To fulfill HCFA's reporting requirements, the state must either structure its forecast to be consistent with the PUC model or it must compute PUC model variables from its actual forecast. Some states refer to this latter option as "backing into" the HCFA forecast. Over time, the HCFA-37 has also added schedules to capture data on special issues of interest to the federal government. For example, at some times HCFA-37 reporting has included extensive reporting on the use of disproportionate share adjustments to hospitals.[13] Sometimes these schedules involve reporting anticipated effects of recently passed federal legislation. The structure of these schedules may or may not reflect normative views concerning how HCFA

thinks states should estimate these policy changes.

Trapnell (1991) discusses a variant of the PUC model that includes the marginal-to-core ratio. This model disaggregates Medicaid into 29 service categories, which are further decomposed into five components:[14]

$$E(y+1) = E(y) \times (1 + P(y+1)) \times (1 + U(y+1)) \times$$
$$(1 + M \times C(y+1))$$

where, $E(y+1)$ is the future year expenditure, $E(y)$ is the current year expenditure, $P(y+1)$ is the projected change in price, $U(y+1)$ is the projected change in utilization, $C(y+1)$ is the projected change in enrollment of beneficiaries, and M is the marginal-to-core factor. Some of these components may require separate calculation for each enrollment category. Other components are essentially static, or are estimated from sources outside of HCFA.

Trapnell implies that use of this or a similar model would be the best method for states to forecast Medicaid expenditure. However, elsewhere he says that the most important elements of good state forecasting are use of a skilled and attentive staff working within a comprehensive analytic framework. The PUC model serves as the analytic framework.

Trapnell's "Best Practices Guide for Preparation of Medicaid Budget Estimates," (1994) presumably reflects his findings in his 1991 study.[15] Most of Trapnell's advice is general with no special application to Medicaid. For example, he advises agencies to avoid expectations of accuracy that cannot be met and to be sure that outputs address client officials data needs. He recommends evaluating forecasts through production of numerous outputs that can be compared with actuals, comparing forecasts with earlier forecasts of the same series, and making frequent forecast updates. He recommends usual forms of pre-forecasting such as disaggregating data and adjusting for non-recurring events, missing data, and lag time between accrual of liabilities and cash transactions. He recommends optimizing the use of knowledge by such actions as establishing a relationship with program staff; distinguishing between matters that must be forecast and those that can be know; and distinguishing between the near future, about which forecasters may have special knowledge, and the distant future, about which they know considerably less.

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[12] Marginal to core refers to an expectation that incremental element of enrollment will have a different utilization pattern than the base (core) enrollment. This view can involve several unrelated matters. First, newly enrolled beneficiaries may have a different usage pattern. It may take awhile for them to establish relationships with medical care providers, so their usage may be lower. On the other hand, they may be more urgent to obtain services that have been postponed while they had no health financing resources, so they may use more services. Second, it is likely that there will be a lag between enrollment and payment for services. As the federal government budgets on a cash basis, this lag appears as a reduced cost in the first year of service.

[13] Disproportionate share hospital adjustments have been a source of friction between states and the federal government since the early 1990s.

[14] Notation is slightly changed.

[15] The author has direct knowledge that Trapnell made site visits to other states beyond those discussed in the 1991 study.

Trapnell raises considerable concern over data used in Medicaid forecasting. This concern reflects a lack of faith in Medicaid data and health care data in general. Data concerns include completeness, reliability, validity and timeliness of data. He suggests several methods of verifying data validity, by which he means that the data is what it purports to be. Data can be validated by reconciling with accounting records, by examining the process of its production when produced by the Medicaid agency, and by examining the documentation of its production and meaning when produced by others.

Trapnell recommends the use of an analytic model to assure that the forecast addresses all elements of expenditure. The model he recommends is a another variant of the PUC model.

Trapnell lists nine special features of Medicaid that make forecasting Medicaid expenditures harder than other health care expenditure forecasting these are:
1. Criteria for Medicaid eligibility are very complex.
2. Many beneficiaries are eligible and enrolled only for short periods.
3. Some individuals become eligible for Medicaid in part because they have high medical bills, so they can be expected to continue to have high medical bills.
4. Medicaid policy making leads to frequent changes in payment levels.
5. Documentation of expenditures is incomplete.
6. There are inconsistent definitions of data in accounting and claims processing.
7. There are constant changes in the program resulting from federal and state legislation, new regulations, administrative initiatives, and court decisions.
8. The political process leads to a random patterns of interventions in payment rates and other program features.
9. Medicaid agencies need to be able to explain their forecasts to officials and interest groups.
Consequently, he recommends that the Medicaid forecast should:
1. Be easy to understand and test for reasonableness.
2. Be easy to adjust for changes.
3. Be easy to incorporate ad hoc adjustments.
4. Be easy and inexpensive to re-estimate using newer data.
5. Be easy to change to accommodate program changes.
6. Produce numerous outputs to compare with actual experience.
7. Produce outputs that fulfill forecast users' needs.
Trapnell also recommends that:

- Medicaid forecasting methodology should be able to detect frequent unexpected shocks to the expenditure system;
- Forecasting should be insulated from political interference;
- Staff should be assigned to forecasting as their full main work function, and
- The loss function that forecasters should minimize is the consequences of forecast error. Trapnell assumes that there equally negative consequences for positive and negative errors, thus, he recommends a symmetrical loss function.

Trapnell does not recommend any specific forecasting technique. He recommends against the use of complex econometric models or "black box" techniques, excessive reliance on high technology, or reliance on any single technology. Positive recommendations include use of simple techniques, fitting techniques to the data and the nature of the problem, and allocating resources for forecasting based on criteria of importance and difficulty.

The National Association of State Budget Officers (NASBO) issued a brief guideline on Medicaid estimation practices (National Association of State Budget Officers, 1991). NASBO offers the general model:
"Simply put, a state's expenditure on Medicaid is the product of the number of people using its services (caseload) and the cost of providing those services (price). Several variables must be accurately forecast for the overall estimate to be correct: the economic environment in which the Medicaid program operates, the eligible population, the types and prices of services used, the participation rate among eligible participants, policy initiatives, and the federal match rate.
This guideline lists nine recommended practices:
1. Include the budget agency, the Medicaid agency, and the legislative fiscal agency in the development of a Medicaid spending estimate. This is labeled a "general practice" which serves consensus building.
2. Ensure that the economics of the spending estimate are consistent with those of the revenue estimate. This practice is of greater concern at turning points when revenue and spending assumptions may become disconnected.
3. Ensure that the population assumptions used in the Medicaid estimate are consistent with overall state demographic trends. Various state agencies should communicate to assure that estimates of related coverage groups are adequately coordinated.

4. Maintain good data. Recommended data elements include users, their attributes, and the services they use.
5. Establish the price of services before the fiscal year begins. The aim is to remove uncertainty. "In general, states will find it easier to develop accurate spending estimates if the cost of services is set before the fiscal year begins. States that reimburse for actual costs incurred are at a disadvantage in this respect."
6. Account for caseload changes associated with outreach efforts. This concern involves the interaction between various programs and the possibility that outreach for one program will affect another program.
7. Track federal and state legislation and regulations. This practice concerns the frequent changes in policies that affect Medicaid spending.
8. Know the federal match rate[16] and the likelihood of it changing. This concern involves the distribution of costs between federal and state governments. Forecasting, in this sense, is oriented towards the costs to the state.
9. Monitor the estimate. Even good estimates can be wrong. Medicaid agencies should produce monthly or quarterly reports that compares Medicaid spending with the original estimates. Deviations should be explained, so that forecasting can improve over time.

Recommendations 2 and 3 may improve accuracy if the facilitate communication between forecasters who have different perspectives on the state economy. Recommendation number 4 is similar to one of Trapnell's chief concerns, but Trapnell provides more explicit advice concerning its implementation. Where states are able to comply with recommendation number 5, they eliminate the need to forecast what they can know. Recommendation number 6 appears to be idiosyncratic to particular concerns of the early 1990s; however, it also seems to reflect Trapnell's more general principle to maximize the use of knowledge. HCFA, Trapnell and NASBO all show considerable concern over the impacts of policy making as discussed in recommendation 7. Recommendation number 8 involves monitoring, not

forecasting. It also reflects Trapnell's principle to maximize use of knowledge.

The Congressional Budget Office uses of a model similar to HCFA's (Muse, 1993). Muse's concern is not to describe the forecasting of the ongoing program, but the method of estimating costs of program changes. The particular changes he is concerned about involve preventive child health. He recommends the use of the following model:[17]

$$-T = -C \text{ x } -P \text{ x } -U + -A - O$$

where, − means "change in," T is total payments, C is population, P is price, U is utilization, A is administrative costs or savings, and O is offsets. Muse's notation is confusing. If one assumes that −C, −P, and −U are ratios[18] as discussed by HCFA or Trapnell, then this formula needs the modification of including the base reimbursement in the right hand and the deletion of the change symbol on the left hand side of the formula; let B_1 = the base expenditure level for medical care and B_2 = the base expenditure level for administration:

$$T = B_1 \text{ x } (1 + -C) \text{ x } (1 + -P) \text{ x } (1 + -U) + B_2 + -A - O$$

or

$$-T = B_1 \text{ x } -C \text{ x } -P \text{ x } -U + -A - (O + B_1)$$

If one assumes that −C, −P, and −U are numbers in their original dimensions, rather than ratios, then a much more complex formula would be required:

$$-T = -C \text{ x } P \text{ x } U + -P \text{ x } C \text{ x } U + -U \text{ x } C \text{ x } P + -A - O$$

where, C, P, and U are the population, price, and utilization levels *after* the policy change and −C, −P, and −U are the changes that led to these new levels. Muse's multiplication of changes by changes omits the effect of changes on the base program, which is likely to be the main effect of policy changes except in the rare circumstance that new beneficiaries getting new services and no old beneficiaries or old services are involved.

Muse's formulation adds two important considerations, impact on administration and offsets. These concerns are more pertinent with program changes where administration may not already be provided for and offsets may have a direct budgetary effect. Presumably, when forecasting the ongoing program, administration is already included in the budget and can be estimated directly. This principle is reflected in the HCFA-37 form, which has a separate section for administrative expenses. Offsets resulting from the base program are reflected

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[16] "Match rate," is one of several terms used to refer to the proportion of Medicaid costs paid by the federal government. Other terms are FMAP rate, FFP, federal share, match, etc. This rate is published in the *Federal Register* in January or February each year with an effective data of the following October 1. Federal Funding Information for States (FFIS), an offshoot of the NASBO, monitors matching rates and forecasts changes prior to their official publication in the *Federal Register*.

[17] Notation is modified.
[18] −A would still be a fully dimensional number.

in the base and do not require separate estimation.

Muse also provides considerable discussion of data quality. This discussion focuses on three data sources, the Current Population Survey, the "Statistical Report of Medical Care: Eligibles, Recipients, Payments, and Services," (also known as the HCFA-2082 report), and the Medicaid Statistical Information System (MSIS). Muse discusses the uses and weaknesses of these data sources. This discussion is not specifically normative; however, it exhibits the same sort of concern raised by Trapnell and NASBO, the forecaster/estimator must attend to data quality.

Of special concern for estimators of new policy impacts is an estimate of participation level for newly eligible individuals. For the base program, participation level is not a significant issue except where forces, such as outreach, might be changing this level. For newly eligible individuals, the estimator needs to anticipate the degree to which this new population will seek to obtain services. Muse says that this question is not easily resolved.

Muse raises several objections to including estimates of offsets in projecting new program costs. Two major reasons for this objection are (1) uncertainty – evidence may be weak, elements of cost may be omitted from calculation of offsets, etc.; and (2) lack of impact – the beneficiary of the offset may be someone other than the entity who must make the cash outlay to obtain the offset. In estimating and forecasting for budgets, one must remain aware of the cash outlay consequences of forecasted events.

Muse also observes that estimators should engage in reality checking; that is, comparing calculated results with the views that people might expect in the real world.

The Joint Legislative Audit and Review Commission of the Virginia General Assembly (JLARC) has reviewed Virginia's Medicaid forecasting in 1992 and 1997.[19] In reports of these studies, JLARC recommends six criteria for forecast models and five criteria for a forecasting process (1991; 1997). These criteria are shown in Tables 3 and 4.

Table 3: Criteria for Forecast Models
1. Model assumptions are clearly understood by participant and periodically reviewed.

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2. Variables used in models' equations are sufficient, accurately measured, and the best information available at the time.
3. Equations are mathematically sound and tested to ensure mathematical precision.
4. Different regional conditions are taken into account sufficiently.
5. Forecast errors are analyzed on an ongoing basis.
6. Forecast models are reviewed and documented well, including any judgmental or policy adjustments

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Table 4: Criteria for Evaluating Forecasting Process
1. The degree of uncertainty associated with forecasts should be understood by process participants.
2. The agency making forecasts should have the data and personnel required to generate a good estimate.
3. Regular reports on actual expenditures and their variance from forecasts should be developed and available to agency staff and interested external participants, as appropriate.
4. The process should maintain the flexibility to respond to dramatic changes in recipient utilization and program expenditures by revising the forecasts.
5. The process should include a mechanism requiring some level of expanded review of the forecasts. (Expanded review means review by people not involved in initial forecasting, such as an external panel.)

Except for criterion 4 of the forecasting process, these are not especially focused on Medicaid. They might be applied to any forecasting problem. Most of these appear to be a subset of more extensive criteria used in evaluating revenue forecasting (Joint Legislative Audit and Review Commission, 1991).

Many of these normative guidelines support the goal of forecasting accuracy. For example, JLARC recommends that formulae be valid and NASBO, among many others, recommends the use of good data. Yet, many other recommendations concern other matters. Trapnell recommends against unrealistic expectations of forecast results and JLARC similarly recommends that forecast participants should understand the degree of uncertainty associated with the forecasts.

RELATION TO REVENUE FORECASTING

Revenue forecasting literature suggests a tendency for an asymmetrical forecasting loss function, favoring a cushion between total revenue and total expenditures (Rodgers and Joyce, 1996). The rationale is that the penalty for overestimated revenue is greater than the

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[19] (1) The author was the budget director at the agency that administers Medicaid in Virginia in 1991. (2) Other states have conducted similar studies; however, there is no systematic method for finding such reports.

penalty for underestimated revenue. Similar reasoning would have states overestimate expenditures in major expenditure categories such as Medicaid. Surpluses are less damaging and, in many states, can be reprogrammed at the end of the fiscal year to offset deficits elsewhere.

However, cushioning budgets through overestimation of Medicaid expenditures differs from underestimation of revenue in one important respect. It changes the locus of control over the cushion. Unappropriated revenue – which is the status of unexpected revenue resulting from greater receipts than budgeted – is, generally, controlled by the central administrative agencies or the legislature. Over-appropriated funds, resultant from appropriating funds to Medicaid agencies based on overestimated forecasts, are controlled by line agencies. As there is a natural distrust between central administrative agencies and line agencies, it is unlikely that states would intentionally allow line agencies to control surplus funds.

Nevertheless, the line agencies, who submit the HCFA-37, may be motivated to seek surplus funding as a cushion against their own forecast error. There would be no advantage for these line agencies to make separate lower estimates for HCFA.

Trapnell argues that agencies might find differing but equally negative consequences for overestimating and underestimating expenditures. McKusick proposes that there is lower penalty for underestimation. On the other hand, Muse's rationale for not counting offsets in estimating program changes suggests a higher penalty for underestimation.

The conflict concerning presence and direction of bias can be explained by several factors. First, McKusick's study reported in 1980 reflects a relatively small Medicaid program. With this small program, political decision making may be more important than financial risk, as is also suggested in some of Trapnell's discussion. In their effort to maximize their distribution of benefits, elective officials may consider a small risk of over expenditure to be less important than their ability to distribute benefits to more people. Still, neither McKusick or Trapnell found empirical evidence of actual underestimation.

SOME HYPOTHESES

These studies provide little explanation of relative forecasting accuracy. However, they are a source for many hypotheses about Medicaid forecasting. In general these hypotheses are found by extrapolating the objective of normative guidelines or the reasons for inquiry in empirical studies. To a large degree, where there is explanatory discussion, most of the views agree with each other. In a few cases, as with the matter of asymmetrical loss function, there is disagreement. Where there is disagreement, the cited sources may not all support the form of the hypothesis expressed here. Following are hypotheses that can be extracted from this body of literature:

1. States' loss functions will be asymmetrical with a preference for overestimation (Trapnell, McKusick, Muse). McKusick proposes a preference for underestimation. Trapnell offers conflicting views, (1) he argues that the political environment equally punishes over- and underestimation, (2) he points out that past federal behavior may create a bias for overestimation, and (3) he proposes that underestimation bias arises from frequent selection of policy initiatives that are underestimated.
2. States manipulate fiscal year end results to improve forecasting results within state budgeting. By implication states whose fiscal year ends coincide with federal fiscal year ends will appear to be more accurate (EOP, Trapnell, Insco).
3. Forecast models result in more accurate forecasts when they:
    a) Account for delivery of medical care on service date with lagged transformation to cash payment date (McKusick, Insco, Lower, Trapnell, Muse).
    b) Decompose data into homogenous service and enrollment categories (McKusick, Trapnell, Lower).
    c) Reflect the PUC model or an extended version of the PUC model (HCFA, Trapnell, Muse, NASBO).
    d) Relate enrollment to economic conditions (McKusick).
    e) Relate service utilization with service supply (McKusick).
    f) Decompose series into baseline and policy events (McKusick, Trapnell, Lower, EOP, HCFA, NASBO, Muse, JLARC).
    g) Decompose utilization into recipients per beneficiary and units of service per recipient (Lower).
    h) Relate price estimates to price indexes (Lower, Trapnell).
    i) Account for federal matching rates (NASBO).
    j) Account for regional variation (JLARC).
4. Forecasting accuracy is affected by:

a) Staff
   i) Skill (EOP, Lower, JLARC).
   ii) Quantity (McKusick, Lower, JLARC).
   iii) Dedication to the forecasting function, as opposed to part-time forecasting (Trapnell).
b) Forecaster understanding of:
   i) Forecast model assumptions (JLARC).
   ii) The Medicaid program (Trapnell).
c) Forecaster access to program staff (Trapnell).
d) Data:
   i) Quality (McKusick, Trapnell, Lower, NASBO, Muse, JLARC).
   ii) Sources (Lower, Trapnell, Muse).
   iii) Periodicity (monthly, etc.) (McKusick, Lower).
   iv) Series length (Lower).
e) Setting rates prior to forecasting (McKusick, Trapnell, NASBO).
f) Composition of the Medicaid program (McKusick, Trapnell, Insco, Lower).
g) Update frequency (Trapnell, Lower).
h) Length of forecast horizon (Trapnell).
i) Decomposition of forecast into near future and distant future (Trapnell).
j) Whether seasonality is examined (Lower).
k) Use of software:
   i) Spreadsheets (Lower).
   ii) Statistical software (Lower).
   iii) Forecast software (Lower).
l) Use of pre-forecast data editing (Trapnell).
m) Insulation of forecasting from politics (Trapnell).
n) Allocation of forecasting resources to problems (components) according to difficulty and importance (Trapnell).
o) Use and quality of forecast evaluation (Trapnell, NASBO, JLARC).

5. Intra-governmental forecasting factors that affect forecasting accuracy include:
   a) Locus of primary forecasting responsibility – Medicaid agency or other state agency (McKusick, Lower).
   b) Cooperation between forecasting bodies (Lower, NASBO, JLARC).
   c) Whether there is coordination between Medicaid forecasting and other state forecasting (NASBO).
   d) Use of "expanded review" (JLARC).

6. Accuracy is improved when forecasting techniques are:
   a) Simple (Trapnell).
   b) Not "black box" (Trapnell).
   c) Fit to the nature of the problem (Trapnell).
   d) Fit to the quality of the data (Trapnell).
   e) Easy to use (Trapnell).
   f) Capable of detecting the effects of policy shocks (Trapnell).

7. Forecasting accuracy is not associated with the use of any particular forecasting techniques (Trapnell). However, McKusick suggests the opposite, implying that more sophisticated techniques may result in greater accuracy.

8. When multi-stage forecasts are used, accuracy of later stage forecasts depend on the accuracy of earlier stage forecasts (Trapnell).

9. Large policy events affect forecasting accuracy. In particular, forecasting accuracy is affected by:
   a) Boren Amendment Lawsuits (Insco, Lower).
   b) Federal policies concerning pregnant women and children (Insco, Lower).
   c) State initiatives involving Disproportionate Share Hospitals (Trapnell, EOP).

10. Perceived forecasting importance affects accuracy and bias. In particular:
   a) The relative size of the Medicaid program to other state programs affects accuracy. As the program increases in relative size, accuracy becomes more valued (McKusick, Lower). McKusick does not offer this view, instead it is implied in his observation of low concern for accuracy in 1980, when Medicaid programs were comparatively small components of state budgets.
   b) The centrality of forecast preparation to state budgeting (McKusick, EOP). EOP observed that states who prepare their federal budget forecast in connection with their state budget forecast appear to submit more accurate federal forecasts. However, it is the current author's observation that this relationship may be complex. If state budget forecasting is biased for political reasons, independent forecasts may be more accurate.
   c) The relative share of expenditures paid by state funds, as compared with federal funds, affects forecast accuracy (NASBO). Where states pay a higher share – that is, have a lower match rate – they will be seek greater forecasting accuracy.

Table 5

	States		Federal	
Year	UnwAvg	CumAvg	UnwAvg	CumAvg
1982	-4.7%	-4.7%	21.6%	21.6%
1983	-5.3%	-5.0%	12.8%	17.2%
1984	-4.9%	-5.0%	54.7%	29.7%
1985	-3.6%	-4.6%	53.7%	35.7%
1986	-0.3%	-3.7%	-0.4%	28.5%
1987	8.1%	-1.8%	-0.2%	23.7%
1988	8.9%	-0.2%	9.5%	21.7%
1989	6.6%	0.6%	13.1%	20.6%
1990	8.4%	1.5%	-2.8%	18.0%
1991	23.8%	3.7%	43.9%	20.6%
1992	35.5%	6.6%	43.2%	22.6%
1993	6.8%	6.6%	46.0%	24.6%
1994	-6.2%	5.6%	78.1%	28.7%
1995	-1.5%	5.1%	7.9%	27.2%
UnwAvg. = Unweighted average.				
CumAvg. = Cumulative average.				
Percent error 24 months prior to fiscal year end.				

Table 6				
	States		Federal	
Year	% <=0	Cum. %	% <=0	Cum. %
1982	71.4%	71.4%	40.0%	40.0%
1983	79.6%	75.5%	0.0%	20.0%
1984	74.0%	75.0%	20.0%	20.0%
1985	78.0%	75.8%	16.7%	19.0%
1986	46.0%	69.8%	83.3%	33.3%
1987	20.0%	61.4%	66.7%	39.4%
1988	22.0%	55.7%	16.7%	35.9%
1989	22.0%	51.5%	33.3%	35.6%
1990	22.0%	48.2%	66.7%	39.2%
1991	8.0%	44.2%	33.3%	38.6%
1992	4.0%	40.5%	16.7%	36.5%
1993	38.0%	40.3%	50.0%	37.7%
1994	80.0%	43.4%	0.0%	34.7%
1995	62.0%	44.7%	0.0%	32.1%

EVALUATION OF HYPOTHESES

These hypotheses are too numerous to fully evaluate in this paper. Further, for many operationalization may be problematic. The following discussion discusses evidence concerning some of these hypotheses:

Hypothesis 1: States will exhibit an asymmetrical loss function with a preference for overestimation.

Analysis of this hypothesis is based on data from the HCFA-37/HCFA-25 budget requests and the HCFA-64 accounting records for the years 1982 through 1995. Over this period, the longest horizon consistently available is 24 months before the end (12 months before the beginning) of the fiscal year. Data are divided into two groups, one for the 50 states,[20] and another for the 6 federal districts and territories. Errors are analyzed using the percent error [(Actual minus Forecast) divided by Actual]. As the forecast is subtracted from the actual, a negative error means the forecast exceeded actual expenditures.

As shown in Table 5, states have negative valued errors in 7 of 14 years, and positive valued errors in the remaining 7. Cumulatively, the error is negative for the first 7 reported years, and positive for the remaining 7 years. Table 6 shows that more than 50% of states have negative errors in 6 years, while they have positive errors in the 8; however, cumulative errors are negative in 8 of 14 years.

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[20] Massachusetts has two distinct programs, these are combined in this analysis.

These results appear to imply that state forecasting of Medicaid expenditures is unbiased. However, this understanding may be incorrect. Medicaid has experienced differing phases of policy activity. During the early 1980s, policy making activity was relatively low. However, in the mid-1980s the federal government began to engage in extensive Medicaid policy making, including several expansions of eligibility for children and pregnant women, welfare reform that expanded Medicaid eligibility, Medicare reform that extended Medicaid eligibility to low income Medicare beneficiaries, and broadening of the minimum coverage requirements for children. In part, the states responded to these changes by incorporating even more services under Medicaid – off loading the cost of those services from programs funded solely with state funds – and by using provider tax and/or donation programs that have the effect of increasing the effective federal share of total program costs. Most such policy making resulted in huge expenditure increases over very short horizons. It is unlikely that these policies would be reflected in forecasts discussed here.

Table 7 and Table 8 show comparative data at 12 months before the end of the fiscal year (the last forecast before any portion of the actual expenditures are experienced), The number of years with positive and negative errors is similar to those in Table 5 and Table 6 – 7 negative average errors and 7 positive (Table 7); and 8 years with more than 50% of states with negative errors and 6 with fewer than 50% (Table 8). However, the cumulative columns reveal a bias towards negative er-

rors. Table 7 shows only 5 years in which the cumulative errors are positive, as compared with 9 years of negative cumulative errors. Table 8 shows only 1 year where the cumulative percent of states with negative errors is below 50%. Over this 14 year period the cumulative percent of states with negative forecasting errors is 53.3%.[21]

These results are consistent with the broader view that budget officials are risk averse. Overestimation of expenditures serves the same ends as underestimation of revenue, to establish a cushion against higher risk error. While errors that lead to surpluses may be viewed unfavorably by those who could have allocated funds to other purposes. The alternative of shortfalls can lead to financial crisis. This analysis supports the view that Medicaid forecasters are more averse to financial crisis.

It is interesting that these results are not found with the federal districts and territories. These data demonstrate a bias for underestimation. The unweighted average forecast error for these six districts at the beginning of fiscal years is positive for 10 of 14 years with the cumulative average error positive 13 of 14 years (Table 7). While there are an equal number of years in which the majority of these districts make negative and positive forecasts at this horizon, cumulatively over 14 years, 47.6% of federal district forecasts overestimate expenditures (Table 8). Federal districts do not have the same bias towards overestimation as states, and they may be biased towards underestimation. No explanation of this alternative bias is available at this time.

Table 7				
	States		Federal	
Year	UnwAvg	CumAvg	UnwAvg	CumAvg
1982	-5.0%	-5.0%	-6.3%	-6.3%
1983	-2.1%	-3.5%	13.0%	3.4%
1984	-5.0%	-4.0%	33.3%	13.3%
1985	-2.0%	-3.5%	1.3%	10.3%
1986	0.2%	-2.8%	-4.0%	7.5%
1987	5.1%	-1.5%	0.6%	6.3%
1988	2.4%	-0.9%	8.8%	6.7%
1989	0.8%	-0.7%	-4.9%	5.2%
1990	2.9%	-0.3%	-3.5%	4.3%
1991	11.5%	0.9%	41.0%	7.9%
1992	4.8%	1.2%	38.5%	10.7%
1993	-4.1%	0.8%	43.8%	13.5%
1994	-4.3%	0.4%	24.8%	14.3%
1995	-0.1%	0.4%	1.3%	13.4%

[21] This result may be affected by beginning arbitrarily in 1982, the first year of data availability.

UnwAvg. = Unweighted average.
CumAvg. = Cumulative average.
Percent error 12 months prior to fiscal year end.

Table 8				
	States		Federal	
Year	% <=0	Cum. %	% <=0	Cum. %
1982	75.5%	75.5%	80.0%	80.0%
1983	73.5%	74.5%	20.0%	50.0%
1984	88.0%	79.1%	16.7%	37.5%
1985	58.0%	73.7%	33.3%	36.4%
1986	52.0%	69.4%	83.3%	46.4%
1987	30.0%	62.8%	66.7%	50.0%
1988	36.0%	58.9%	33.3%	47.5%
1989	42.0%	56.8%	66.7%	50.0%
1990	34.0%	54.2%	66.7%	51.9%
1991	22.0%	51.0%	33.3%	50.0%
1992	28.0%	48.9%	16.7%	46.9%
1993	84.0%	51.8%	50.0%	47.1%
1994	70.0%	53.2%	16.7%	44.7%
1995	54.0%	53.3%	83.3%	47.6%

Hypothesis 2: States manipulate fiscal year end accounting data to improve forecast outcomes.

State motivation for this practice rests with the fact that, in the case of Medicaid, the forecast coincides with the budget. State officials may be motivated to ensure that the actual expenditures coincide with planned expenditures. In the case of Medicaid, ordinary fiscal management may not be sufficient to attain such results. Most Medicaid expenditures are made through claims processing, not discretionary or quasi-discretionary expenditures. In most states, claims processing is automated. So, adjusting year end expenditures to match budget plans would involve causing claims processing to accelerate or decelerate.

Medicaid programs are operated by state agencies. Executives of these agencies are responsive to state officials, including state governors and state legislators, because they report to these officials. So, the motivation to appear correct would be a feature of state budgeting. There is no particular advantage of manipulating expenditures reported to the federal government to achieve the illusion of forecast accuracy. Presumably, the illusion is achieved by either delaying or accelerating payments in the last quarter of the fiscal year, with a mirror image change in expenditures in the next fiscal quarter. So, the illusion should appear in data from those states whose fiscal year coincides with the federal fiscal year, but should be absent from data with other fiscal years.

Table 9			
	Average Error	States	Obs.
States:			
April	6.55%	1	14
July	6.54%	46	643
Combined	6.54%	47	657
September	4.45%	1	14
October	5.46%	2	28
Combined	5.12%	3	42
Federal Districts	20.9%	6	84

To evaluate this hypothesis absolute percent error for each state are pooled across the 14 years and then averaged within groups for each fiscal year end. Federal districts are reported separately. The absolute error is evaluated because the direction of error is not at issue. The errors are pooled because of the low number of states whose fiscal year coincides with the federal fiscal year. There are 46 states with fiscal years beginning in July, 1 beginning in April (New York), 1 beginning in September (Texas), and two beginning in October (Michigan and Alabama). The federal fiscal year begins in October. The pooled observations are not independent, so no statistical analysis is attempted.

For the 47 states with fiscal years beginning more than a month off of the beginning of the federal fiscal year, the average absolute error for 647 separate fiscal years (Arizona is not reported for 1982) is 6.54%. If Texas (fiscal year beginning in September) is included with this group, the average drops to 6.50%. For the two states with fiscal years matching the federal fiscal year, the average absolute error for 28 separate fiscal years is 5.46%. If Texas is included with this group, the average drops to 5.12%. Thus, the range of difference between these errors is between 1.04% and 1.42% depending on which group Texas is included with. These results weakly support the view that states manipulate year end activities to create the illusion of budgetary accuracy.

Hypothesis 3: Forecasts are more accurate when forecast models more explicitly reflect the elements generating the forecasted series.

Data are not available to evaluate each of the 10 sub-hypotheses enumerated. However, two sub-hypotheses can be evaluated. The first sub-hypothesis specifies that forecasts will be more accurate when states explicitly account for the transformation between service date and payment date. This sub-hypothesis is evaluated using the pooled 14 year absolute forecast errors as discussed with the second hypothesis. Identification of states who explicitly account for service date to payment date transformation is found in data determined by Lower. Results are shown in Table 10. States who focus on "payment date" do not attempt to evaluate service date (accrual) events, while those who forecast "service date" do. (No federal districts are reported in the Lower study.) A third group of states evaluate service date data some times. Based on these pooled errors, there is no reason to anticipate that accounting for the service date events improves forecast accuracy.

Table 10		
	Average Error	States
Payment Date	6.10%	28
Service Date	6.13%	9
Mixed	7.61%	6

However, it may be that the time period between the earlier forecasts and the date of the Lower survey invalidates the evaluation using these pooled errors. Table 11 shows comparable results with errors pooled from 1992 through 1995. As with Table 10, there is no evidence that forecast models that account for service date events are more accurate than those that do not.

Table 11		
	Average Error	States
Payment Date	5.75%	28
Service Date	6.10%	9
Mixed	6.23%	6

The third sub-hypothesis specifies that forecasts made within the framework of the recommended PUC model will be more accurate than those that are not. This hypothesis is of special concern as HCFA requires states to produce and submit data on the HCFA-37 that reflects the PUC model, whether or not they use this model. If the hypothesis is incorrect, states may be required to conduct unnecessary analyses and forecasts for the sole purpose of completing arduous paperwork required by HCFA.

The evaluation of this hypothesis is based on the same 4 year pooled errors as used in Table 11. Identification of states that use the PUC model is based on pre-

liminary data from a survey of state Medicaid agencies occurring in 1997. At the time of this paper, the survey has received 35 responses out of 56 Medicaid programs. Results are shown in Table 12. Based on these results, there is no evidence that use of the PUC model improves forecast accuracy.

Table 12		
	Average Error	States
Use PUC	5.65%	13
Do not Use PUC	5.81%	20
Federal	8.97%	2

Hypothesis 4: Forecast accuracy is affected by numerous specific technical elements of the forecast.

Most aspects discussed here are still to be evaluat-ed. Figure 1 demonstrates the relationship between forecast accuracy and time. Each line demonstrates the change in forecast error over the period beginning with the first forecast submitted to HCFA and ending with the fiscal year end. Data do not always converge to zero because the HCFA-37 was not required to match the HCFA-64 (accounting data) for past periods prior to 1992. It is not very surprising that forecasts become more accurate as the forecast horizon diminishes. It is interesting how little accuracy improves over time in many years. The chart shows only minimal improve-ment in average error in forecasts for 1982 through 1986, 1994, and 1995. These results arise because of relative accurate forecasts at the longest horizons. A re-view of state specific data (not shown here) reveals that accuracy in earlier periods arises from the cancellation of forecast errors between states, and that there is a conver-gence towards forecast accuracy over time.

Percent Error By Months Before the End of the Fiscal Year
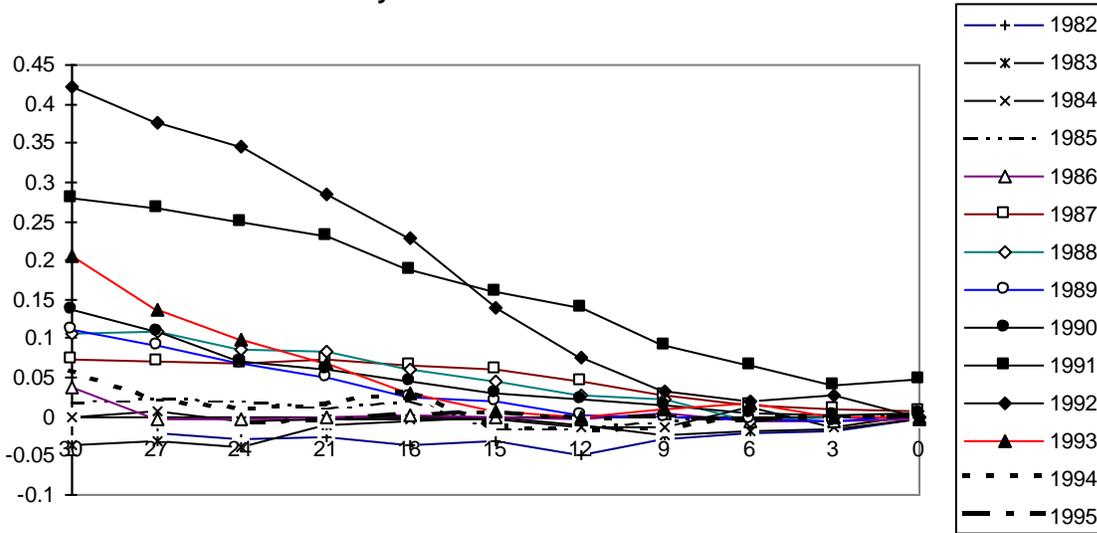
CONCLUSION

This paper is a interim report of research in pro-gress. The report shows that Medicaid forecast data can be used to evaluate applied forecasting. Some tentative conclusions include:

State forecasters use asymmetrical loss functions in selecting forecasts to report. Forecasters are more averse to underestimation of expenditures than to overestima-tion.

Federal district and territory forecasters are not averse to underestimation and may be averse to overes-timation.

States may manipulate fiscal year end activities to ensure the accuracy of fiscal plans.

There is no evidence the explicitly accounting for some details of data generating events – specifically, the transformation between service date events and payment

date events – results in increased forecasting accuracy.

There is no evidence that the HCFA recommended Price x Utilization x Caseload model of data generation produces more accurate forecasts.

Forecast accuracy is associated with length of horizon.

These results support the view that further analysis of these data will generate other interesting findings that can improve the understanding of applied forecasting.

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