JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION
OF THE VIRGINIA GENERAL ASSEMBLY

TECHNICAL STATUS REPORT

An Overview of Expenditure Forecasting in Four Major State Programs

House Document No. 3

Preface

During the 1999 Legislative Session, the General Assembly adopted Item 16K of the Appropriation Act, initiating a new function within the Joint Legislative Audit and Review Commission (JLARC). The Commission's technical staff was expanded in order to conduct legislative fiscal impact analyses, as well to provide oversight of the expenditure forecasting process.

This report is the first in a series that is being prepared by JLARC fiscal analysis staff in response to the forecasting mandate. It reviews the forecasting methods and processes in four programs that account for nearly two-thirds of Virginia's general fund budget.

This review found that three of the four forecasts are strongly linked to the State budget (the exception is higher education). All four derive from statistical procedures and data sources that appear appropriate. Further, the forecasts used to develop the FY 1999 budget were relatively accurate.

However, due to the magnitude of these large programs, even small forecasting errors can have large impacts on the State budget. For example, a forecast error of 0.3 percent in the initial average daily membership (ADM) projection led to an appropriation of $8.8 million more than was ultimately needed for the ADM-based accounts in the Department of Education.

Even with well-managed, participative forecasting processes, there is no guarantee that a high level of accuracy can be maintained. This review suggests, however, that broader participation may help protect the budget process from serious forecasting errors, and can help build confidence in the forecasts which are adopted.

On behalf of the JLARC staff, I would like to thank the staffs of the Departments of Planning and Budget, Medical Assistance Services, Education, Corrections, and the State Council for Higher Education for Virginia, for their assistance during our review.

Philip A. Leone
Director

August 2, 2000

JLARC Report Summary

An Overview of Expenditure Forecasting in Four Major State Programs

July 2000

Joint Legislative Audit and Review Commission

Nearly $15.5 billion, almost two-thirds of Virginia's general fund biennial budget of $24.7 billion, is appropriated to four State programs for the 2000-2002 biennium, as shown in the table on the next page. The largest of these programs is aid to public education, which receives more than three of every ten general fund dollars. Higher education is the second largest general funded program, and Medicaid is a close third. Adult corrections is a more distant fourth, receiving slightly more than half as much as Medicaid.

Appropriations for three of these programs depend heavily upon forecasts of either the population served or expected expenditures. From 67 to nearly 100 percent of three of these large budgets (higher education being the exception) derive from forecasts of client population and unit costs. Except for higher education, these programs are "entitlement" in nature – they are required by law to serve or provide funding for services for their target populations, regardless of the size of that population. Because so much of these budgets hinge on a forecast, accuracy in forecasting is of crucial importance for budget-makers. In these cases, accurate forecasts are essential to avoid over- or under-appropriating funds. Accuracy of these forecasts in FY 1999 generally improved over prior years.

This report responds to the Appropriation Act mandate for JLARC to conduct oversight of the State's expenditure forecasting process. This mandate grew out of a legislative concern, articulated by the Joint Commission on the Commonwealth's Planning and Budgeting Process, that additional oversight was needed of key expenditure areas that increasingly dominated the State budget. The Joint Commission recommended that JLARC provide this oversight. As directed by JLARC, staff have focused on forecasts involved with the four largest general-funded programs.

Elementary and Secondary Education Enrollment Forecasting

Between 1994 and 2000, enrollment in Virginia's elementary and secondary public schools increased by 8.4 percent, to more than 1.1 million.

The State and localities share responsibility for funding public education. In the 2000-2002 biennium, the State budget provides $8 billion in general funds to direct aid for public education.

The Department of Education (DOE) is responsible for forecasting enrollment by

Expenditure Forecasting Oversight: JLARC Areas of Review			
Program Area	**Lead Agency**	**2000-2002 Biennial GF**	**% of Total GF Budget**
Direct State Aid to Public Education (K-12)	Department of Education	$ 7,967,728,365	32%
Higher Education	State Council of Higher Education	$ 3,144,885,876	13%
Medicaid	Department of Medical Assistance Services	$ 2,926,696,032	12%
Adult Corrections	Department of Corrections	$ 1,458,327,279	6%
Total		$15,497,637,552	63%

Source: JLARC staff review of agency information and 2000-2002 Appropriation Act.

school division each year. These forecasts are used to develop the biennial State budget, and to make adjustments to funding levels during the biennium. Enrollment is measured by average daily membership (ADM), the average number of students enrolled over the first seven months of the school year, and by fall membership, the number of students enrolled on or about September 30.

To project ADM for each school division, DOE uses simple ratios based on annual changes in ADM to fall membership ratios over the previous three years. To do this, DOE must first project fall membership levels. DOE compares the results of its projection with the fall membership forecasts independently produced by the University of Virginia's Weldon Cooper Center for Public Service. DOE generally selects the fall membership forecast closest to the Center's forecast. DOE then projects division level ADM based on historical ADM to fall membership ratios. A final step involves manual adjustments to individual division projections if localities provide information, such as unusual local trends, that would not be detected by DOE's model. This model does not look at underlying demographics or other factors, such as migration patterns.

The Center for Public Service employs a methodology that uses a grade progression ratio (based on the number of students in each grade divided by the number of students in the previous grade the year before), and conducts additional analysis to help select particular progression ratios to use in preparing a forecast.

DOE's ADM forecasts are used in the SOQ funding model to provide the number of students to be used to calculate expected costs per student for each of the 137 school divisions. These per-pupil costs are then included in the budget presented to the General Assembly each year. It should be noted that while the budget includes expected funding levels for each school division, actual payments to school divisions are based on final March 31 ADM levels.

The straightforward use of ratios in DOE forecasting has proven both accurate and easy to understand and explain. A good understanding of the process, coupled with error rates of less than one-half percent for the statewide forecast, has led to general acceptance of the forecasts by State-level budget decision-makers. Error rates at the individual division level can be much higher, however, particularly for the smaller school divisions.

Higher Education Enrollment Projections

Enrollment in Virginia's public institutions of higher education has increased nearly 13 percent over the past decade. The fall headcount for the 1999-2000 academic year was 311,536 students, with an estimated FTE level (one Full Time Equivalent – FTE – equals 15 undergraduate credit hours) of 232,348. Fall headcount is primarily used to indicate the demand on the university system, and FTEs are a factor in capital budget considerations. The higher education general fund operating budget (including the community college system) for 2000-2002 is $3.1 billion, a 15 percent increase over the prior biennium.

The State Council of Higher Education for Virginia (SCHEV) prepares a systemwide higher education budget which is publicly released prior to the Governor's biennial budget. As part of this budget process, SCHEV approves enrollment projections for the four-year institutions, in part on the basis of enrollment projections prepared by SCHEV staff. Both SCHEV and DPB project enrollment at each institution, and the institutions each project their own enrollment levels as well. The SCHEV and DPB projections are used primarily as benchmarks for assessing the reasonableness of the institutions' projections.

The higher education enrollment projection process is somewhat different from the other forecasting processes discussed in this report, because four-year institutions can be selective as to whom they provide services for, and are therefore better able to manage the size of the population they serve. For some institutions, a "forecast" is more an indication of the institution's planned enrollment level. Another key difference is that the higher education forecasts are not directly used in calculating the State budget.

SCHEV staff develop two enrollment forecasting models for each institution. A statistical model is used to develop enrollment levels for each category of student admissions, and may employ any of a variety of statistical methods. A demographic model estimates enrollment by mapping demographic data from counties across the State to particular institutions. DPB staff use similar methodologies to develop projections.

Since 1997, when SCHEV began producing six-year projections of FTE and headcount, error rates have been low. The error rates for the statewide headcount forecasts computed in the fall of 1997 were -0.4 percent for each year of the 1998-2000 biennium. The error rate in the statewide FTE projection for FY 1999 was -0.6 percent (actual FTE data is not yet available for FY 2000).

Although enrollment projections have not been strongly linked to the higher education budget process in recent years, this may change under proposals being considered by SCHEV, the Governor's Blue Ribbon Commission on Higher Education, and the Joint Subcommittee on Higher Education Funding Policies. Each of these groups is considering new funding models that could be used to bring increased uniformity to the higher education budget process, including a stronger role for enrollment projections.

Medicaid Forecasting

In FY 1999, Virginia spent $1.0 billion in general funds to provide Medicaid health care services to over 630,000 low-income Virginians. Medicaid has been the fastest growing of the four programs discussed in this report, increasing 160 percent during the 1990s, compared to an overall State general fund budget increase of 85 percent.

Two agencies, DPB and DMAS, produce independent Medicaid forecasts and then compare their results to produce an official Virginia forecast. Under language in the Appropriation Act, DPB is in effect authorized to make the final selection of a forecast upon which to base the Governor's Medicaid budget proposal.

DMAS uses two separate approaches to prepare its expenditure forecast. One approach applies exponential smoothing techniques to historical data on 70 specific Medicaid services. A second approach employs regression analysis to produce forecasts of large, acute care expenditure categories such as inpatient and outpatient hospital, physician, and pharmacy services. By combining these separate forecasts, DMAS produces a total spending forecast. For some expenditure items, DMAS staff average the results of the two approaches; for other items, the result of one or the other method is used. The expected cost of other factors, such as policy initiatives, are also included.

DPB also uses multiple methods, including regression analysis and ARIMA models, to forecast Medicaid expenditures. The final, official Medicaid forecast stems from meetings between DPB and DMAS forecasters to review data, statistical models, and technical differences. Differences are typically resolved by comparing the detailed forecasts to identify differences in assumptions or other factors. It appears that DPB staff make the final selection of forecasts to be used in preparing the biennial Medicaid budget. Two of the last three official forecasts were averages of DMAS and DPB numbers.

The FY 1999 forecasts generated by this process came within one percent of actual expenditures. The forecast adopted in the fall of 1997 for FY 1999 was 0.71 percent over the actual level of spending; the FY 1999 forecast adopted in the fall of 1998 was 0.83 percent below the actual spending level.

Inmate Population Forecasting

After several years of double-digit growth in the State's adult inmate population and a major prison construction program, Virginia has most recently seen the size of the inmate population level off and even slightly decline. The adult inmate population for which the State is responsible (under current law, felons with a sentence of one year or more) stood at 30,951 in January, 2000, down slightly from 31,181 as of June, 1999. The official forecast anticipates growth of less than three percent per year over the next ten years. This contrasts with increases of as much as 15 percent per year in the State-responsible population earlier in the 1990s.

Since the late 1980s, the Secretary of Public Safety has annually overseen a process which forecasts the number of adult inmates for whom either the State or the localities have responsibility. The forecasting process uses two committees to produce the official forecast, a technical committee that uses statistical methods (including a simulation model) to make projections, and a policy committee that reviews the projections and selects a forecast to recommend to the Secretary. Members of the policy committee include personnel who are knowledgeable about or are involved in the criminal justice process, but who are not necessarily statisticians or responsible for the incarcerated population. The policy committee also considers the effect of any newly adopted legislation on the forecast, and makes other adjustments as it deems appropriate.

The difference between the forecast and actual State-responsible inmate population in the 1996-1998 biennium ranged from 7.2 to 17.2 percent. Accuracy of the forecasts used for the 1998-2000 biennium is better; the difference between forecast and actual for FY 1999 was less than one percent. This was the only time since at least FY 1994 that the forecast used for developing the biennial budget came within five percent of the actual population.

The inclusion of additional outside parties in the inmate population forecasting process presents a useful model for the other forecasts considered in this report. Dividing the overall task between technical and policy-based issues and assigning them to appropriate personnel also brings diverse expertise to bear. This process also helps ensure that no significant trend or change is overlooked in preparing the forecast, and helps ensure a more objective forecasting result. Documentation from this forecasting process, in the form of a report issued by the Secretary of Public Safety, describes the decisions made during the process as well as the final official forecast.

Measuring Accuracy Across the Forecasts

The forecasts used to develop the 1998-2000 biennial budget were initially generated in the fall of 1997. The table on the next page compares the forecasts made during this time period for FY 1999 with the actual experience of FY 1999; these forecasts generated differences of –0.71 to +0.83 percent. Because the 1998-2000 biennial budget was adjusted again by the 1999 General Assembly, the accuracy of forecasts compiled in the fall of 1998 and used during the 1999 Session can also be assessed. Differences between forecast and actual in these mid-biennium updated forecasts for FY 1999 was closer, ranging from 0 to +0.83 percent.

While the ranges shown in the table are low, the budgetary impact of small differences can be quite high. A 0.3 percent difference in the case of elementary and secondary education enrollment, for example, led to an initial over-appropriation of $8.8 million to the Department of Education's Basic Aid program in FY 1999. In the case of the inmate population, a one percent difference could result in the development of housing for an additional 300 inmates. Despite the different impacts that can result from a small percentage difference between a forecast and the actual population or expenditure, a single standard for forecasting error may, for all forecasts, not be practical.

Although the fact that Virginia has an annual budget adjustment process tends to mitigate the need for a highly accurate biennial forecast, accuracy over a fiscal year generally is expected. This objective can be difficult and has not always been met, as illustrated by the transfer of $19.7 million from the FY 2000 Medicaid budget into FY 1999, in part due to differences between forecasted and actual expenditures. A second example was an initial FY 1999 appropriation for the ADM-based Direct Aid to Public Education accounts that was $8.8 million more than was ultimately needed.

How the Forecasts are Finalized

The process for selecting a forecast and reaching agreement that it is the most appropriate or "best" forecast is an important part of the budget process. Ideally, agreement on a particular forecast should promote agreement on the amount of funding needed to meet the forecast. The JLARC staff review found that the processes for reaching agreement in the four areas appear to be guided by a common overall strategy.

This general strategy involves comparing forecasts which are independently generated. This process can bolster confidence in the forecast that is selected, and can increase the amount of information brought to bear on the forecasting process, because it requires somewhat broader participation in the forecasting process than would otherwise be the case.

This strategy also differs from the notion that all the forecasts reviewed in this report are "consensus" forecasts. Whether

Accuracy of Forecasts in Four Major State Programs			
Program Area	**Units of Measurement**	**Accuracy of Original FY 1999 Forecast***	**Accuracy of Revised FY 1999 Forecast****
Elementary & Secondary Education Enrollment	Average Daily Membership	+0.3%	+0.1%
Higher Education***	Headcount	-0.4%	-0.4%
	FTEs	-0.6%	0.0%
Medicaid	Expenditures	+0.71%	-0.83%
State-Responsible Inmate Population	Population	+0.8%	+0.04%

*Generally 20-month forecasts generated in fall 1997, and used during the 1998 General Assembly.
**Generally 8-month forecasts generated in fall 1998, and used during the 1999 General Assembly.
***The higher education forecast was not used in budget development for FY99.

Source: JLARC staff review of agency data.

multiple parties agree to a particular set of forecasts may be less important than ensuring that the forecasts are reliable and accepted for use in the budget process. Confidence in a forecast and agreement to use a particular set of numbers for budget making may be almost as important as the eventual accuracy of the selected forecast.

Documentation for three of the four forecasts is minimal, although forecasting staff provide briefings and information during the budget process. An important means of bolstering confidence may be through better documentation.

Even with a well-managed, participative, and consensus-based forecast process, there is no assurance that the resulting forecasts will be highly accurate. The State-responsible inmate population forecasts of 1996-1998 were in error by as much as 17 percent, despite participation by seven agencies and additional nonstate personnel. Ideally, broad agreement on a particular forecast should promote agreement on funding, but does not guarantee accurate budgeting.

Future Directions

This status report is the first in a series of JLARC reports dealing with forecasting in major State programs. The next report, set for late in 2000 or early in 2001, will deal more extensively with the Medicaid forecast. This will also provide JLARC staff an opportunity to respond to the new requirement, adopted by the 2000 General Assembly in SB 515, for the Department of Planning and Budget (in cooperation with the Department of Medical Assistance Services) to provide JLARC with a two-year forecast of Medicaid expenditures by November 15 of each year. JLARC staff also intend to provide ongoing oversight of major State expenditure forecasts.

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I. Introduction

Nearly $15.5 billion, almost two-thirds of Virginia's general fund, will go to just four State programs in the 2000-2002 biennium, as shown in Table 1. The largest of these programs is State aid to public education, which receives more than three of every ten general fund dollars. Higher education is the second largest general funded program, and Medicaid is a close third. Adult corrections is a more distant fourth, receiving about half as much as Medicaid.

Appropriations for three of these programs depend heavily upon forecasts of either the population served, costs, or units of service. With the exception of higher education, these programs are "entitlement" in nature – they are required by law to serve or provide funding for services for their target populations, regardless of the size of that population. The State's need to develop a two-year budget thus places a premium on accurately predicting how many people will be eligible for these programs or how much service will be provided over the biennium, and what the resulting budgets need to be.

With the exception of higher education, from 67 to nearly 100 percent of these large budgets derive from forecasts of client population and unit costs. Figure 1 shows the share of the 2000-2002 budget appropriated to each of these "budget drivers." The figure also shows the portion of each of the major driver's funding that depends, in some way, on Virginia executive branch forecasts.

This report is the first step in responding to the mandate in Item 16K of the Appropriation Act, adopted in 1999, for JLARC to conduct oversight of the State's expenditure forecasting process. The language of the mandate is included in Appendix A. As directed by JLARC and recommended by the Commission on the Planning and Budgeting Process, staff have focused on forecasts involved with the four largest general fund programs. This report:

- documents the current forecasting processes that form the basis for these large general fund budgets and programs;
- identifies the differences between forecasted and actual populations, service levels, and expenditures;
- discusses the consequences of these differences in the various State forecasts;
- describes how forecasting is used to prepare the budgets for these programs; and
- reviews the methods and data sources used in preparing the forecasts.

Table 1

JLARC's Expenditure Forecasting Oversight
Areas of Review

Program Area	Lead Agency	2000-2002 Biennial GF	% of Total GF Budget
Direct State Aid to Public Education (K-12)	Department of Education	$ 7,967,728,365	32%
Higher Education	State Council of Higher Education	$ 3,144,885,876	13%
Medicaid	Department of Medical Assistance Services	$ 2,926,696,032	12%
Adult Corrections	Department of Corrections	$ 1,458,327,279	6%
Totals		$15,497,637,552	63%

Source: JLARC staff review of agency information & 2000-2002 Appropriation Act.

Over time, JLARC staff will conduct additional oversight activities and further examine and monitor the performance of the forecast models in order to fulfill the mandate and the new functions assigned by the General Assembly.

GROWTH IN MAJOR PROGRAMS

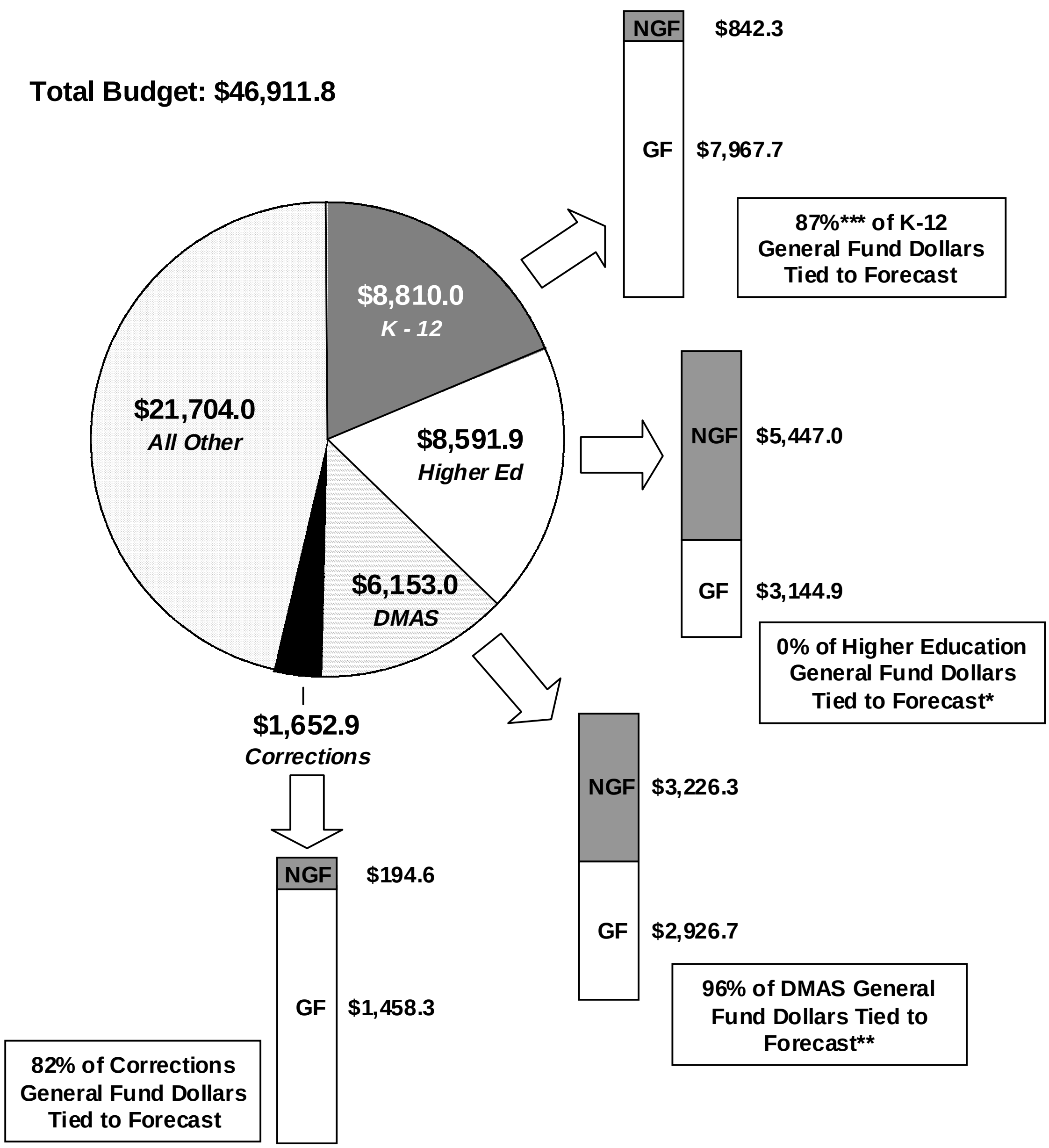
Virginia's biennial budget for 2000-2002 totals $46.9 billion. The general fund portion of this budget is $24.7 billion, a little more than half the total State budget. The general fund derives from general tax sources such as the individual and corporate income taxes. There are no restrictions on how general fund dollars can be used. The remainder of the State budget comes from federal funds and from various fees, taxes, and other sources that are earmarked by State law for specific purposes. An example of an earmarked source is motor fuel taxes, which can only be used for transportation purposes.

Education, Medicaid, and corrections are core services of the State, and have received the largest share of the general fund for a long time. These programs are the focus of this report. The importance of these programs is reflected by the Commonwealth's allocation to them of nearly two-thirds of the 2000-2002 general fund budget, as noted in Table 1. Historically, these programs have required a majority of the general fund budget since at least FY 1975, when 69 percent of the total general fund budget was appropriated to them.

Figure 1

Major Components of the State Budget, 2000 - 2002

(in Millions of Dollars)



* Forecasts are not routinely used in developing the Higher Education budget. However, the 2000-2002 Appropriation Act includes funds related to the enrollment forecast.

** Medical Assistance Services (excludes administration).

*** Includes State portion of lottery revenue and 1% sales tax.

Source: JLARC Staff Analysis of 2000-2002 Appropriation Act.

Divergent Growth Rates

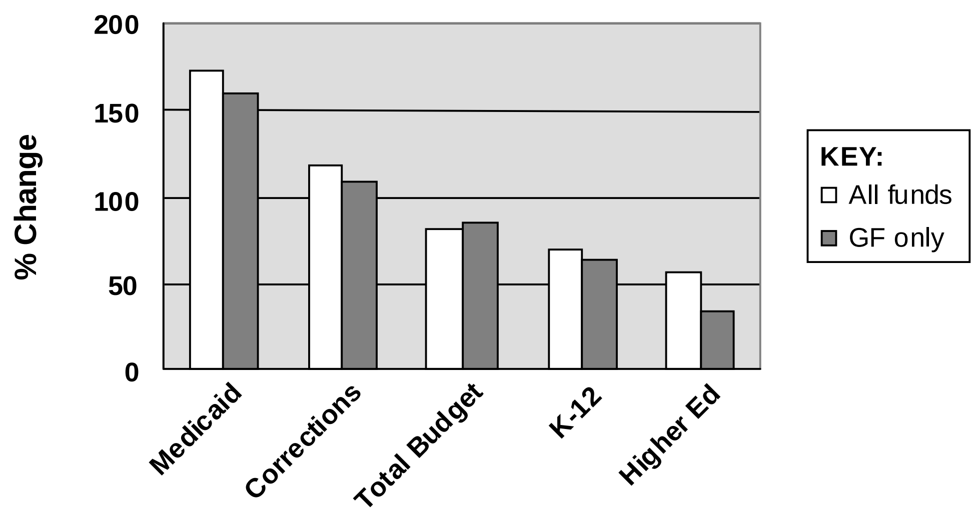
The rate of growth in appropriations for these programs has been significant. During the 1980s, growth in these four programs exceeded the growth in the overall State budget, according to a review by the Department of Planning and Budget. During the decade of the 1990s, growth in Medicaid and corrections funding continued to outpace growth in the overall budget (Figure 2). Growth in State financial assistance to both public and higher education during the 1990s slowed, however, to less than the growth rate of the overall State budget.

Medicaid has been the fastest growing of these programs. Medicaid is a State and federal program that provides health and medical care for eligible needy people. General fund appropriations for Medicaid doubled between FY 1985 and FY 1990, and doubled again between FY 1990 and FY 1995. Both the cost of services and the number of services covered by Medicaid have increased, helping to drive appropriations. Since FY 1990, Medicaid appropriations have increased 160 percent, compared to an overall State general fund budget increase of 85 percent.

Corrections has been the second fastest growing of these four programs, reflecting the rapid increase in the inmate population. Corrections' appropriations have more than tripled since FY 1985, while the prison inmate population also more than tripled. Corrections funding (including the Departments of Corrections, Correctional Education, Juvenile Justice, and the Parole Board) grew 118 percent during the 1990s.

Figure 2

Increases in Appropriations, FY 1990 - 2000



Source: JLARC staff review of Appropriation Acts.

Appropriations during the 1990s for elementary and secondary education, as well as for higher education, grew at a slower rate than Medicaid, corrections, or the overall budget, as shown in Figure 2. Growth rates for educational appropriations slowed the most between FY 1990 and FY 1995. General fund appropriations for higher education actually declined 13 percent between FY 1990 and FY 1995. This decline in State aid for higher education was offset to some extent by increases in student-paid tuition and fees. In the second half of the decade, growth in appropriations resumed for elementary and secondary (41 percent growth in general funds) as well as higher education (54 percent growth in general funds).

Appropriations Depend on Forecasts

Forecasting is an integral part of the State's budget process, affecting both revenue and expenditures. Section 2.1-393 of the *Code of Virginia* requires the Governor to submit a six-year revenue estimate to the General Assembly by December 15 of each year. Other statutes require agency expenditure or client population forecasts to be produced and linked to the budget. For example, the Department of Medical Assistance Services (DMAS) is required by statute (Section 32.1-323.1, *Code of Virginia*) to forecast biennial expenditures for Medicaid. The Board and Department of Education is required by section 22.1-253.13:6 of the *Code* to revise annually a six-year improvement plan, including a forecast of primary and secondary school enrollment. Other statutes (section 30.19.1:4 of the *Code*) require appropriations for forecasted six-year peak increases in prison and jail inmate population, when the increase is attributable to proposed legislation.

Three of the four largest general fund budgets are closely tied to forecasts. Figure 1 shows the share of the 2000-2002 budget appropriated to each of the four "budget driver" programs. The figure also indicates the portion of each program's funding that depends, in some way, on Virginia executive branch forecasts. In three of the four largest general fund programs, most of the program's budget is tied to a forecast. Discrete policy decisions and initiatives are also important factors in calculating the budgets of these programs.

Although biennial budgeting requires forecasting an agency's needs as much as two to three years into the future, the forecasts underlying the programs highlighted in this report differ from more conventional, incremental budgeting practices. These differences stem from these programs' larger size than other State programs, and also from their entitlement nature – services must be provided to the eligible population, whether elementary school students or prison inmates. The uncontrollable nature of the size of the eligible population in these programs – education, Medicaid, and corrections – requires forecasting in order to generate a multi-year budget that will be reasonably accurate. Because so much of each program's budget hinges on a forecast, accuracy in forecasting is of crucial importance for budget-makers. In these cases, forecasts that are as accurate as possible are essential to minimize over- or under-appropriating funds.

Forecasts Derive From Statistical Procedures

As large budgets have become more dependent on forecasts, sophisticated statistical techniques have become more widely used in generating the forecasts. This report provides brief descriptions of several of the statistical techniques currently used in developing the forecasts. The accuracy of the forecasts generated using these procedures depends on correct application and interpretation of the statistical procedures, as well as accurate data.

A common strategy across the major forecasts reviewed in this report is to generate multiple forecasts using different statistical methods and data. Forecasting staff then compare the results of the different methods. Convergence of these separately generated forecasts tends to bolster confidence in the final forecast. Divergence, on the other hand, often suggests the need for further analysis to better understand the underlying trends and factors. This process can improve confidence in a forecast, and can also improve forecasting accuracy.

JLARC REVIEW

The 1999 General Assembly strengthened its staff capability in the areas of fiscal impact review and expenditure forecasting by providing funding and three positions to JLARC for these purposes. The Joint Commission on the Commonwealth's Planning and Budget Process had recommended this action:

> The preparation of long-range expenditure forecasting is extremely difficult. As a starting point, it would be preferable to focus on projected expenditure trends in the budget drivers that account for the bulk of the growth in the general fund budget: Medicaid, adult and juvenile corrections, public education, and higher education. The Joint Legislative Audit and Review Commission should be given the resources to conduct oversight of expenditure forecasting processes for programs that are drivers of growth in the state budget.

The 1999 General Assembly implemented this recommendation by providing funds and direction in Item 16K of the Appropriation Act. This item specified that:

> Funds are provided to expand the technical support staff of the Joint Legislative Audit and Review Commission, in order to assist with legislative fiscal impact analysis when an impact statement is referred from the chairman of a standing committee of the House or Senate, and to conduct oversight of the expenditure forecasting process. Pursuant to existing statutory authority, all agencies of the Commonwealth shall provide access to information necessary to accomplish these duties.

This report represents the fiscal analysis section's initial effort regarding these major expenditure forecasts.

Research Activities

This document briefly describes the forecasting methods used by five State agencies to estimate future populations and caseloads, and summarizes the recent accuracy of these forecasts. This report is intended as a guide to the forecasts and provides some basic comparative information about the forecasts.

JLARC staff undertook a variety of activities to prepare this overview. Documentation was collected from each of the lead agencies. JLARC staff interviewed a number of individuals to collect information about the agencies' forecasting methods. Interviews were conducted with staff at each of the lead agencies, as well as with staff at DPB, House Appropriations, Senate Finance, the University of Virginia's Weldon Cooper Center for Public Service, and other agencies.

JLARC staff also compared forecasts and projections of program populations to the actual size of these populations, in order to better understand accuracy and error rates, and conducted other assessments. For example, the linkage between the forecasts and the State budget was examined.

The level of documentation about the forecasting process that is available from the agencies varies greatly. In the case of SCHEV, for example, little written documentation is available to describe the forecasting process. On the other hand, the inmate population forecast results in a published annual report with quarterly reports monitoring the forecast's accuracy during the year.

Report Organization

This report describes the forecasts used in the four largest State general funded programs: financial assistance for primary and secondary education, higher education, Medicaid, and corrections. The process and methodology for each of the major forecasts is described, as is the accuracy of recent forecasts and the link between the forecast and the respective budgets.

Chapter I has presented an overview of the four programs and their growth and importance within the State budget. Chapter II focuses on the primary and secondary education enrollment forecast. Chapter III reviews the forecasting methods used for higher education enrollment. Chapter IV describes Medicaid forecasting. Chapter V examines the forecasting process for adult corrections. Chapter VI concludes the report by identifying several issues that cut across several of the forecasts.

II. Elementary and Secondary Education Enrollment Forecasting

Over one million children attend public elementary and secondary schools in the Commonwealth of Virginia. Approximately 1,900 public schools are located within Virginia's 137 school divisions, and over 75,000 teachers instruct the Commonwealth's public education students. Responsibility for the public education system is shared by the State Board of Education, the Department of Education, the General Assembly, and local school boards.

Between 1994 and 2000, enrollment in Virginia's elementary and secondary public schools increased by 8.4 percent. Enrollment is generally measured by the State in terms of Average Daily Membership (ADM), which is the average daily number of students enrolled in a school division over the first seven months of the school year. ADM is the basis on which the majority of State funds for public education are distributed to the localities. Enrollment may also be measured in terms of the fall membership, which is simply the number of students enrolled in public schools at the start of the school year, on or about September 30.

The Department of Education (DOE) is responsible for forecasting enrollments by school division each year. Exhibit 1 highlights key points about the enrollment forecast. DOE's forecasts are used to develop the biennial budget, and to make adjustments to funding levels throughout the biennium. DOE is projecting an ADM level of 1,131,302 for FY 2001 and an ADM of 1,141,876 for FY 2002, as shown in Table 2.

The responsibility for funding public education is shared by the State and the localities. DOE is responsible for administering the State's portion of funding. In the 2000-2002 biennium, the State will dedicate almost $8.0 billion in general funds to direct aid for public education, about 32 percent of the total general funds available for the biennium. The State's educational standards, in particular the Standards of Quality, and student enrollment levels are significant components in determining the State's direct aid funding requirements.

The following sections will discuss the process and models used by DOE to forecast ADM, the role of the Weldon Cooper Center for Public Service in forecasting ADM, the accuracy of DOE's recent ADM forecasts, and the relationship between the ADM forecasts and the public education budget.

ELEMENTARY AND SECONDARY ENROLLMENT FORECASTING PROCESS

DOE develops a three-year ADM forecast for each biennial budget and prepares annual updates. Figure 3 (page 11) displays the forecasting process followed by

Exhibit 1

Key Points About the Elementary and Secondary Education Enrollment Forecast

During the 2000-2002 biennium, Virginia will spend almost $8.0 billion in general fund revenue to educate the State's 1.1 million elementary and secondary public education students. The Average Daily Membership (ADM) forecast, which is used to fund the State's educational standards and to allocate State funds to local school divisions, is produced by the Department of Education (DOE).

DOE is projecting an ADM level of 1,131,302 for FY 2001 and an ADM of 1,141,876 for FY 2002. This is a 1.8 percent increase over the FY 2000 ADM level of 1,122,191. Recent error rates for DOE's ADM forecasts have been less than one percent. Statewide error rates for the most recent two biennia have averaged about 0.4 percent. Forecasts of enrollment in some local school divisions may be higher.

In order to help improve accuracy rates, DOE makes use of other primary and secondary enrollment forecasts in Virginia. DOE's forecasting process incorporates the fall membership forecasts produced by the Weldon Cooper Center for Public Service, and DOE reviews locally-produced ADM forecasts to detect any changes in trends that its models may not have accounted for.

Table 2

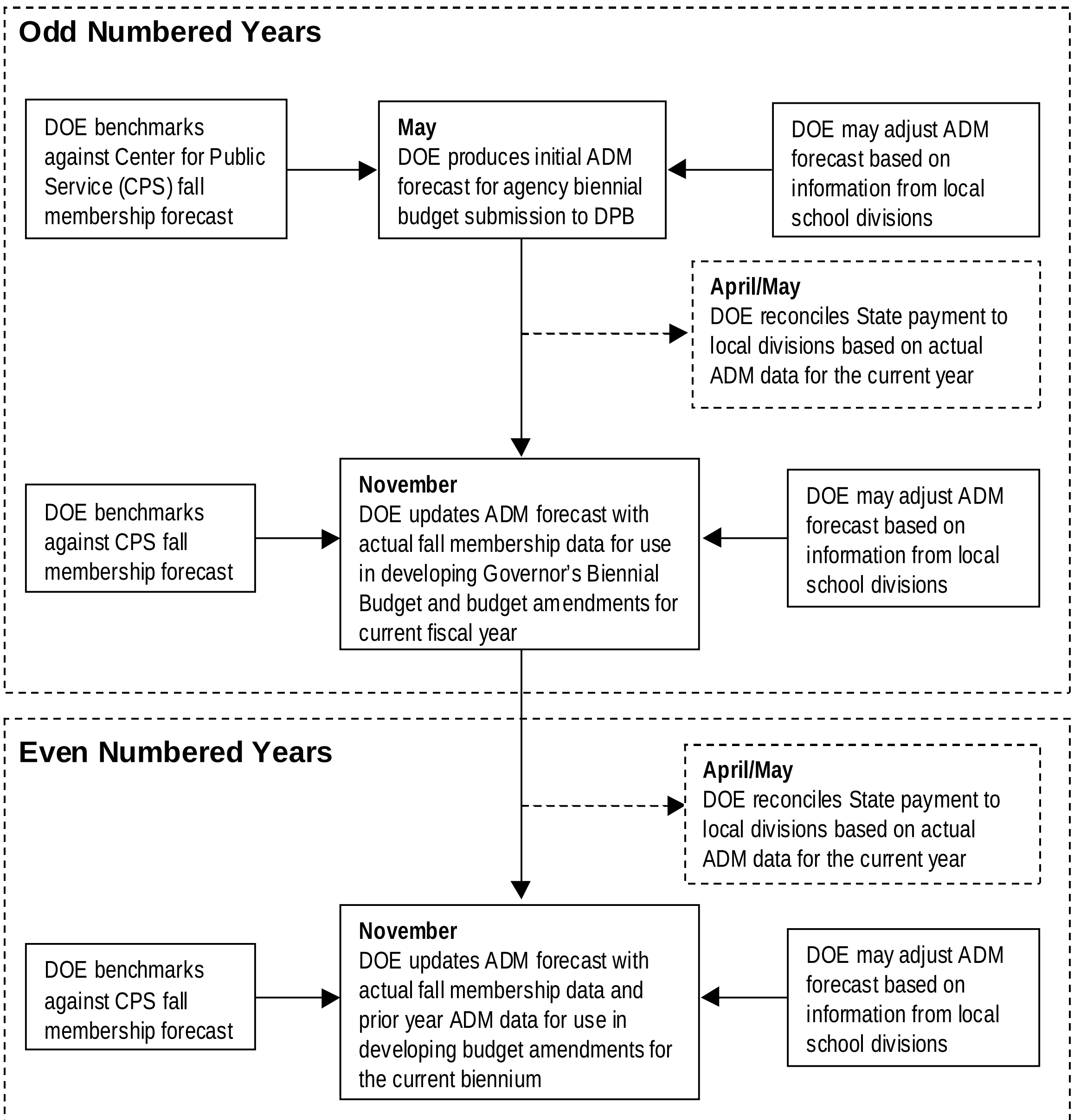
Historical and Projected ADM Levels

Fiscal Year	Actual ADM	Projected ADM	Percent Increase
1994	1,035,063		- -
1995	1,051,589		1.6%
1996	1,069,907		1.7%
1997	1,085,716		1.5%
1998	1,099,999		1.3%
1999	1,110,843		1.0%
2000	1,122,191		1.0%
2001		1,131,302	0.8%
2002		1,141,876	0.9%

Source: DOE.

Figure 3

Elementary and Secondary Average Daily Membership (ADM) Forecasting Process



DOE. In May of odd-numbered years, DOE makes its initial ADM forecast, which is used to develop the agency's budget request. The budget request is approved by the Board of Education in late summer and submitted to the Department of Planning and Budget (DPB) in August or September. Revisions are made to the forecasts every November based on actual fall membership data and previous year ADM data that have become available. The November forecast is used either to help produce the funding levels in the Governor's biennial budget or to develop amendments to the budget.

Although DOE does not employ a consensus forecasting process, its methodology considers the fall membership forecasts produced by the University of Virginia's Weldon Cooper Center for Public Service. DOE also receives ADM forecasts produced by local school divisions, and may make adjustments to its forecasts if divisions provide information indicating that there will be a change in enrollment patterns that would not be projected by DOE's forecast model. DOE does not routinely check back with all school divisions, but staff do contact divisions if there appears to be large variances between DOE and local ADM forecasts. Unlike the other major State forecasts, the Department of Planning and Budget is not involved in the elementary and secondary ADM forecast.

DOE Uses a Ratio Model to Forecast ADM

DOE employs a ratio model, which utilizes the close relationship between fall membership levels and ADM, to project ADM enrollment levels. The model is based on the historical trends of the fall membership-ADM relationship, and is maintained by DOE on Excel spreadsheets. The model produces an ADM projection for each school division, which is used to allocate State funds for public education among the localities.

Although ADM data ultimately drive many budget allocations, DOE's model also makes use of fall membership data because school divisions report fall membership relatively early in the school year. In contrast, divisions do not report ADM data until after March 31 of each year.

Fall membership data is also important because it is used for other purposes in the State's education funding model. However, most funding is ultimately allocated to localities based on actual March 31 ADM levels. DOE does not maintain error rates on the fall membership forecast.

Fall Membership. Forecasting ADM is a two-part process in which DOE first projects fall membership for each school division, which is then used to forecast division ADM. To forecast fall membership, the model analyzes the yearly change, or ratio, of total division fall membership levels over a three-year period. The model then projects two fall membership levels for the forecast year – one based on the ratio average over the three-year period and one based on the latest one-year ratio. The model analyzes the one-year ratios to determine whether there is an increasing or decreasing trend. If either exists, the model produces a projection that continues the historical trend. The model only analyzes total fall membership levels for each school division and does not look at specific components, such as migration patterns.

DOE compares the two forecasts (one based on the average ratio and one based on the trended one-year ratio) to the fall membership forecast produced by the Weldon

Cooper Center for Public Service (CPS). DOE generally selects the fall membership forecast that is closest to the CPS forecast. (The CPS forecasting process is discussed later in this chapter.)

To forecast fall membership levels for the following year, which in many cases would be the second year of the biennium, the same process is used. However, to forecast the second year, DOE has less actual data available, and the model must rely on more projected data to make the forecast. For example, for the May forecast of fall membership for the first year of the biennium, DOE uses three years of actual data and must rely on one year of projected data. However, to project fall membership for the second year, DOE uses two years of actual data and therefore must rely on two years of projected data.

ADM. Similar to the fall membership process, a ratio methodology is used to project ADM levels. The model calculates the ADM-to-fall membership ratio for each division. As with fall membership, the model produces two ADM estimates for the forecast year.

The model first calculates an ADM level based on the average of the previous three years' ADM-to-fall membership ratios. The model also determines whether there is an upward or downward trend to the ratios. If a trend is detected, the model calculates a historically trended year-to-year ratio to forecast ADM. If no trend exists, DOE uses the ADM level based on the three-year average ratio.

As with forecasting fall membership, the further out ADM levels are forecast, the more the forecasts rely on projected data rather than actual data. DOE updates both the fall membership forecast and the ADM forecast as actual data become available from the school divisions. Actual fall membership data is available sooner in the process than ADM. By using fall membership data in the forecasting process, DOE is able to rely on more actual data, which should help to reduce error rates. This depends on a stable within-year relationship between fall membership and ADM, which DOE has found to be the case.

DOE may make manual adjustments to division ADM projections if localities provide information, such as unusual enrollment trends, that would not be detected by DOE's model. DOE staff indicate they generally adjust fewer than ten divisions in each round of forecasts.

Center for Public Service Also Forecasts Fall Membership

From 1990 through 1995, DOE contracted with the Weldon Cooper Center for Public Service (CPS) at the University of Virginia to provide the enrollment forecasts for elementary and secondary education. CPS provided both fall membership and ADM forecasts by division. The responsibility for forecasting ADM migrated to DOE in the mid-1990s after the General Assembly eliminated the budget language and appropriation supporting the CPS contract.

Although CPS is no longer under contract, it continues to produce fall membership forecasts on a reduced scale. CPS staff indicated that local school divisions and the general public are the primary consumers of its forecasts, which are published each spring. (DOE makes its fall membership and ADM forecasts available to divisions throughout the budget process; however, it does not regularly release public reports of its forecasts.) DOE uses the published CPS forecasts as a benchmark for selecting between its own fall membership forecasts, which are later used to produce the ADM forecast. For the 2000-2001 school year, DOE is projecting a statewide fall membership level of 1,138,363 and CPS is forecasting a fall membership level of 1,132,462, a difference of 0.5 percent.

Similar to DOE, CPS uses a ratio model to forecast fall membership for each school division, but over a five-year time frame. However, rather than measuring the change in aggregate fall membership ratios from year to year, the CPS model is based on grade progression ratios.

The CPS model determines the grade progression ratios for each division by dividing the number of students in a particular grade in a given year by the number of students in the previous grade the year before. A ratio of less than one indicates that there has been attrition from that particular cohort, and a ratio greater than one indicates that there have been transfers into the cohort. To calculate a ratio for kindergarten, the model compares the number of students in kindergarten to historic birth information. Factors that may affect the grade progression ratios are mortality, migration, transfers between private and public schools, the compulsory attendance law, and student academic ability.

To determine the appropriate forecast ratios, CPS analyzes the historical grade progression ratios over a multi-year time frame (currently 1980 - 1999). CPS calculates various potential forecast ratios based on the historical ratios, including the mean ratio over all the historical data points, the mean ratio over the last five years, and ratios based on the results of an exponential smoothing model. Exhibit 2 provides a discussion of exponential smoothing models. CPS then selects appropriate ratios for use in projecting progression between each grade over the forecast period.

There is no rule for selecting a particular ratio, other than the experience of the CPS staff. The default selection is the set of ratios produced by the exponential smoothing model. While exponential smoothing models may produce more accurate forecasts in the short run, they tend to produce results that are excessively high or low further out in the forecast horizon. If CPS staff believes there is a risk of over-projecting or under-projecting in the later years, they may select one of the mean-based ratios for use in the forecast.

An exception to the grade progression methodology is the population of ungraded students. Ungraded students include eighth grade students who fail to pass the literacy test and some special education and alternative education students. Ungraded students are projected as a simple proportion of the total graded membership and generally make up around three percent of total fall membership. According to DOE, the population of ungraded students is expected to decline because, starting in the fall of 2000, school divisions must report a grade for all students.

Exhibit 2

Exponential Smoothing Models

Exponential smoothing models are based on the concept that the past behavior of a data series is likely to continue into the future. These models use a single variable and provide forecasts of the variable using a weighted moving average of its past values. Exponential smoothing models rely on the notion that more recent observations provide the best guide to the future. The model averages the values of previous observations to forecast future values of the variable, although more weight is given to recent observations. The amount of weight the smoothing parameter gives to the recent observations varies depending on the time series being forecast. Seasonality and trends in a data series can also be reflected in exponential smoothing models.

To take a simple example, participation in a State program next year may be very close to the level of participation this year. In this case, a high smoothing parameter would be used in the model. If participation is better reflected by a more balanced average of the past several years, a lower smoothing parameter would be used.

Since exponential smoothing models use historical values of the forecast variable, forecasts will always trail any trend in the actual data and will not pick up abrupt changes in trend. Therefore, these models are most appropriately used with a stable data series. In addition, the forecasts are only reliable for a few data points into the future and should not be used to produce long-term forecasts.

Despite these limitations, exponential smoothing models are widely used to forecast stable data series because they are relatively easily understood and do not require as much technical expertise or data as other statistical forecasting techniques.

CPS' average forecast error from 1991-1999 for projecting 18 months into the future (the time frame necessary for use in the development of the biennial budget) was about 0.6 percent. This is comparable to DOE's forecasting error rate of about 0.7 percent over the same time frame. However, CPS' error rates are for fall membership forecasts, while DOE's error rates are based on ADM forecasts. (DOE does not maintain error rates for its fall membership forecasts.) CPS' average error rate for forecasting six months in the future, the closest forecast to the actual fall membership count, was 0.3 percent. CPS has not consistently over- or under-forecast fall membership. Rather, there has been forecast error on both sides of the actual levels.

DOE'S ACCURACY HAS BEEN WITHIN ONE PERCENT

DOE's recent error rates have consistently been under one percent regardless of where the agency is in the forecasting process. From 1997-2000, the average forecast error for the ADM projection used in the budget submission to DPB, which is approximately one year before the start of the biennium (approximately 16 months prior to the start of the first academic year in the biennium), was 0.3 percent (Table 3). The average forecast error was 0.4 percent for the projections used in the biennial budget which was submitted to the General Assembly. For the final forecast of ADM, which is made in November prior to the close of the academic year and is used to develop final budget amendments, the average forecasting error was 0.1 percent. At this point, DOE has actual fall membership for the current school year and actual ADM for the previous year. Thus, DOE's forecast of ADM levels for the current year is based completely on actual data.

With few exceptions, DOE's statewide forecast errors have been on the positive side. A forecast which is greater than the actual ADM levels could lead to an overappropriation of funds for some ADM-based accounts. However, according to DOE staff, the Governor or the money committees generally apply any such appropriations due to overprojections of ADM to other areas of the Direct Aid budget.

In some cases, an overprojection of ADM may actually lead to a shortfall in ADM-based accounts. For example, if actual ADM is lower than projected, DOE may be required to make higher enrollment loss payments to localities with declining enrollments. In this case, DOE may transfer funds from accounts experiencing a surplus due to the overprojection to the enrollment loss account. Staff indicated that the practice of transferring funds among the Direct Aid accounts occurs throughout the biennium. In addition, DOE reconciles the State's Direct Aid payments to localities based on actual ADM levels prior to the close of the fiscal year. Thus, localities ultimately receive funding based on their actual ADM levels, not their projected levels.

Although forecast errors at the aggregate Statewide level are less than one percent, aggregate error rates incorporate both positive and negative errors at the local level. Therefore, the forecast errors for particular divisions could be noticeably higher than the aggregate Statewide error rates. In recent years, the division-level error rates have been generally less than five percent. Divisions that experienced error rates greater than five percent were usually divisions with an ADM of less than 5,000. Appendix B displays error rates at the school division level for the 1998-2000 biennium.

BUDGET IMPACT OF THE FORECASTS

The elementary and secondary ADM forecast is very closely linked to the State budget for public education. A combination of the Standards of Quality, the composite index, and the enrollment forecast drive much of the State's funding for public education.

In an attempt to ensure that students across the State receive a quality educational foundation, the General Assembly and the Board of Education have developed the Standards of Quality (SOQ) for public education. The SOQ, in Article VIII, Section 2 of the *Constitution of Virginia*, and codified in Section 22.1-253.13:1-8 of the *Code of Virginia*, prescribes what the Board of Education and local school boards must do to

Table 3

Average Daily Membership Forecast Error Rates At Different Points in the Budget Process

Fiscal Year	Biennial Budget Submitted to DPB[1]	Biennial Budget Submitted to G.A.[2]	Final Amendments To the Biennial Budget[3]
1996-98 Biennium			
1997	-0.2%	0.2%	0.1%
1998	0.0%	0.5%	0.0%
1998-00 Biennium			
1999	0.5%	0.3%	0.1%
2000	0.6%	0.6%	-0.2%
Average Absolute Error Rates	0.3%	0.4%	0.1%

[1] May Forecast; 1st Year of Biennium: 16 months prior to start of the academic year, 2nd Year of Biennium: 28 months prior to start of academic year.

[2] November Forecast; 1st Year of Biennium: 10 months prior to start of the academic year, 2nd Year of Biennium: 22 months prior to start of academic year.

[3] November Forecast; 7 months prior to end of the academic year.

Source: DOE.

provide the basis for a minimum educational program in Virginia. (The 2000 General Assembly directed JLARC to review State funding for the SOQ and local educational expenditures that exceed the SOQ.) In particular, the SOQ set minimum instructional staffing, administrative staffing, and support standards. For example, the SOQ set student/teacher ratio standards at the class, school, and division levels.

DOE maintains an SOQ funding model which contains the ratios and parameters required by the SOQ. The model uses actual and forecasted fall membership levels to help determine the required number of instructors and administrators for each division. Using the required number of positions, the prevailing costs of these positions, and the prevailing support costs, the SOQ model calculates a cost per student for each school division.

The per-pupil cost is applied to the division level ADM forecast to obtain a total SOQ cost at the division level. After one percent of the State sales and use tax is deducted from the SOQ cost, the localities' composite indices, which measure their relative ability to pay education costs, are then applied to determine the State and local shares of the remaining SOQ costs. (The composite index determines a locality's relative ability to pay by comparing the locality's real property value, adjusted gross income, and taxable retail sales levels on per-student and per-capita bases to the statewide levels for these items.) Exhibit 3 provides an illustrative example of how SOQ costs are derived and apportioned between the State and the school divisions.

According to DOE staff, State aid for the Standards of Quality is actually provided from 14 different educational programs. The largest program is Basic Aid, which accounts for over 75 percent of the State's SOQ costs, including one percent of the State sales tax and the lottery funds, and provides the minimum regular education programs for public education. Figure 4 shows funding sources for the costs of the Basic Aid program. The one percent of State sales and use tax is dedicated specifically to these basic operation costs and is distributed to the localities on the basis of school age population. The remaining basic operation costs are allocated between the State and the localities based on the composite index.

The State's share of the State lottery revenue, which is 60 percent of total lottery revenues available for education, is used to help fund the State's share of Basic Aid. The remaining 40 percent of lottery revenues are disbursed to the local school divisions. Localities must use at least 50 percent of the lottery revenues for nonrecurring costs, such as capital or construction costs, and may not use any of the revenues to support their share of the SOQ costs.

The State pays over $3 billion in SOQ costs annually, including the revenue from the State sales and use tax and the lottery. This is, on average, about 60 percent of total SOQ costs across the localities. The SOQ program and incentive programs, which are also funded based on enrollment levels and require matching funds from the localities, make up around 90 percent of State public educational funding.

Exhibit 3

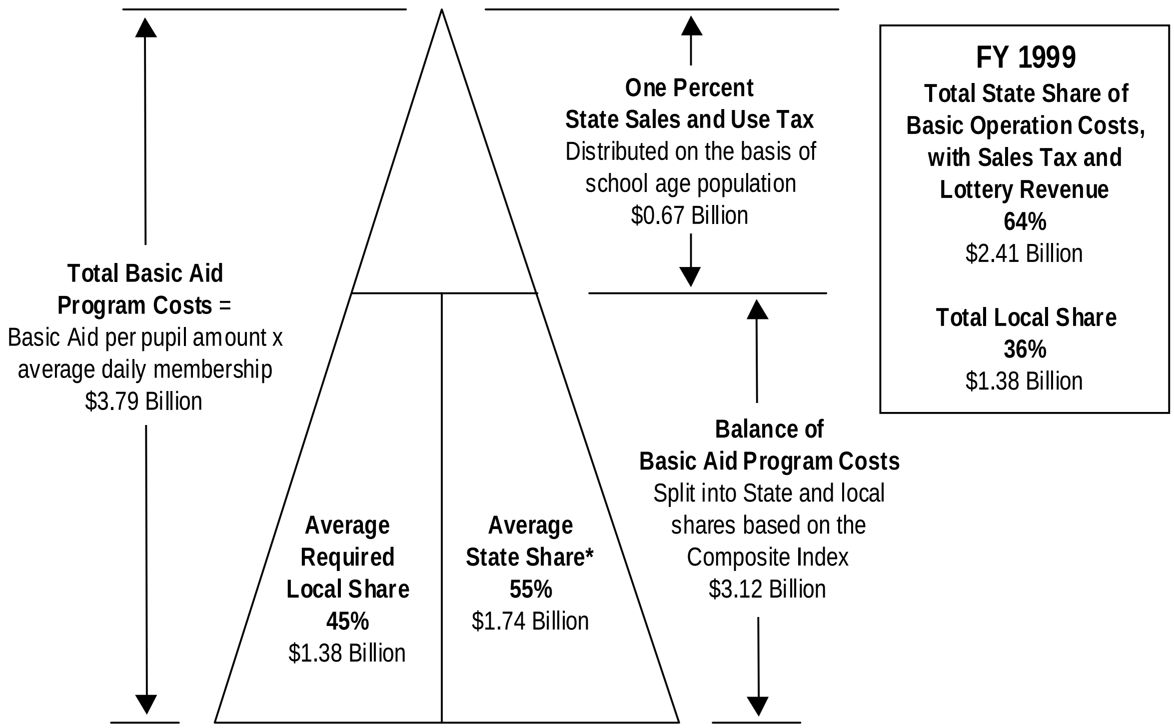
Illustrative Example of SOQ Costs for Accomack County

The following is an illustrative example of how SOQ costs are derived and apportioned between the State and a local school division. In Fiscal Year 1998, the SOQ per pupil cost in Accomack county was roughly $4,300. If Accomack's ADM level were 5,300, its total SOQ cost would be $22,790,000. One percent of the State sales and use tax is applied directly to Accomack's SOQ costs. If Accomack received $2,600,000 in sales and use tax receipts, its net SOQ costs would be $20,190,000. Accomack's composite index is 0.32, which means that Accomack is responsible for funding 32 percent of its remaining SOQ costs, and the State is responsible for 68 percent of the remaining costs. Therefore, the State's share of SOQ costs in Accomack, including the one percent sales and use tax, would be $16,329,200 and the local share would be $6,460,800.

Figure 4

Funding Sources for the Costs of the Basic Aid Program

(FY 1999 Funding Levels)



*Average State Basic Aid Payment includes the State's share of lottery revenues.

Source: Department of Education.

Because enrollment levels are so closely tied to the public education budget, a small error in forecasting could have noticeable budgetary consequences. For example, the error rate for the ADM projection used to construct the Governor's initial FY 1999 budget was 0.3 percent. This led to an initial appropriation of $8.8 million (0.4 percent) more than was ultimately needed for the ADM related accounts, which was $2.4 billion.

The $8.8 million amount was not specified in the Direct Aid accounts at the close of FY 1999, nor can it be found in any of the budget documents. As is typically the case, as FY 1999 drew closer it became evident to DOE staff that the initial projection of ADM contained some error – in this case it was too high. According to DOE staff, appropriations adjustments and reprogrammings of funds therefore took place throughout FY 1999 by the Governor, the money committees, and DOE to meet other education needs. (The Department of Planning and Budget is notified of any reprogrammings of funds initiated by DOE.) The largest of these adjustments took place during the 1999 Session when amendments were made to the FY 1999 appropriation. The ADM-based accounts were adjusted downward by $7.2 million to account for the lower ADM forecast.

Although appropriations adjustments were made to reflect revised ADM projections, and later the actual ADM levels, several other adjustments were also made to the FY 1999 Direct Aid appropriation. According to DOE staff, these adjustments often have compounding and interrelated effects. Therefore, the budget typically does not separately break out the appropriations changes made to account for ADM adjustments.

Simplicity and Acceptability Are Strengths of the K-12 Forecasting Process

In summary, DOE's relatively straight-forward and intuitive forecasting approach has several advantages. A ratio model tends to be easier to understand and explain than a more complex statistical model, which requires a higher level of technical expertise. Thus, the results of the DOE forecasting model tend to be better understood by policy makers at both the State and local level. A good understanding of the process, coupled with error rates of less than one percent for the Statewide forecast, appears to have led to general acceptance of DOE's forecasts, at least by State-level policy officials. As noted previously, error rates at the division level can be significantly higher, particularly for small school divisions.

Another positive aspect of the DOE process is that it takes into consideration forecasts from other sources. DOE staff incorporate the separately produced Center for Public Service forecast into their model, as well as ADM forecasts produced at the local level. Although this is not a strictly consensus- based approach, it should lead to more accurate forecasts of ADM, which is particularly important given the relevance of the ADM forecast in the budget process. In order to maintain this ability to benchmark against independently produced forecasts, DOE may want to consider formalizing its relationship with these entities, particularly the Center for Public Service.

III. Higher Education Enrollment Projections

Virginia's public higher education system is made up of 15 four-year institutions, a two-year institution, and 23 community colleges. Enrollment in Virginia's public institutions of higher education has increased nearly 13 percent over the past decade to a fall headcount level of 311,536 in FY 2000. During the 2000-2002 biennium, enrollment is expected to increase by an additional one percent.

Oversight of Virginia's public higher education institutions is provided by the State Council of Higher Education for Virginia (SCHEV). SCHEV was established in 1956 to:

> promote the development and operation of an educationally and economically sound, vigorous, progressive, and coordinated system of higher education. (*Code of Virginia* Sec. 23-9.3.)

The Council consists of eleven members, who are appointed by the Governor and confirmed by the General Assembly. Among other things, the duties of SCHEV include preparing biennial plans for higher education in the Commonwealth, approving changes to academic programs and departments, and, each biennium, approving a systemwide higher education budget plan that is publicly released prior to the Governor's biennial budget.

SCHEV is also responsible for approving enrollment projections at the public institutions. In order to do this, SCHEV staff produce higher education enrollment projections. This is in addition to the enrollment projections made by each four-year institution and the Department of Planning and Budget. Although these projections follow the budget process, they are not systematically used to develop the higher education operating budget.

There are two measures or counts of higher education enrollment levels that are used – the number of Full Time Equivalent (FTE) students, and the fall headcount. Fifteen undergraduate credit hours in a semester constitute one FTE. The number of FTE students is a factor in capital budget considerations, and the fall headcount is primarily used to indicate the maximum demand on the university system. (The term "enrollment" is used in this section to refer generically to both the fall headcount and the number of FTE students). Exhibit 4 highlights key points about the higher education enrollment forecast that are discussed in more detail in this section.

For the 1999-2000 academic year, the fall headcount was 311,536 students and the estimated FTE student level was 232,348 for all higher education institutions. (Actual FTE data is not yet available for the 1999-2000 academic year.) This is an increase over the 1998-99 academic year of two percent for the fall headcount and an estimated 0.5 percent for student FTEs. The fall headcount increased by 1.3 percent at the four-year public institutions and 2.9 percent at the community colleges over this

Exhibit 4

Key Points About Higher Education Enrollment Projections

The higher education general fund operating budget for the 1998-2000 biennium is $2.7 billion and includes funds for Virginia's four-year public institutions, the Virginia Community College System, Richard Bland College, and other State higher education entities. The fall headcount for the 1999-2000 academic year was 311,536 students, and a student Full Time Equivalent (FTE) level of 232,348 is estimated for the year.

Fall headcount and FTE projections for the four-year institutions are finalized through a process involving the State Council of Higher Education for Virginia, the Department of Planning and Budget, and the institutions. This process takes place in the spring of odd-numbered years prior to the start of the new biennium. Enrollment projections are updated each fall, if necessary. Official projections are not made for the community colleges or the private institutions.

For the projections made in 1995 for the 1996-1998 biennium, the error rates for the fall headcount projection for the first and second years of the biennium were 2.2 percent and 2.8 percent, respectively. Error rates for the FTE projection over this time frame were 2.2 percent and 2.5 percent. For the projections made in 1997, there was a noticeable drop in error rates. The error rates for the fall headcount projection for the 1998-2000 biennium were 0.4 percent for each year of the biennium, and the error rate for the FTE projection for the first year of the biennium was 0.6 percent. (Actual FTE data are not available for the second year of the biennium.)

Enrollment projections are not systematically used in the State's process for developing the higher education operating budget. However, this may change if a standardized funding model for higher education is adopted, as is being considered by the Executive Branch and the General Assembly.

time frame. Not all institutions experienced an increase, however. For example, the fall headcount decreased by 3.4 percent at Richard Bland College. Enrollment in community colleges accounts for about 44 percent of total fall headcount and 33 percent of total FTEs.

The higher education general fund operating budget for the 1998–2000 biennium is $2.7 billion. The budget passed by the General Assembly for the 2000-2002 biennium includes $3.1 billion in general funds for higher education, a 15 percent increase over the previous biennium. Roughly 20 percent of the higher education budget is for the community college system, with the remaining 80 percent for all other higher education entities, primarily the four-year institutions.

These funding levels only reflect the resources appropriated from the State's general fund. In fact, institutions may receive significant amounts of funding from other sources, such as tuition and fees, federal funds, and private endowments. In the 1998-2000 biennium, these non-general fund levels for higher education were in excess of $5 billion.

This chapter discusses the higher education enrollment projection process, the projection models employed by the State agencies and the institutions, the accuracy of the enrollment projections, and the budget implications of the enrollment projections.

ENROLLMENT PROJECTION PROCESS

The higher education enrollment projection process is somewhat different in nature than the forecasting process for other State services. This is largely because other major State-funded programs, such as Medicaid and elementary and secondary education, are required to provide services to all who are eligible for their programs. However, the four-year higher education institutions often can be quite selective in the admission of applicants, and are therefore better able to manage the size of their student populations. For institutions that can control or manage the size of their student populations, a "forecast" is more an indication of the institution's planned enrollment level.

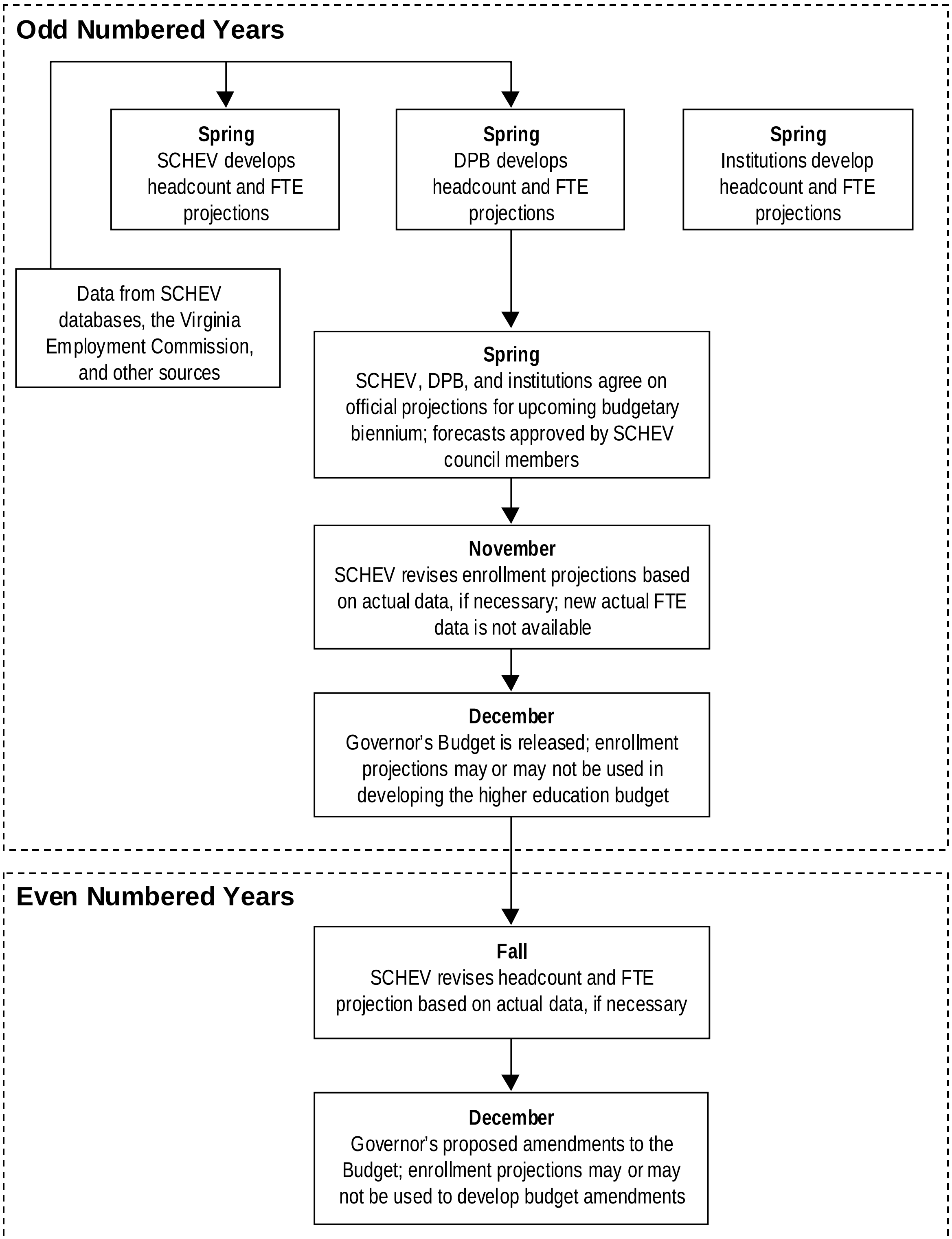
SCHEV and DPB do not project enrollment levels for the private institutions or the community colleges. Although community colleges are public institutions, they have open enrollment policies and must accept all applicants who qualify for admission, which makes them more like the other major State entitlement programs. According to SCHEV staff, several years ago they stopped producing enrollment projections for the community colleges following a request from the Virginia Community College System (VCCS). This was, in part, because enrollment levels tended to be very volatile which led to relatively high projection error rates. Currently, estimates of future community college enrollment levels are simply the most recent level of actual enrollment.

Consensus Process

The enrollment projection process for four-year public institutions involves SCHEV, DPB, and the institutions and is outlined in Figure 5. Staff from SCHEV, DPB, and the institutions meet in the spring of every odd-numbered year to agree upon the enrollment projections for the budgetary biennium. According to SCHEV staff, these projections are not routinely used in developing the operating budget, although they are among the factors used in developing the capital budget. However, the Governor's budget for the 2000-2002 biennium (HB/SB 30) proposed a $16.6 million

Figure 5

Higher Education Enrollment Projection Process



increase, and the General Assembly approved funding for a $13 million increase to the higher education operating budget for enrollment growth.

The outcome of the spring consensus meetings is a fall headcount projection and an FTE projection over a six-year time frame for each of the four-year institutions. The projections are then submitted to the SCHEV council members for final approval. The enrollment projections are reviewed each fall, and if necessary, revised in light of actual data. (The threshold for revising an institution's projections is a five percent error.) Actual fall headcount data is initially available from the institutions in November, but often is not finalized until the following spring. The institutions do not report actual FTE data to SCHEV until up to a year after the close of the academic year.

Both SCHEV and DPB project enrollment for each four-year institution, and the institutions each project their own enrollment levels as well. SCHEV's mandate, as stated by Section 23-9.6 of the *Code of Virginia*, is to "review and approve or disapprove all enrollment projections proposed by each public institution of higher education." Consequently, the SCHEV and DPB projections are used primarily as a benchmark for assessing the reasonableness of institutions' projections. In addition, staff from the institutions have institution-specific knowledge regarding anticipated changes in admissions policies or recruitment efforts that cannot be captured by the State agency enrollment models.

There are no criteria or methodologies for selecting a particular enrollment projection for an institution. Instead, selections are made on a case-by-case basis. Staff at SCHEV, DPB, and the institutions acknowledge that there is give and take on both sides in settling on a projection level. If there is a significant discrepancy between an institution's projection and those of SCHEV or DPB, staff will evaluate the assumptions underlying each projection and will agree upon which projections are the most appropriate.

SCHEV Uses Two Projection Models

SCHEV staff employ two models to project the fall headcount levels – a statistical model and a demographic model. The statistical model is used to develop the fall headcount levels by projecting each category of student admissions (inputs to the system) and the number of students leaving the system through graduation or attrition (outputs from the system). For example, projections are made of the number of out-of-state students that will be entering and leaving the system. The demographic model estimates the fall headcount by mapping demographic data from counties across the State to particular institutions. Out-of-state fall headcount is projected separately in the demographic model. To project student FTE, SCHEV staff applies a fall headcount to FTE ratio to the projected fall headcount levels.

Statistical Model. The specific type of statistical models employed by SCHEV staff may vary from one year to the next. SCHEV staff indicate that they select the final set of statistical models based on which models have the least "error" or unexplained variance. The statistical model may utilize either multivariate econometric models or univariate models, such as ARIMA or exponential smoothing models. (See Exhibit 5 for a discussion of ARIMA models.) Econometric models may include explanatory variables such as tuition and fees, unemployment rates, and other economic indicators. The primary source of data for the econometric models is the Virginia Employment Commission (VEC), although SCHEV staff also gathers data from a variety of other sources for these models. Univariate models are based on historical levels of the forecast variable.

The statistical model initially produces a statewide fall headcount level. SCHEV staff then use a market share analysis to allocate the fall headcount levels to each institution. To determine the market share allocation, SCHEV staff compare each institution's fall headcount level with the statewide fall headcount for the most recent three years for which actual data is available.

For 2000-2002, the statistical model utilized primarily univariate models. SCHEV staff have found that the statistical models have been relatively accurate at predicting the fall headcount at the aggregate level. However, the models have not been as strong at predicting the fall headcount at the individual institution level.

Demographic Model. SCHEV staff also employ a demographic model to estimate the fall headcount. This model uses data from SCHEV's student-level database, which includes the age and county of residence of all in-state students currently attending Virginia's public institutions, and demographic data available from the VEC. To project the fall headcount, the model applies county level growth rates by age cohort to the corresponding student cohorts at each of the institutions. The county level demographic growth rates are provided by the VEC.

For example, SCHEV's student level database may indicate that there were 100 students between the ages of 20 and 24 from Arlington County attending Virginia Commonwealth University (VCU) in 1999. If the VEC projects that the 20 to 24 year-old age cohort in Arlington county will increase 2 percent by 2001, SCHEV would apply this 2 percent growth rate to the corresponding student cohort at VCU. The projected fall headcount level for this cohort at VCU in 2001 would be 102.

To project the out-of-state fall headcount at the institutions, the model simply applies historical growth rates to the most recent actual out-of-state fall headcount levels. The in-state and out-of-state fall headcount projections are combined to determine a total fall headcount projection for each institution.

In contrast to the statistical model, which projects inputs and outputs to the higher education system, the demographic model projects the fall headcount levels directly. The strength of the demographic model is its accuracy in allocating the fall headcount levels among the institutions rather than its overall projection level.

SCHEV staff use the institutions' fall headcount projections to develop student FTE projections. Staff apply institutions' historical fall headcount to FTE ratios

Exhibit 5

Autoregressive Integrated Moving Average (ARIMA) Models

Autoregressive Integrated Moving Average (ARIMA) models are statistical time series models that rely on the idea that past behavior is a predictor of future behavior. Similar to exponential smoothing models, ARIMA models rely on historical values of the forecast variable. However, ARIMAs are statistically and computationally more complex than exponential smoothing models.

ARIMA models are based on the concept of random disturbances in a data series. Between two observations in a series, a disturbance occurs that somehow affects the level of the series. ARIMAs use up to three different processes (autoregression, differencing to control for integration, and moving averages) to describe these random disturbances in data series.

There are three basic steps to using an ARIMA model to forecast data. The first step is to identify the processes underlying the series – that is the order of autoregression, the degree of differencing, and the order of the moving average. The next step is to estimate a new series based on the ARIMA model that was identified. This new series will include estimates of the variable over historical time periods, as well as forecasts of the variable in future periods. The final step in the ARIMA process is diagnosing the model results to determine whether the appropriate model has been identified. This includes comparing how well the model estimates fit the actual data series over the historical time periods.

Unlike other statistical models, such as regression models, ARIMAs are driven less by theory and more by the data series itself. Using ARIMAs to forecast a series is an iterative process that entails experimenting with different models until the best fitting model has been identified.

ARIMAs have tended to perform relatively well in producing short-term forecasts compared with other forecasting techniques. In addition, because ARIMAs rely on only one variable, there is no need to forecast other explanatory variables to provide a forecast for the variable in question. However, as is the case with exponential smoothing models, ARIMA models only produce reliable forecasts for a few data points into the future. In addition, ARIMAs can be conceptually more difficult to understand than other forecasting techniques.

to their projected fall headcount levels to estimate student FTE. Since the ratios are applied to both sets of the fall headcount projections, staff obtain two sets of student FTE projections as well.

Because the statistical and demographic models have different strengths, SCHEV uses the projections based on both models when discussing enrollment levels with institutions. By using projections from two different models, SCHEV often has a range for what may constitute a reasonable enrollment level for a particular institution.

Department of Planning and Budget's Role in the Projection Process

In 1997 DPB became involved in the higher education enrollment projection process. DPB staff project the fall headcount using a statistical model similar to that used by SCHEV. The DPB model utilizes exponential smoothing models to project each category of student admissions (inputs to the system) and the number of students leaving the system through graduation or attrition (outputs to the system). Similar to the SCHEV model, the DPB model produces an aggregate statewide fall headcount level, and DPB staff uses a market share analysis to allocate the fall headcount levels among the institutions. To project student FTEs, DPB staff also apply fall headcount to FTE ratios to projected fall headcount levels.

Because DPB staff and SCHEV staff use very similar statistical models, the projections from their respective models tend to be quite similar. Although DPB staff and SCHEV staff compare the projection results based on their models prior to meeting with the institutions, each State agency brings its own enrollment projections to the consensus meetings with the institutions. The DPB projection is used along with the SCHEV forecast in assessing the reasonableness of the institutions' projections.

The Institutions Project Enrollment Levels

The four-year institutions contacted during this study relied on simple historical trend models to project the student headcount and FTEs. Institutional staff review historical growth rates for various categories of students and determine whether these growth rates will continue into the future in light of other factors such as the economy or changes in the method of delivering academic programs. In addition, institutions may adjust their admission rates to achieve desired enrollment goals.

Although SCHEV requests that institutions provide detailed information supporting their institution-wide enrollment projections, the agency is mainly concerned with achieving an accurate projection at the institution-wide level. However, for institutional management purposes, the institutions themselves are interested in obtaining accurate enrollment projections at a more detailed level, for example by class level or by academic program. The categories of students projected by institutions vary, although they all must provide the level of detail requested by SCHEV.

Because most of the four-year institutions experience relatively stable acceptance, retention, and promotion rates, the institutions contacted for this study claim that a model based on basic growth factors is a reliable means of projecting enrollment. The length of an institution's waiting list may simplify the projection process even further. If an institution has a deep waiting list, it will have even more flexibility to control its yield rate, which compares the number of students accepted for enrollment to the number who actually attend in the fall.

All schools must deal with issues regarding the number and quality of their admission pool and their enrollment rates and retention rates. These issues can have a significant effect on future enrollments at even the most selective institutions. However, in recent years most of the institutions have experienced projection error rates of less than five percent, which is SCHEV's threshold for requiring institutions to update their projections during the biennium.

In order to bring more structure and standardization to the institutions' forecasting processes, starting in 1997 SCHEV began requiring each institution to detail its forecasting assumptions in a standardized Excel template for use during the consensus process. Institutions are required to provide information such as enrollment by level (classified by freshman, sophomore, junior, or senior status); the number of new enrollees, transfers, and continuing students; student progression rates; and fall headcount to FTE ratios. With this more detailed information, SCHEV and DPB staff can better evaluate both the institutions' forecasts and their own forecasts. SCHEV and DPB staff believe that the use of this data helped contribute to the low error rates achieved for the 1998-2000 biennium. Several institutions contacted by JLARC staff agreed as well. The use of standardized templates has helped lower projection error rates by requiring that institutions have a basis for selecting particular growth rates.

PROJECTION ACCURACY HAS IMPROVED

SCHEV and DPB staff do not compare the performance of their initial projections with actual enrollment levels. Rather, SCHEV maintains the accuracy rates of the final official enrollment projections that were agreed upon through the consensus process and approved by the SCHEV council members. As such, the accuracy rates discussed below are not a reflection of SCHEV's projection models alone, but rather the accuracy of the projections produced through the consensus process involving DPB and the institutions. In addition, this report does not provide the error rates for the separate institutions' projections, as SCHEV does not maintain these error rates.

SCHEV staff maintain separate error rates for the fall headcount and FTE projections. Prior to 1997, the consensus process produced both short-range (generally four-year) and long-range (ten-year) enrollment projections. Assessing the error rates for both sets of forecasts presents some problems, as the short-range and long-range projections occasionally disagreed for the same year, and the long-range projections were not documented for every year of the projection period.

In 1997, the consensus process began producing one set of six-year projections for headcount and FTE. SCHEV staff indicated that the short-range projections produced prior to 1997 are most comparable to the current projections. Therefore, this report only discusses error rates for the short-range projections, which are displayed in Table 4.

The error rates for fall headcount forecasts made in 1995 for the 1996-1998 biennium were 2.2 percent for the first year of the biennium and 2.8 percent for the second year. The error rates for the FTE forecasts made over this time frame were similar: 2.2 percent for the first year and 2.5 percent for the second year.

Table 4

Error Rates of Enrollment Projections at Different Points in the Budget Process

Fiscal Year	Biennial Budget Submitted to G.A.	Final Enrollment Projections
Headcount*		
FY 1996-1998 Biennium		
FY 1997	2.2%	0.1%
FY 1998	2.8%	-0.8%
FY 1998-2000 Biennium		
FY 1999	-0.4%	-0.4%
FY 2000	-0.4%	-0.5%
FTE		
FY 1996-1998 Biennium		
FY 1997	2.2%	0.3%
FY 1998	2.5%	-0.6%
FY 1998-2000 Biennium		
FY 1999	-0.6%	0.0%
FY 2000	N/A	N/A

* The fall headcount is never used to develop budget levels but is included in this table for comparative purposes.

Source: Error rates provided by SCHEV, 11/99.

The error rates for the forecasts made in 1997 for the 1998-2000 biennium were significantly lower than in previous years. The error rates for the headcount forecasts were 0.4 percent for both years of the biennium. Similarly, the error rate for the FTE projection for FY 1999 was 0.6 percent. Actual FTE data is not yet available for FY 2000.

By the time final amendments were made to the budget, the error rates for the fall headcount and student FTEs were less than one percent in both the 1996-1998 and the 1998-2000 biennia. (Although student FTE figures are occasionally used to develop funding levels, headcount data is never used for budgetary purposes.) For FY 1997 and FY 1998, the error rates for the final fall headcount projections were 0.1 percent and 0.8 percent. The final headcount projection error rate for FY 1999 was 0.4 percent, and the error rate for the final projection for FY 2000 was 0.5 percent.

The error rate for the FTE forecasts available for final amendments to the FY 1997 and FY 1998 budgets were 0.3 percent and 0.6 percent. For FY 1999, the error rate for the forecast available for final amendments was less than one-tenth of a percent. The actual FTE enrollment is not yet available for FY 2000.

The changes to the projection process made in 1997, namely including DPB in the process, requiring institutions to document their projection assumptions in a standardized template, and combining the separate short-range and long-range projections into a single six year projection, appear to have had a salutary effect on the headcount and FTE projection error rates. It may be too soon to fully assess the impact of these changes, since error rates under the new processes are only available for one biennium. However, the error rates for both the headcount and FTE projections have been noticeably lower since 1997.

BUDGET IMPLICATIONS OF THE FORECAST

According to SCHEV staff, since the early 1990s the State's higher education operating budget has not been directly or systemically related to the higher education enrollment projection levels. Hence, the impact on the State operating budget due to changes in the enrollment projections or projection errors is minimal. Projected student FTE data is one of several components used to evaluate new projects in the capital budget. These projects are largely evaluated on the basis of a space needs assessment that considers available space, utilization of the space, and current and projected FTE levels. However, the FTE level has only been used on an *ad hoc* basis in the decision-making process for the operating budget.

For the 2000-2002 biennium, the budgeting process did take FTE levels into consideration. As noted earlier, the Governor's Budget (HB/SB 30) proposed $16.6 million and the General Assembly approved $13 million in the operating budget for enrollment growth. (The current and projected enrollment levels by institution are shown in Table 5.)

From the mid-1980s through the early 1990s, enrollment levels played a more direct role in higher education funding through a document commonly referred to as "Appendix M." This document contained a set of funding guidelines that was largely based on student FTE enrollment levels and was used by SCHEV, DPB, and the General Assembly to develop institutional operating budgets. However, during the recession of the early 1990s the funding model was abandoned. Apparently a decision was made that the State could not afford the funding levels derived through the "Appendix M" document.

Although enrollment projections typically have not been strongly linked to the higher education budget process in recent years, this may change. SCHEV, the Governor's Blue Ribbon Commission on Higher Education, and the Joint Subcommittee on Higher Education Funding Policies are considering or have recommended alter-

Table 5

Fall Headcount and FTE Levels by Institution

	1999-2000		2000-2001		2001-2002	
	Actual	Projected	Projected		Projected	
Institution	Headct.	FTE	Headct.	FTE	Headct.	FTE
Christopher Newport University	5,164	4,044	5,224	4,125	5,296	4,190
College of William and Mary	7,553	7,506	7,554	7,487	7,512	7,444
George Mason University	24,180	17,892	24,616	18,103	24,932	18,321
James Madison University	15,223	15,242	15,495	15,332	15,556	15,385
Longwood College	3,709	3,595	3,832	3,770	3,985	3,913
Mary Washington College	4,000	3,740	4,137	3,877	4,219	3,951
Norfolk State University	6,987	6,250	7,022	6,243	6,994	6,258
Old Dominion University	18,873	14,320	19,170	14,520	19,438	14,700
Radford University	8,579	8,387	8,752	8,525	8,821	8,598
University of Virginia	22,433	21,113	22,261	21,186	22,381	21,256
University of Virginia at Wise	1,545	1,436	1,568	1,453	1,574	1,468
Virginia Commonwealth Univ.	23,481	18,507	23,648	18,821	24,023	19,085
Virginia Military Institute	1,335	1,560	1,325	1,549	1,324	1,549
Virginia Polytechnic Institute	27,910	26,771	27,247	26,752	27,381	26,728
Virginia State University	4,303	3,700	4,537	3,852	4,598	4,055
Total Four-Year Institutions	**175,275**	**154,063**	**176,388**	**155,595**	**178,034**	**156,901**
Richard Bland College	1,274	955	1,336	961	1,344	967
Virginia Community College System	134,987	77,330	134,987	77,330	134,987	77,330
Total Institutions	**311,536**	**232,348**	**312,711**	**233,886**	**314,365**	**235,198**

Sources: Actual fall headcount from data provided by SCHEV, 12/99. Projected fall headcount and FTE students data from SCHEV enrollment projections for Virginia's State supported institutions, 2000-2002 biennium (approved May 18, 1999)

native funding options that could be used to bring increased uniformity to the higher education budget process. In the options recommended by the Blue Ribbon Commission and under consideration by the Joint Subcommittee, enrollment levels would play a stronger role in determining resource levels for institutions.

The Projection Process Has Improved

It appears that the changes made in 1997 to the higher education enrollment projection process, which include requiring institutions to complete a standardized template detailing their projection assumptions, adding DPB to the process, and producing a single six-year projection, have had a positive effect on projection accuracy. Since this revised process has only been in effect for one biennium's worth of projections, it may be too soon to fully credit the reductions in error rates to the changed process. However, it is likely that these changes have contributed to the improved accuracy of the projections.

Since the higher education enrollment projections are not directly used to develop the higher education operating budget, projection errors have relatively few budgetary consequences. However, if the Executive Branch and the General Assembly decide to adopt a standardized funding approach that is somewhat dependent on enrollment levels, the higher education enrollment projection will become a more significant step in the budgeting process. At such a point in time, the State agencies and institutions may want to develop better documentation of the forecasting process and the specific models that were used in the process. The use of enrollment-dependent funding models may also call into question whether the community colleges should be brought back into the forecasting process.

IV. Medicaid Forecasting

Virginia general fund, general Medicaid expenditures in FY 1999 totaled $1.0 billion. This funding, along with matching federal funds, provided Medicaid health care services to over 630,000 low-income Virginians. General Medicaid expenditures exclude mental health/mental retardation, mental illness services, and administration, which also receive Medicaid funding.

The forecast of FY 1999 Medicaid expenditures generated by the Executive Branch were within one percent of the actual spending level. However, the large size of the Medicaid program means that a small percentage error can mean a significant difference in dollars. For example, the 0.83 percent difference between the fall 1998 forecast of FY 1999 expenditures and the actual level of expenditures that year amounted to $17.2 million.

This chapter focuses on the nature of the Medicaid program, the Medicaid forecasting process conducted in the Executive Branch, and the performance of the forecast. JLARC last completed a review of Medicaid forecasting in 1997. Senate Bill 515 passed by the 2000 General Assembly calls for JLARC to receive the Medicaid forecast produced by the Department of Medical Assistance Services and the Department of Planning and Budget.

BACKGROUND

The Medicaid program was established in 1965 by Title XIX of the Social Security Act. The program provides three types of health protection: (1) health insurance for low income families and people with disabilities; (2) long term care for older Americans and people with disabilities; and (3) Medigap coverage that helps low income elderly fill in the gaps of the limited Medicare benefit. It is a cooperative venture between the states and the federal government, with the U.S. government paying a federal matching percentage of between 50 percent and 83 percent of each state's Medicaid expenses. In FY 2000, the federal government will pay 51.65 percent of total Medicaid medical services expenditures in Virginia. The General Assembly appropriates general funds based on the official Virginia Medicaid forecast. Federal funds are allocated based on reporting of Medicaid claims made by Virginia's Medicaid agency, the Department of Medical Assistance Services (DMAS).

Each state administers its own Medicaid programs through a central agency. Federal guidance and regulations come from the Health Care Financing Administration (HCFA), although broad statutory guidelines permit states to set their own eligibility standards, and to determine the type, amount, duration, and scope of the services they will cover. States also have considerable flexibility in setting payment rates for services.

DMAS administers the Medicaid program for the Commonwealth of Virginia. A director, appointed by the Governor, reports to the Secretary of Health and Human Services. The Board of Medical Assistance Services is responsible for maintaining the State's Plan for Medical Assistance, the principal policy and guidance document for Medicaid. Exhibit 6 highlights some key points about Medicaid forecasting that are discussed in more detail below.

Medicaid Spending Has Increased Significantly

Medicaid spending has increased substantially during the 1990s, as shown in Figure 6. Medicaid appropriations doubled between FY 1985 and FY 1990, and then doubled again between FY 1990 and FY 1995. During the 1990s, Medicaid appropriations increased 160 percent, compared to an overall State general fund budget increase of 85 percent.

Medicaid funds are distributed to a variety of medical and health care providers. Virginia Medicaid forecasters identify nine broad service categories. These nine are frequently referred to as the "top line" categories and include: inpatient hospital, outpatient hospital, physicians, pharmacy, nursing facilities, managed care, Medicare premiums, other long-term care, and other general Medicaid. The official Medicaid forecast includes the mental illness category in addition to the "top line" nine.

Figure 6 also shows the distribution of funding to these service categories in FY1999. Inpatient hospitals received the largest share of general Medicaid funds, at

Exhibit 6

Key Points About Medicaid Forecasting

In FY 1999, Virginia spent $1.0 billion on general Medicaid services, funded through the Department of Medical Assistance Services (DMAS). Virginia's official Medicaid forecast is developed from separate forecasts by DMAS and DPB.

The official forecast delivered to the 2000 General Assembly calls for total spending to increase 10.2 percent in FY 2000, from $2,068,697,833 in FY 1999 to $2,279,647,565 in FY 2000. An increase of 3.3 percent is forecasted for FY 2001, to $2,354,832,486. A 4.7 percent increase is forecasted for FY 2002, to $2,466,012,401.

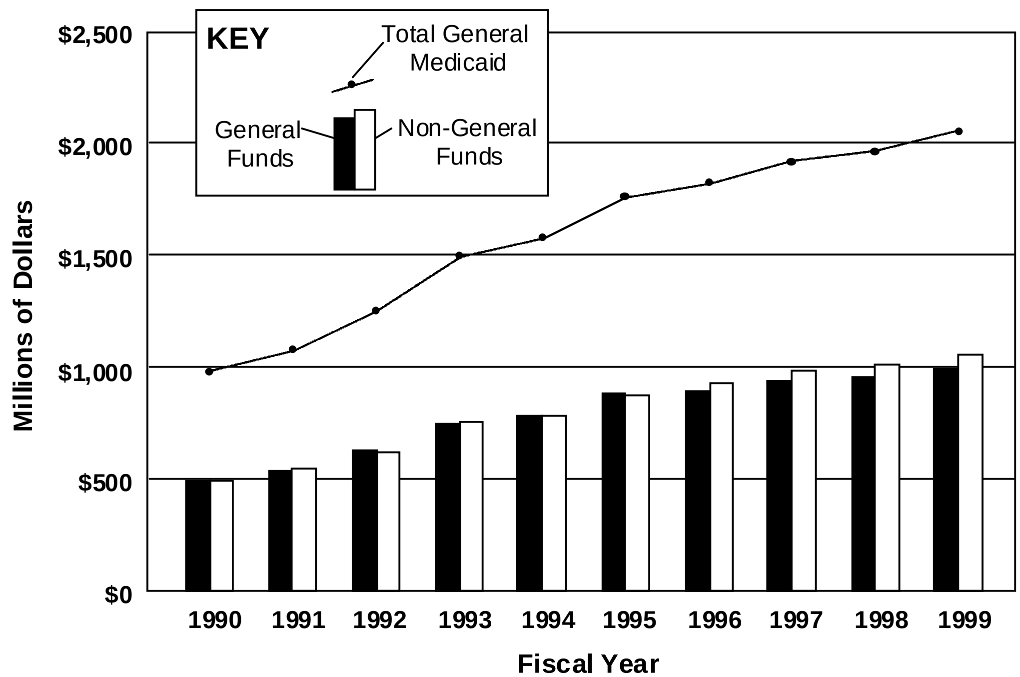
The forecasting methods used by DMAS and DPB are appropriate to the forecasting task at hand. Both agencies actively monitor the process and modify their methods when forecasts begin to depart from observed data.

Senate Bill 515, adopted by the 2000 General Assembly, adds JLARC as a recipient of the Medicaid forecast.

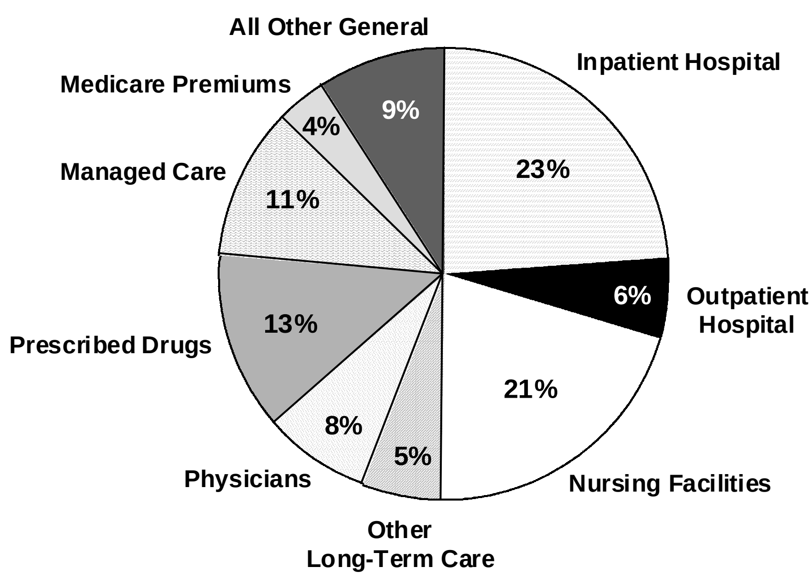
Figure 6

Medicaid Spending

General Medicaid Expenditures



Expenditures by Service Category, FY 1999



Source: DMAS 1999 Statistical Record.

23 percent, followed by nursing facilities at 21 percent and prescription drugs at 13 percent. The various "top line" service categories spending grew at different rates in the 1990's. Table 6 indicates the five and ten year growth rates for these service categories.

While Medicaid expenditures grew rapidly over the ten-year period between 1989 and 1999, as is clear from Table 6, spending on the various "top line services varied. Spending on these services averaged growth of nearly 200 percent during this period. The only category growing by less than 100 percent over these ten years was spending on nursing facilities. Spending on outpatient hospital services slowed to two percent in the last half of the 1990s. Spending on physician services actually decreased in those last five years.

Costly Client Categories Drive Spending

Medicaid expenditures depend on the numbers and types of clients served by the program, as well as on the particular services provided. Different categories of clients generate widely varying spending levels. For instance, although children rep-

Table 6

Expenditure Growth for Categories of Service (State and Federal Funds)

Category	5-Year Growth Rate (1994 – 1999)	10-Year Growth Rate (1989 – 1999)	FY1999 Expenditures ($ Millions)
Inpatient Hospital	6.5%	153.0%	$489.1
Outpatient Hospital	2.0	155.1	118.4
Nursing Facilities	12.9	82.8	424.2
Other Long-Term Care	59.0	288.7	109.9
Physicians	-22.1	136.5	159.2
Prescribed Drugs	85.3	269.1	262.4
Managed Care	Program Started in FY 1995	Program Started in FY 1995	222.8
Medicare Premiums	33.3	221.6	74.5
Other General Medicaid	49.5	418.1	186.6
Total	32.3	193.4	2,047.0

Source: JLARC staff analysis of DMAS 1999 Statistical Record.

resent 50 percent of recipients, they receive only 16 percent of total annual spending. The blind and disabled category accounts for 19 percent of recipients but receive 45 percent of annual spending. Figure 7 shows the relative size of the various eligibility categories and the relative share of total spending going to each category.

While the change in total Medicaid enrollment has moderated from the double-digit growth of the early 1990's, the mix of enrollees is changing to include a greater proportion of the most expensive categories of enrollees. The number of aged, blind and disabled recipients has increased since 1997. Medical treatments are also increasing in cost, including double-digit annual increases in prescription drug prices.

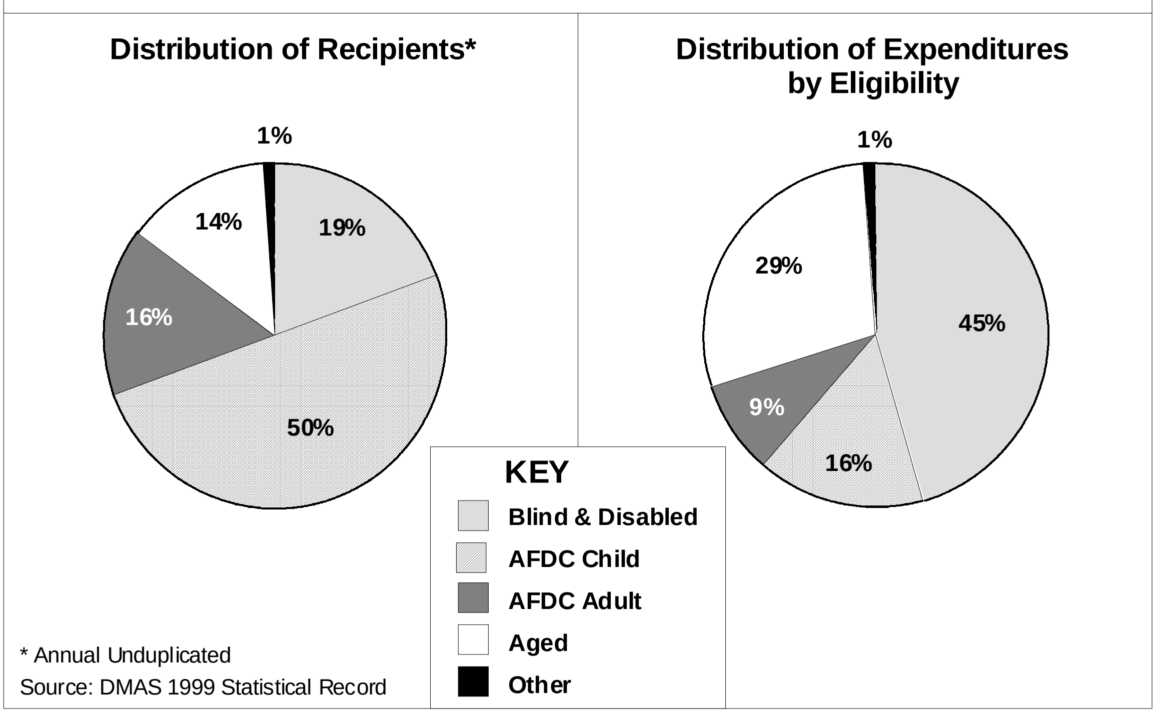
The cumulative effect of these trends is that total Medicaid expenditures in Virginia are expected to continue increasing. Total general Medicaid expenditures between FY 1997 and FY 1999 increased by 7.2 percent. The current official forecast calls for spending to increase 10.2 percent in FY 2000, 3.3 percent in FY 2001, and 4.7 percent in FY 2002.

Client Eligibility and Provider Certification

States have flexibility in setting eligibility and coverage policy. To qualify for federal matching funds, states must provide Medicaid coverage for certain individuals

Figure 7

Medicaid Spending Distribution, FY 1999



* Annual Unduplicated

Source: DMAS 1999 Statistical Record

who receive federal income-maintenance payments, as well as for related groups not receiving cash payments. These requirements have an important impact on Medicaid spending, which is what the forecasts predict.

Key steps in the Medicaid funding process that are important to understanding Medicaid expenditures and forecasting are shown in Figure 8. The most important steps include client enrollment and eligibility, provider certification and service delivery, claims processing and reporting, the forecasting process, and the budgeting process. This section provides information on enrollment and eligibility, and on claims processing and reporting. The forecasting process and the budget process are discussed in following sections.

Categorically Needy. Medicaid is a means-tested program. The primary group provided with Medicaid coverage is the categorically needy. Major segments of this category include:

- recipients of Temporary Assistance to Needy Families (TANF),
- pregnant women and children with incomes at or below 133 percent of the federal poverty level, and
- Supplemental Security Income (SSI) recipients.

Categorically needy individuals are eligible for full Medicaid benefits.

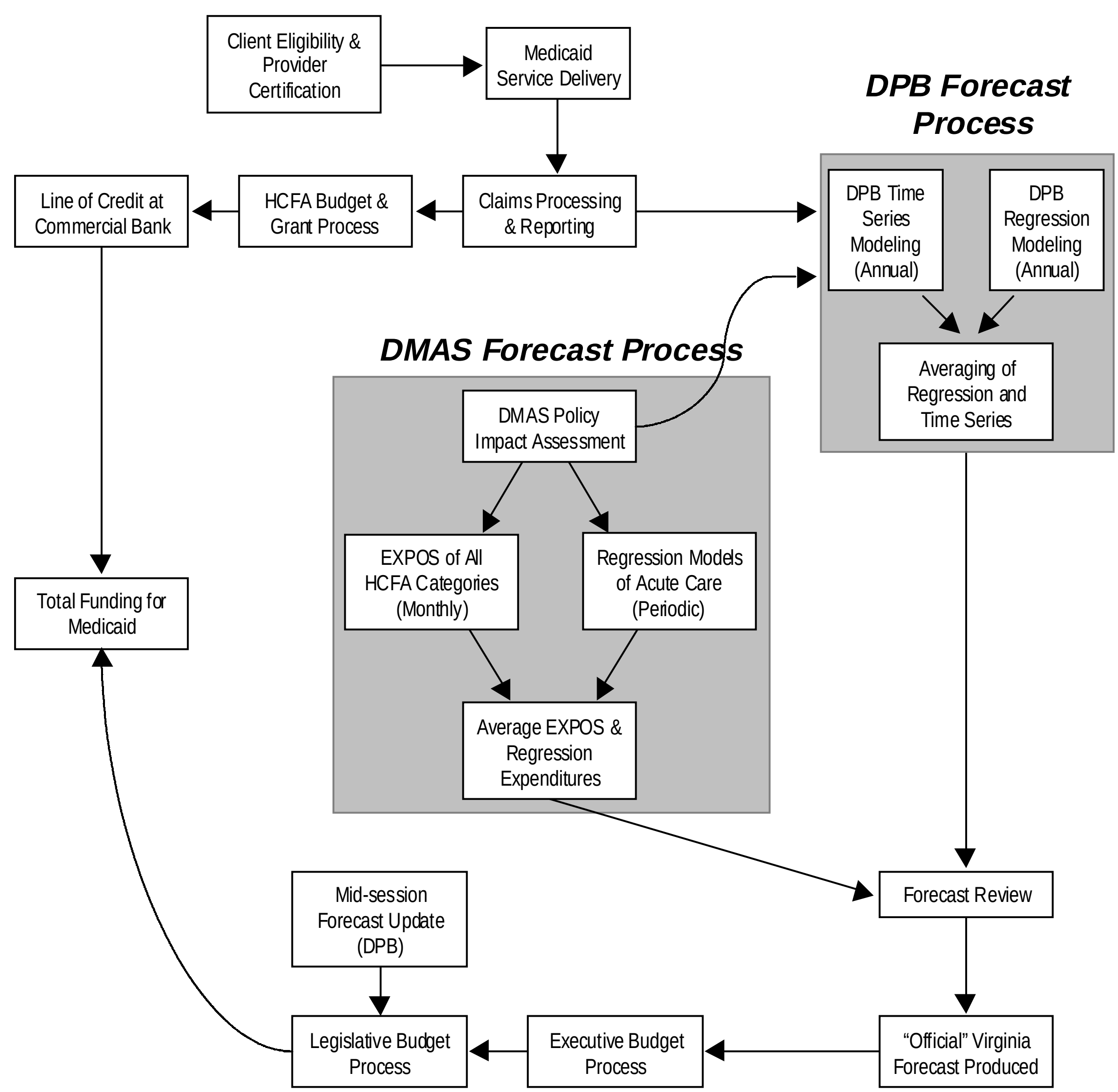
To receive federal matching funds, a state must offer certain basic services to the categorically-needy population. These services include inpatient and outpatient hospital services, physician services, early, periodic screening, diagnostic and treatment services (EPSDT),nursing facility services, home health care, family planning, rural health clinics, transportation, and laboratory and X-ray services. States may elect to offer optional services such as clinics, prescription drugs, and dental services.

Medically Needy. Medically needy individuals define a second group and may be eligible for some Medicaid benefits. Medically needy people are those who would fall into a mandatory eligibility group but exceed an income or resource standard, and thus do not qualify for categorically needy status. The State determines the income limits to define this group. Persons in this group qualify by incurring medical bills that reduce their income and or resources to the necessary level.

Eligibility and Certification. An individual must apply for Medicaid in order to receive medical services through the program. This process normally involves a trip to their local Department of Social Services (DSS) office. Once there, the individual will be interviewed by a DSS caseworker to determine if the individual meets the income and resource limits set for Medicaid eligibility. If the individual meets these requirements, he or she is issued a Medicaid card, which must be presented when visiting a Medicaid provider.

Figure 8

System of Medicaid Forecasting



EXPOS = exponential smoothing model.
Source: JLARC staff analysis

Just as Medicaid clients must apply and be registered as Medicaid eligible, health care providers must apply for Medicaid provider certification. The provider must agree that Medicaid patients will not be discriminated against in the services they receive or in their freedom to access other Medicaid professional or institutional providers and to accept as payment in full the amount established by Medicaid. Providers also agree to use certain claims and billing forms and to maintain adequate records.

Claims Administration. A contract with First Health Services Corporation (FHSC) provides the State with Medicaid claims processing, payments to providers, and regular use and costs reports, which supply the forecasting process with data. Once a Medicaid client receives services from a Medicaid provider, the provider submits a claim to FHSC, which processes it and determines if it meets certain criteria before payment. Claim checks are distributed weekly by FHSC.

In FY1999, FHSC processed nearly 25 million claims for DMAS. Nearly one in five of these were denied (19.8 percent).

Medicaid Reporting Requirements

Using data collected by FHSC, DMAS submits a series of reports to HCFA. These reports provide HCFA with information to review the State's Medicaid program and to plan for future Medicaid needs.

The most important data reports submitted by DMAS are the HCFA-2082, the HCFA-64, and the HCFA-37. The first two reports are discussed briefly here; HCFA-37 is discussed in the forecasting section.

The HCFA-2082 is an annual report that provides HCFA with Medicaid population characteristics and utilization data. Much of the data used to evaluate a State's Medicaid program and population come from this report.

The HCFA-64 provides actual payment information on Medicaid claims. The HCFA-64 reconciles the estimates provided to HCFA before the fiscal quarter (in the form of the HCFA-37). The HCFA-64 allows HCFA to identify overpayments and underpayments to the states. The amounts claimed on the HCFA-64 must be actual expenditures for which all supporting documentation is available at the time the claim is filed.

THE MEDICAID FORECAST

Two agencies independently produce Medicaid forecasts and then compare their results to produce an official Virginia forecast. The Department of Planning and Budget (DPB) is authorized by language in the Appropriation Act to present a Medicaid forecast to the General Assembly in conjunction with DMAS:

> By November 15 of each year the Department of Planning and Budget, in cooperation with the Department of Medical Assistance Services, shall prepare and submit a forecast of Medicaid expenditures, upon which the Governor's budget recommendations will be based, to the Chairmen of the House Appropriations and Senate Finance Committees. (Chapter 1073, Item 316).

It is thus the responsibility of the Executive Branch to base the Medicaid budget on this forecast. The Medicaid forecasting process bridges the gap between the service delivery and claims processing stages and the budget process. Forecasts of Medicaid expenditures play a role in both State and federal funding processes.

DMAS Forecasting Process

DMAS forecasters must accommodate two budgeting processes. They must produce forecasts that can be used by federal and State budget makers. The result is a forecasting cycle that provides information to DMAS management, and for uses outside of DMAS such as the Virginia budget process and the federal budget and grant processes.

DMAS Data and Procedures. The most important data elements in DMAS Medicaid forecasts come from data collected by First Health Services Corporation. The Medicaid forecasters use two data reports. The first is a weekly expenditures and operations allocations report that shows remittances, average expenditures per transaction, and lump sum payments. Presented for some 140 Medicaid items, these statistics can be grouped into more comprehensive categories such as hospitals and pharmacy. DMAS forecasters use cumulative data from the final report each month.

The second report is built from FHSC's claims database. This report provides monthly total payments and units of service. Units of service vary for each provider type. For example, inpatient hospital encounters are measured in days.

This data can be used to obtain the average cost of a unit of service. The monthly summary report breaks Medicaid spending out into 27 HCFA service categories such as inpatient hospital, mental health facilities, and nursing homes.

DMAS builds its forecasting models from the line items in these reports. DMAS analysts create and monitor 70 detailed forecast models and use them to produce a forecast each month incorporating the new month's data. DMAS also maintains an additional set of models that cover a subset of the major Medicaid service categories. Both sets of models are combined in an averaging process to produce a monthly Medicaid forecast. This forecast is used internally for various DMAS planning and operations tasks.

Two of DMAS's monthly forecasts play an important role in the funding of Medicaid. The September forecast becomes the principal guide in the Virginia fiscal cycle. The August forecast is the final forecast available for reporting to HCFA for federal Medicaid appropriations.

The quarterly budget estimate (HCFA-37) includes both actual spending and forecasts of future spending. The August submission of this document to HCFA creates the initial State allocation for the new federal fiscal year, beginning in October.

HCFA emphasizes, in its State Medicaid Manual, that the November HCFA-37 submission is important for federal budget formulation. The November submission serves as the basis for the formulation of the Medicaid portion of the President's budget, presented to Congress each January. HCFA also emphasizes that quarterly submissions are equally important components of the grant award cycle. Virginia receives an annual grant allocation, although the State still files quarterly budget estimates and expenditure reports with HCFA.

While DMAS relies on historical spending and other Medicaid data to produce a forecast, additional information is also incorporated in the forecast process. DMAS forecasters must be concerned with numerous policy changes that can alter the way Medicaid works. The two most important changes are changes in eligibility — rules about client entry into Medicaid — and coverage, the list of services that will be covered by Medicaid. Changes in either of these can have substantial effects on Medicaid spending.

DMAS Policy Impact Adjustments

During the General Assembly Session, DMAS forecasters monitor legislation to detect significant policy changes. Once a policy change has been identified, DMAS has a method for incorporating these changes in its forecasting models. DMAS incorporates policy changes into the exponential smoothing models through a "level-shift" process. This process permits the analyst to introduce a policy issue directly into a forecasting equation, adjusting forecast data to the new policy environment. These policy adjustments, as DMAS calls them, influence almost all of the major forecasts.

An example of a recent policy adjustment was health maintenance organization (HMO) expansion. When the HMO program expands, DMAS adjusts the forecasts for the major acute care services. These adjustments reduce the forecasted hospital, physician, and pharmacy services because managed care generally decreases the use of these services.

There have also been policy adjustments, in the form of rate increases, for nursing facilities and personal care, the major long-term care forecasts. These rate increases, approved by the 1999 General Assembly, took effect in July 1999.

There are also inflation adjustments to the data used in DMAS forecasts. Hospitals, nursing homes and home health agency reimbursement rates are annually adjusted for inflation. Pharmacy reimbursement rates are linked to the average wholesale price drug listing and are thus indirectly adjusted for inflation.

DMAS Forecasting Models

DMAS currently uses two types of forecasting models when it prepares the monthly Medicaid expenditure forecast. These two types include exponential smoothing and multiple regression.

Exponential Smoothing Models. The first type is a series of exponential smoothing models. Exponential smoothing is a single-variable time series approach to forecasting (see Exhibit 2 in Chapter II for a description of exponential smoothing models). With this system, DMAS forecasts approximately 70 Medicaid services using historic spending data for each item forecast.

DMAS generates a forecast for the utilization of each service, the costs per unit for each service, and the lump sum payments for each service. There are thus over 200 outputs of the exponential smoothing process. By combining the separate forecasts for utilization and costs, DMAS can produce a total spending forecast for the Medicaid service item.

Once these detail (or line item) forecasts are complete, DMAS combines these service items into more comprehensive groupings. DMAS aggregates the estimates into the nine "top line" service category forecasts. These models are then used to produce a total general medical services forecast, which describe all general Medicaid spending.

DMAS exponential smoothing models have changed over time. The most significant recent change was the removal of data from the early 1990s. The early 1990s were a period of rapid Medicaid policy-driven growth. This was forcing the prediction up, and the exponential smoothing models were over-forecasting expenditures. Since this change to the models two years ago, DMAS stated that the exponential smoothing models have become more accurate.

DMAS notes that by having a larger number of forecasts that are aggregated, they produce a more accurate forecast than could be achieved if only a total Medicaid forecast was produced. The literature on smoothing models rates these models as highly accurate for immediate and short-term forecast horizons. The exponential smoothing model used by DMAS can account for data that exhibits several complicated features and can forecast data that has seasonal variations and long-term upward or downward trends.

Regression Models. The second forecasting method used by DMAS is regression analysis. DMAS uses multiple regression models to produce forecasts of large, acute care expenditure categories, including inpatient and outpatient hospital, physician, and pharmacy services. These regression models use more than one variable to predict forecasted values. Exhibit 7 briefly describes regression analysis.

The DMAS regression models are used to predict future utilization of acute care services by specific client groups. Each model is slightly different but typically uses predictive variables, such as the projected number of eligible members of the Medicaid fee-for-service population, and various calendar-based variables.

DMAS uses at least one regression model for each service type and eligibility type. For example, for inpatient hospital services, DMAS uses an equation for indigent women and children, disabled individuals, and aged individuals. For the various ag-

Exhibit 7

Regression Analysis

Regression models are statistical models involving more than one variable that focus on the relationship between the variables in the model. In this way regression models differ from other forecasting models that focus on the historic trend of a single variable, such as ARIMA and exponential smoothing.

The regression approach assumes that there is a relationship between one variable (generally known as the dependent variable) and one or more underlying variables (generally known as the independent variables). Regression can be used to forecast any measurable variable.

Suppose one wants to forecast future State spending in program A. Also assume it is believed that spending in program A depends on the size of the state's population. A regression model will predict how much spending may change as the size of the service population increases or decreases. Any number of variables can be added to the model. When there are more than two variables in a regression model, one can tell which variable is the most important in driving spending for program A.

To forecast future spending on program A, one must estimate what the values of the major underlying variables will be in the future. Then the analyst uses these estimates in the model and produces a forecast of program spending in the future. Forecast quality depends on the quality of the estimates of the independent variable, and on the fundamental relationship between all the variables continuing to be the same in the future as it was in the past. Bad input estimates, or changes in relationships, will cause regression models to produce poor forecasts. It is therefore important to use the best available estimates in the regression model.

A final limitation of regression models is that the analyst must know enough about the program to pick the right variables to include in the model. If important variables are not included in the model, the forecasts may perform poorly.

gregated categories such as the aged, the blind and disabled, or the medically needy, there may be several models, the results of which are combined for a subtotal.

Once DMAS has predicted service utilization with a regression model, this number is multiplied by a prediction of the cost per unit of that service delivered for the eligible group in question. For example, the prediction of inpatient hospital utilization is multiplied by the estimated future average cost of each unit of hospital use. The result is the predicted total cost of inpatient hospital services for the given eligible group. Predictions of average, or per unit, costs come from an additional set of exponential smoothing models.

DMAS began using regression models two years ago to supplement the results from the more comprehensive exponential smoothing system. Regression models are more useful in explaining variations in expenditure patterns than the exponential smoothing models. The multivariate regression models also provide a second source of forecasts that can be combined with the single variable exponential smoothing results.

DMAS averages the prediction from the exponential smoothing system with the results from the regression models to produce the final forecast. For the large acute care services (hospitals, physicians, and pharmacy), then, the final DMAS forecast is the average of the exponential smoothing model results and the regression model results. For other categories, the final DMAS forecast is the forecast produced from the exponential smoothing model.

DMAS Forecasting Review and Update

DMAS updates the exponential smoothing models monthly. This regular updating is necessary to prevent the models from drifting off course over time. Evaluating these models typically involves examining their historical accuracy and adjusting the smoothing parameters to optimize the model's performance.

DMAS reviews and revises the regression models less often than the exponential smoothing models. Typically, DMAS re-evaluates the regression models at least monthly during the fall budget cycle. The review of the regression models includes standard diagnostic tests: checking the relative accuracy of the models (mean absolute percentage error), checking the statistical significance of the independent variables (t-tests), and examining the overall explanatory power of the model (r-square).

DPB's Medicaid Forecasting Process

DPB's Medicaid forecasting begins with receipt of the August financial and utilization data from DMAS. DPB forecasting staff use the same weekly and monthly data reports from First Health Services Corporation that are used by DMAS. DPB produces its own forecasts of Medicaid population subcategories by using a variety of data. For example, DPB uses TANF data from the Department of Social Services to produce a forecast of TANF recipients, caseload, and cost per case. DPB also uses inflation data from a private vendor and produces a separate inflation forecast.

DPB forecasters consider their work to be an independent forecast of Medicaid. Within DPB, the forecasting staff is separate from the staff of budget analysts, and DPB forecasters note that this contributes to their independence from the budget process.

DPB's Medicaid forecasting efforts can be grouped into three broad categories: an expenditure forecast, a utilization forecast, and a series of regression models. These are then combined. The end result is compared to the DMAS forecast.

During sessions of the General Assembly, DPB generally presents a forecast update to the Senate Finance and House Appropriations committee staff. DPB reruns the same models used during the August forecast, adding the additional months of data that have become available. If the numbers seem to diverge from the original forecast, a review of detail items will be undertaken.

DPB's Forecasting Models

DPB Medicaid forecasts are based on both regression and time series models. DPB staff uses a variety of time series models including simple moving averages, exponential smoothing, and ARIMA models. DPB chooses the time series models based on the statistical fit of the model and historical forecast performance. A variety of time series models are evaluated, although DPB typically selects ARIMA models for the larger series and exponential smoothing models are used for smaller categories. (See Exhibit 6 in Chapter III for a description of ARIMA models.)

DPB staff use a variety of ARIMA and exponential smoothing models for each line item. DPB staff systematically evaluate the performance of each model and choose a model form for each line item forecast. These line item forecasts are then aggregated into "top line" expenditure forecasts and "top line" utilization forecasts.

DPB staff also use regression analysis to forecast several major spending categories. Ultimately the results of the time series and regression models are combined to produce a final "top line" forecast of Medicaid expenditures.

DPB staff also incorporate various policy adjustments into their forecast models. The information needed to identify these policy issues frequently come from discussions with DMAS analysts.

The DMAS/DPB Forecast Comparison Process

The Medicaid forecasting process produces a final "official" Virginia Medicaid forecast. This process has changed somewhat each year, although it typically involves DPB and DMAS forecasters meeting to review data and models and to work out technical differences.

Prior to the fall meeting between DMAS and DPB, there are ongoing discussions between staff of the two agencies. These are important for keeping both sides informed of any policy or modeling changes that need to be considered in the forecasting process.

The comparison begins by both agencies reviewing the "top line" forecast totals. If there are no major differences between the two "top line" forecasts, as the agencies determined in preparing the final FY 1999 forecast, then the results from each agency are averaged to produce an official Medicaid forecast. Table 7 suggests that sometimes one agency's forecast is chosen, and at other times an average of the two forecasts is used.

Table 7

Recent Medicaid Expenditure Forecasts

Session Forecast Was Used	DMAS Total Medicaid Forecast	DPB Total Medicaid Forecast	Official Total Medicaid Forecast
1998	$2,017,445,485	$1,980,021,847	$2,017,445,485
1999	$2,068,523,413	$2,052,307,961	$2,052,307,961
2000	$2,268,307,890	$2,290,987,240	$2,279,647,565

One-year forecasts of nine general Medicaid “top line” expenditures and mental illness.

Source: DMAS and DPB submissions to JLARC staff.

When there are differences at a “top line” category the two agencies then compare the more detailed forecasts that are combined to make up their respective “top line” forecasts. At this level of detail, it is often possible to identify the use of a different set of assumptions or the failure of one agency to incorporate a relevant policy change. If the difference can be isolated at this detail level, either the more “reasonable” estimate will be used or one agency may reforecast their detail item.

Once detail differences are resolved, or even if both agencies agree to disagree, any of several steps may be taken. It appears that DPB staff make the decision on how the two forecasts will be combined. For example, the top-line forecasts may be averaged. Sometimes one agency’s forecast is selected or given more weight. There have been instances where the DMAS forecast was used for the short run portion of the forecast horizon, six to nine months into the future, although apparently that practice has not been used at least since the fall 1997 forecast.

DPB staff note that, in 1999, both forecasts were performing so well that they simply averaged the forecasts over the entire forecast timeline. Giving equal weight to each forecast indicates that the value of the average is greater than the value of either forecast standing alone. For the 1999 General Assembly, the DPB forecast was submitted.

MEDICAID FUNDING PROCESS

There are two major steps in the Medicaid funding process. First, federal dollars must be budgeted, appropriated, and allocated to the State. Second, State dollars must be budgeted and appropriated.

Federal Funding Process

The federal portion of Medicaid funding is partially a function of Medicaid forecasts. Federal funds are set aside for Virginia to access based on forecasted data while reports of actual expenditures reconcile this federal grant and actual spending.

Federal funds for Medicaid are acquired through the HCFA reporting process. The HCFA-37 is sent in prior to each federal fiscal quarter. It is an estimate of the State's next quarter Medicaid budget needs. The DMAS budget office prepares this report and includes in it information from the report of actual expenditures produced by DMAS accounting, the HCFA-64. The HCFA-64 reconciles the budget estimate (forecast) submitted in the HCFA-37. If there is a shortfall apparent in Medicaid spending, DMAS can resubmit its budget estimate for increased federal funding.

These reports are submitted to HCFA and reviewed by both the regional and central HCFA offices. Once approved, these reports are used by HCFA to establish a State Medicaid grant. This grant is essentially a line of credit at a commercial bank. DMAS can access this line of credit to draw down the federal share of Medicaid funding. HCFA also uses these reports in projecting its own budget needs for the President's budget submission to Congress.

State Funding Process

In the State budget process, the Medicaid forecast is the primary source of information about Medicaid used by the Governor and staff who prepare the Executive budget, as well as by the General Assembly, which appropriates funding. The State budget process, through policy initiatives and other budget adjustments, may produce a budget that differs from the official forecast. Because of such budgetary adjustments, the forecast does not necessarily equal the DMAS Medicaid budget.

After the Governor's budget is released, the Senate Finance and House Appropriations committee staff may request a mid-Session update of the Medicaid forecast from DPB. DMAS staff indicate they do not participate in the mid-Session forecasting process, although the agency continues its monthly forecast updates. After DPB produces a mid-Session forecast update, the results are compared with the most recent DMAS forecast. DPB staff indicate that any deviations are discussed with DMAS staff.

During the General Assembly Session, there may be additional policy changes. Thus, the resulting appropriation for Medicaid may differ from both the executive budget and the official Medicaid forecast.

FORECAST ACCURACY

The accuracy of the Medicaid forecast is very important since the Medicaid budget is so large. Even a small percentage of error, a conventional way to measure the accuracy of a forecast, can nonetheless have a large dollar impact. Because Medicaid is an entitlement program, sufficient funds must be provided to cover the costs incurred by Medicaid recipients. A forecast that underestimates Medicaid spending can lead to transfers of funds from elsewhere in the State budget. If the forecast overestimates Medicaid spending, other State programs forgo funding that could have been made available to them instead of Medicaid.

Table 8 shows how close official forecasts have come to predicting actual spending on Medicaid over a three year period. The official forecast was within one percent of actual expenditures for FY 1997 and FY 1999 and within two percent for FY 1998.

Late in FY1999, $19.7 million in general funds and a matching amount in federal funds were transferred into the DMAS budget. This transfer, according to DMAS staff, was the first transfer of this type in several years. DMAS found that it was expending Medicaid dollars at a rate that would exceed the available funding. Due to the entitlement nature of Medicaid, funds had to be found and moved into the agency's budget to accommodate the higher spending.

Using a provision of the Appropriation Act, funds were transferred from the FY 2000 DMAS budget into the FY 1999 DMAS budget. The "hole" thus created in the FY 2000 DMAS budget had to be replaced during the subsequent budget cycle. This was accomplished in HB 29, the "caboose" budget bill submitted to the 2000 General Assembly. Of the $19.7 million in general funds transferred, $4.6 million was not spent in FY1999 and was thus carried forward to FY2000. This overall transaction illustrates the sensitivity of the budget to small percentage errors in the forecasts, and the complexity involved in handling such errors.

Table 8

Difference Between Medicaid Forecasts and Expenditures

Fall Forecast	Forecasted Fiscal Year	Two-Year Difference	One-Year Difference
1995/1996	1997	0.68%	0.72%
1997/1998	1999	0.71	-0.83

Source: JLARC staff analysis of the Medicaid forecast compared to Medicaid spending (general Medicaid and mental illness), based on forecasts submitted by DPB and expenditures from the DMAS 1999 Statistical Record.)

V. Inmate Population Forecasting

After several years of double-digit growth in the State's adult inmate population and a major prison construction program, Virginia has most recently seen a downturn in both the number and rate of arrests, and the growth in the inmate population has leveled off and declined slightly. The adult inmate population for which the State is responsible stood at 30,951 in January, 2000, down slightly from 31,181 as of June, 1999. The official forecast anticipates growth of less than three percent per year over the next ten years. This contrasts with increases of as much as 15 percent per year in the State-responsible population earlier in the 1990s.

Forecasts of the adult inmate population used in 1994-95 led to a significant prison construction program. Those forecasts were too high, and the resulting prison construction program led to a surplus of prison beds. By late 1999, Virginia was renting over 3,000 prison beds to five other states and the Federal Bureau of Prisons. Virginia generated over $35 million in revenue this way in FY 1999, which was used to offset the cost of prison operations. Based on the current official forecast, Virginia may already have sufficient prison capacity to house the expected prison population through 2005, and possibly beyond.

A variety of reasons have been suggested for declining criminal activity, which is a nationwide trend, and for the slowed growth of Virginia's incarcerated prison population. Reasons that have been suggested for declining criminal activity nationwide include statutory changes such as sentencing reforms that remove convicted felons from society for a longer period, thus reducing their opportunity to commit additional crimes, a strengthened economy, lower unemployment, and an aging crime-prone population. Reasons that have been suggested for the plateauing of the Virginia prison population include those just mentioned, as well as the abolition of parole, implementation of sentencing guidelines, expansion of intermediate punishment and treatment programs, and decreases in the rates of violent and other serious crime.

Because corrections has been one of the major sources of budgetary growth for more than a decade, and due to its continued role as a major component of the State's general fund budget, a review of the Virginia correctional forecasting process is included in this report. Exhibit 8 highlights some key points about corrections forecasting in Virginia that are discussed in more detail in the remainder of this chapter.

INMATE POPULATION FORECASTING IS A CONSENSUS PROCESS

JLARC staff first reviewed the Corrections forecasting methodology and procedures in a 1985 report which identified weaknesses in the methods then used by the

Exhibit 8

Key Points About the Adult Inmate Population Forecast

In June 1999, there were 31,181 adult inmates for whom the Commonwealth of Virginia was responsible. The Department of Corrections had a total General Fund appropriation for FY 1999 of $613.8 million.

The inmate population grew by as much as 15 percent per year in the mid-1990s. By the late 1990s, this growth had slowed to less than six percent per year, and was forecasted to slow further, to an annual rate of 1.2 percent between 2000-2004.

Since 1995, the error in forecasting the next year's inmate population has averaged less than four percent. Longer-term forecasts used to prepare the biennial budgets have been less accurate. The official forecast stems from a process involving personnel from seven State agencies. Major concerns focus on forecasting the effects of proposed changes in legislation which may significantly impact the size of the inmate population.

Department of Corrections to forecast the adult inmate population. A 1987 JLARC report recommended a change in the process for developing forecasts:

> a more open, participative process should be considered as a means of promoting forecast accuracy and understanding. The process for producing and validating the forecasts should be expanded to include more participants. Such a process would ensure that key actors in the criminal justice system have input into the forecast. Moreover, such a group would promote general understanding of the forecast and the assumptions which drive it.

A more open, participative forecasting process was implemented in the late 1980s and remains in use today. The goals set out in the 1987 report have largely been achieved.

Since the late 1980s, the Secretary of Public Safety has annually overseen a process which estimates the number of adult inmates for whom either the State or the localities have responsibility. The forecasting process now uses two committees to produce the official forecast. First, members of a technical committee use quantitative methods and analysis to make projections based on past trends in the admissions and incarceration of criminal offenders. The technical committee generally begins meeting in July of each year, and usually concludes its work by September.

A policy committee, generally meeting in September and October, then reviews these projections in light of policy issues that are likely to affect future inmate populations, and recommends a particular projection to the Secretary. The process concludes when the Secretary issues a report documenting the process and stating the official forecast. During the last several years, this report has been issued annually on November 1. A timeline depicting these activities is shown in Exhibit 9.

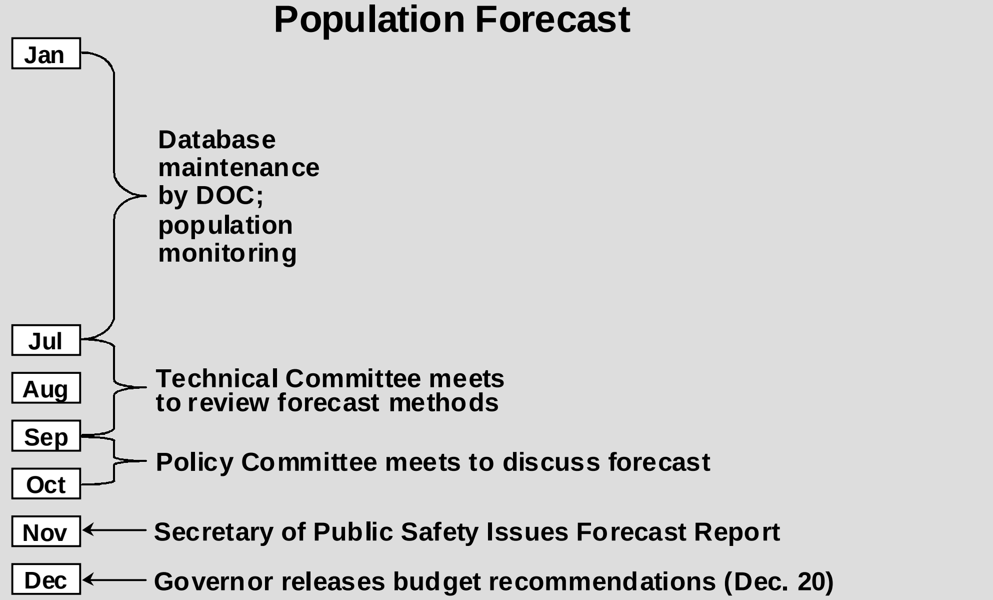
Forecasts of three distinct incarcerated groups are made: the State- responsible population, the local-responsible population, and the juvenile offender population. The local-responsible population, housed in local and regional jails, is forecasted through processes similar to the one used for the State-responsible population. The size of the juvenile offender population, housed in facilities operated by the Department of Juvenile Justice (DJJ), has also been forecasted from a process using both a technical and a policy committee.

This overview focuses on the largest of these three groups, the State-responsible adult population. This population is defined in *Code of Virginia* §53.1-20, which says that the Department of Corrections must house felons with a net sentence of one year or more when sentenced for a crime committed on or after July 1, 1995 ("new law" offenders), and felons with sentences of two years or more for crimes committed prior to that date ("old law" offenders).

The technical advisory committee is the committee initially involved in forecasting the inmate population. This committee consists of persons in various State agencies who have expertise in statistical and quantitative methods as well as staff of the Department of Corrections who are directly responsible for forecasting. Included on this committee are staff from agencies that are not involved in the day-to-day administration of correctional facilities, such as the Department of Criminal Justice Services, the Criminal Sentencing Commission, the Department of Planning and Bud-

Exhibit 9

Timeline for State-Responsible Inmate Population Forecast



JLARC staff graphic.

get, and JLARC, who provide an independent and objective perspective on the methods and data.

This committee reviews trends, methods, and assumptions employed in the forecasts, and helps assure that the final forecast has a sound methodological basis. Staff from the Department of Planning and Budget present a forecast to this committee, in part to ensure that the committee has the benefit of at least two forecasts prepared by different agencies, often using different methods.

The technical advisory committee reviews the various forecasts for statistical performance and recommends which forecasts the policy committee should consider. The policy committee reviews these recommended forecasts, supplementing them with additional judgements about the expected effects of policy and legislative initiatives. For example, the 1999 policy committee, which included several local magistrates, considered and made an explicit adjustment to the forecast for the combined effects of the "Virginia Exile" and bail reform bill, adopted by the 1999 General Assembly (HB 1691). Despite participation by experts and persons active in the criminal justice process, sometimes these adjustments are essentially "educated guesses." This is often due to the nature of the factors impacting the forecast, and a general lack of data or experience with some of them.

The extent of outside participation distinguishes the corrections forecasting process from other State forecasting efforts. The process for adopting a State and local-responsible inmate forecast is a "consensus" forecasting process. Staff from the various agencies review and approve the application of the model. Alternative models are developed and considered.

The final, official forecast is selected and adjusted based on open discussion by the policy committee, which includes representatives from several agencies with no direct responsibility for the prison population, such as the agencies noted earlier, as well as staff from the Attorney General's office and the House Appropriations and Senate Finance committees. Meetings of the policy committee are open to outside personnel, who are encouraged to provide comments on data, methods, policy assumptions, and other issues.

When divergent views can be reconciled and incorporated into the forecast, overall confidence in the forecast may be improved. It has not always been possible to achieve this degree of consensus, however. The policy committee adopts the forecast on the basis of a vote. Minority opinions have sometimes been submitted in writing, disagreeing with aspects of the forecast.

FORECASTING PROCESS USES SEVERAL METHODS

Forecasts based on at least two different methods are generally used in the annual forecasting cycle. For several years, the Department of Corrections (DOC) has developed a five-year forecast using a simulation model originally developed by the National Council on Crime and Delinquency. DOC then calculates the average percentage difference from this five-year forecast to produce a forecast for the subsequent five-year period, yielding a ten-year forecast. DPB generates forecasts of the State-responsible inmate population using ARIMA and exponential smoothing models (ARIMA models are discussed in Chapter III, Exhibit 3; exponential smoothing models are discussed in Chapter II, Exhibit 2).

Department of Corrections' Methodology

DOC maintains a forecasting model which annually generates a baseline forecast for consideration. Since 1980, DOC has used several computerized simulation models that mimic the flow of offenders through the correctional system. A general description of simulation models used in corrections forecasting is provided in Exhibit 10. The current simulation model, dubbed the "Prophet" model, starts from a forecast of new admissions generated by a consultant using an ARIMA methodology. The admissions forecast takes into account recent trends in court commitments for each of several categories of offenders, such as violent and nonviolent males, and violent and nonviolent females.

The Prophet simulation model then calculates each inmate's likelihood of being released from prison or retained as an inmate in each year of the forecast horizon. These probabilities are based on the actual experience of the population during the most recent calendar year. Thus, the fall 1999 projections are based on data about offenders admitted, incarcerated, and/or released during calendar year 1998.

It should be noted that the likelihood of release due to parole has declined in recent years, in part because the population subject to parole has declined since Truth-in-Sentencing took effect in 1995 and because many inmates eligible for parole are repeatedly turned down. The parole grant rate between 1989 and 1993 averaged 41 percent. In FY 1998 it was 17 percent. The Chairman of the Parole Board has indicated that the rate declined further during FY 1999 to about 6.5 percent. The first five months' average for FY 2000 is about ten percent.

Adjustments are made to the model's results to take account of changes in law and other factors that affect the offender population. Adjustments made during the 1999 forecasting process covered three events:

- The Virginia Exile and bail bond reform bill (HB 1691) was adopted by the 1999 General Assembly. It is estimated to generate an additional 127 inmates to be housed by the year 2004.

- Another bill was adopted in 1999 dealing with habitual offenders (HB 841), which set a one-year minimum mandatory sentence for a fourth DUI conviction within ten years and was estimated to generate an additional 74 inmates to be housed in 2004.

Exhibit 10

Simulation Models in Corrections Forecasting

Simulation models are computerized analytical tools designed, in the case of the corrections population, to mimic or simulate the flow of offenders through the correctional system. The model does this by using actual offender profile information such as sentencing, length of stay, release rates, and parole grant rates. The model generates hypothetical cases and traces the progress of each case through each status change an inmate experiences until they exit from the system.

Starting with the number of expected new commitments to prison for the next year (these numbers are generated outside the simulation model, and are an input to the model), the simulation model applies probabilities based on the incarcerated population's most recent actual experience at key decision points in the process of entering and leaving prison.

To greatly simplify, the model in effect assigns each expected new commitment a probability, based on the most recent actual experience, that it entered the prison system as a drug offender (24.7% of new commitments in 1998), a non-violent offender (46.6%), or a violent offender (28.7%). (More than three categories are used: probabilities are assigned based on the most serious offense and by sentencing law.)

The model then determines the probability that such new offender was granted parole or released from prison in the first year, again based on actual release data for each offender type during the most recent year. If the offender was not released, then the model adds the offender to the base population for the next year, when again, an expected number of admissions is generated and the simulation process is repeated. As the offender stays longer, the probability of release changes, again based on actual experience in the Virginia prison population.

A key advantage of a simulation model is that each of these decision points in the process of admitting, incarcerating, and releasing an offender can be altered during the computational process to see what effect a different policy decision may have on the size of the population. Another advantage is that the model is built on the actual probabilities experienced by the prison population, and therefore incorporates the reality of the correctional process as opposed to assumptions about it. Another aspect of simulation is that extensive, detailed, and accurate data are required to operate the models.

Source: JLARC staff elaboration of material contained in the Secretary of Public Safety's *Inmate Population Forecast Report*, November 1, 1999, and the Technical Advisory Committee Briefing Books, July 16 and August 11, 1999

- In 1998 the Director of Corrections decided not to accept "new law" offenders with felony sentences of 12 months. Virginia law distinguishes between a felony sentence of one year, which Corrections accepts, and felony sentences of 12 months, which Corrections has decided not to accept. Felony offenders with 12-month sentences will serve the time in a local or regional jail. This change in policy resulted in a reduction of 562 inmates from the prison population in 2004. These 562 were added to the forecasted local-responsible population for that year.

As noted earlier, the simulation model results, with adjustments, are used to develop a five-year State-responsible inmate population forecast. A forecast for the subsequent five-year period is then calculated using the average percentage change from the already-forecasted first five years. The two time periods are then combined to produce a ten-year forecast.

The resulting ten-year forecast thus includes a "straight-line" forecast for years six through ten, with the rate of change tied to the average forecasted rate of change over the first five years. This practice has been generally accepted for several reasons, including concern about the accuracy and limitations of simulation models over longer time periods, and the lessened interest by decision-makers in the out-years. Decisions to construct new prison facilities have historically been linked mainly to forecasts over the short- to middle-term period of one to five years. The longer term forecast is a useful reference, but few budgetary or policy decisions have been based on out-year forecasts.

DPB Methodology

Although the official forecast has, for several years, derived from the simulation model maintained by DOC, DPB has also generated forecasts of the State-responsible inmate population for consideration in the forecasting cycle. Confidence in the official forecast may be bolstered if the different methods used by the two agencies tend to converge on the same future population levels.

For example, during the 1999 forecasting process, DPB used several methods to project the number of new State-responsible admissions and was able to generate forecasts within five percent of the DOC consultant's work. DOC used a consultant to generate projections of new admissions, and the DPB methodology was also used in the admissions forecast finally adjusted. Working at a disaggregated level (in other words, generating a forecast for each of several categories of offenders, such as male and female drug offenders, male and female violent offenders, etc.), DPB used exponential smoothing and ARIMA methods to forecast the size of these groups.

ACCURACY REMAINS PROBLEMATIC

The accuracy of the forecast of the State-responsible population has improved in recent years. At the time of the JLARC reviews in the mid-1980s, the Department of

Corrections had an expectation of forecast accuracy within ten percent, although the time period of this goal was unstated. Short-term forecasting accuracy in the late 1990s was generally better, but longer-term forecasts remained problematic. For example, Table 9 shows that 8-month forecasts produced between 1994 and 1998 (from November to the following June) averaged 1.74 percent above the actual population. These short-term forecasts are the basis for making budget adjustments in the second year of a biennium.

Another perspective on accuracy is provided by comparing forecasts released in November of odd-numbered years with actual populations over the subsequent biennium. This parallels the biennial budget development process, when a November forecast is used to develop the Department of Corrections' budget for the following biennium. These longer-term forecasts are the ones available to the Governor and General Assembly when developing and considering the biennial budget.

Table 10 indicates that the two-year accuracy of forecasts produced in odd-numbered years has been off by as much as 17 percent as recently as the 1996-98 biennium. From this perspective, the closeness of the FY 1999 forecast appears anomalous, as it was the only time in the past five years that the forecast used for developing the biennial budget came within five percent of the actual population. The Commonwealth's budget is in fact adjusted annually, enabling the Governor and General Assembly to use an annually updated forecast instead of relying only on a biennial forecast. The accuracy of these shorter-term forecasts is generally better, as noted in Table 9. Nonetheless, the biennial forecast is an important tool for allocating general funds in the biennial budget.

Table 9

Eight-Month Forecast Accuracy of the State-Responsible Population*

(Forecast from November of prior year for June)

	Forecast	Actual*	% Difference
June 1995	28,034	27,364	+2.45%
June 1996	29,963	29,719	+0.82%
June 1997	30,804	29,513	+4.37%
June 1998	30,271	29,922	+1.17%
June 1999	31,194	31,181	+0.04%
5-year average			**+1.74%**

*Excludes out-of-state inmates residing in DOC facilities. For 1995 and 1999, in accord with Policy Committee direction, excludes estimated diversions and alternative placements. The State-responsible population may reside in DOC facilities, in local or regional jails, and in various alternative placements.

Source: Department of Corrections Research Unit; Technical Advisory Committee Briefing Book, 8/11/99.

Table 10

Accuracy of Forecasts Used in Developing Biennial Budgets FY 1997 – FY 2000
(Percentage difference, forecast vs. actual)

FY	Initial Biennial Budget	Final Amendments to Biennial Budget
Forecast released 11/1/95, used for 1996-98 budget:		
97	+12.7%	+ 7.2%
98	+17.2%	+12.1%
Forecast released 11/1/97, used for 1998-2000 budget:		
99	+ 0.8%	+0.04%
00	*	*

Based on June 30 population each year.

*FY2000 actual State-responsible population not available.

Source: Forecast Reports Issued by Secretary of Public Safety; DOC.

The most recent official forecast and the five most recent years of actual inmate populations are shown in Table 11. Despite two increases of five percent or more in the last five years, the current forecast calls for only small increases in the population over the next five years. This forecast was used in preparing the 2000-2002 budget for the Department of Corrections.

Budgetary Impact of the Forecast

The inmate forecast is important for both the capital and operating budgets of the Department of Corrections. By comparing the official forecast of State-responsible inmates with the capacity of the State prison system, a determination is made about whether Virginia has enough beds to accommodate the forecasted population (taking into account alternative placements in the community corrections system, and adjusting the forecasted year-end number to an average daily population), or whether there will be a surplus or deficit of beds.

In the case of insufficient beds to meet the forecast, prison construction or expansion may be needed, which is costly. The cost of constructing two new maximum-security facilities in Sussex county, which included 2,444 beds and opened in 1998, totaled $142.5 million ($58,300 per bed). The forecast-to-capacity comparison is also used to identify the volume of beds, if any, that can be used to house out-of-state inmates and thus generate revenue. As previously noted, Virginia generated over $35 million in FY 1999 by renting prison beds to other states.

Table 11

Current Official Forecast of the State-Responsible Population

Forecast Released November 1, 1999

End of Fiscal Year	Inmates	Difference	Percent
Historical Change			
1995	27,364	- -	- -
1996	28,743	1,379	5.0%
1997	28,743	0	0.0%
1998	29,442	699	2.4%
1999	31,181	1,739	5.9%
Projected			
2000	32,077	896	2.9%
2001	32,607	530	1.7%
2002	32,791	184	0.6%
2003	32,839	48	0.1%
2004	32,992	153	0.5%
Average Change per Year			
1995-1999	3.3%		
2000-2004	1.2%		

Source: Inmate Population Forecasts, FY 2000 to FY 2009, issued by Secretary of Public Safety, November 1, 1999.

In FY 2000, 82 percent, or $575 million, of the $713 million operating budget of the Department of Corrections was tied to the adult inmate population forecast. The "direct care" portion of the agency's budget is based on an estimated cost of caring for an inmate which includes, for example, food, clothing, medical, and related costs. This amount is then multiplied by the expected population, to derive the "direct care" portion of the agency's budget. In FY 2000, this portion totaled $99 million. An additional amount is calculated based on the costs of operating the facilities which house the inmates. At $476 million budgeted for FY 2000, this amount is also directly attributable to incarcerating the inmate population.

Monitoring Legislation for Impact on the Forecast

Virginia has a statutory requirement for proposed legislation to be assessed for impact on the size of the inmate population. Section 30-19.1:4 of the *Code of Virginia* requires a General Fund appropriation to cover the highest estimated annual increase in operating costs over the subsequent decade. A bill passed by the 2000 General Assembly (SB 595) will change the agency making this assessment from DPB to the Criminal Sentencing Commission, and drop the period over which operating costs must be assessed from ten years to six years.

These statutory requirements mean that legislation which may change the size of the inmate population is identified early. Any needed budget adjustments can be made when the legislation is adopted and the legislation's effects can be incorporated into the subsequent forecasting process. It should be noted that while funding must be set aside under this requirement, the funds are not automatically available to DOC to accommodate population growth. Additional actions must be taken by the General Assembly to move the funds into DOC's operating budget.

One problem in assessing legislation is that there is often little data concerning violations of new criminal statutes, even though there may be general agreement that there will be a significant impact. Forecasting the effects of new policies requires some basis, and often there is no experience or other empirical data to use.

Consensus Process Can Serve as a Model

The forecasting process used for the adult inmate population has several advantages that should be considered for forecasts used by other State agencies:

- Dividing the overall task between technical and policy-based issues, and assigning them to appropriately qualified personnel, acknowledges the complexity and impact of the forecast and brings diverse expertise to bear on a difficult problem in State government.

- Considering forecasts derived from more than one methodological approach, and ensuring that there is more than one forecast for consideration, improves confidence in the conclusion.

- Including interested and knowledgeable parties in a review and comment process prior to finalization helps ensure that no significant change is overlooked in a criminal justice system featuring many decision points.

- Including persons in the review process who have no direct stake in the outcome helps assure a more objective forecasting result.

- A final report issued by the Secretary of Public Safety serves to conclude the process and document the decisions made during the annual process, as well as describe the official forecast.

While these features do not guarantee improved accuracy of the forecasts, the inclusion of additional parties has helped improve confidence in the forecasts and procedures used to generate them.

VI. Comparing the Forecasts

This report reviews the forecasting methods and processes in four programs that together account for nearly two-thirds of Virginia's general fund appropriations. Each of the preceding chapters described these methods and processes, as well as the accuracy of the forecasts, for a specific program area. This chapter briefly discusses ways to measure forecast accuracy, and assesses the various ways in which the forecasting processes are brought to closure prior to being incorporated into the State budget.

MEASURING ACCURACY ACROSS THE FORECASTS

Some differences between forecasted and observed numbers are inevitable in any forecasting effort. Over the time periods involved in forecasting, such differences can stem from a variety of possible causes. Such causes include unexpected policy initiatives on the part of the federal government, the Governor or the General Assembly, unforeseen changes in underlying factors, as well as technical flaws in the data or in the application of statistical procedures.

The fiscal consequences of forecasting error may be more meaningful than the percentage difference between forecasted and actual numbers, which is the conventional measure of forecast accuracy. A key goal in State budgeting is to provide funding sufficient to meet the need – neither too much nor too little in the way of funding. While various budgeting mechanisms are available to cover a forecast-based shortfall or overage, it is crucial that the forecasts be as accurate as possible so that adequate funding can be provided, with no need for extraordinary budget actions.

Percentage Accuracy Assessment

This report assesses two measures of forecasting accuracy: the percentage difference between forecast and actuals, and whether the differences led to any budgetary impact. Both measures also need to take into account the time frame of the forecast.

For example, forecasts used to develop the 1998-2000 biennial budget were initially generated in the fall of 1997. Looking over this intermediate time frame, from the four forecasts made in the fall 1997 for FY 1999, the first year of the 1998-2000 biennium, the differences between the forecast and the actuals ranged from –0.71 percent to +0.8 percent, as shown in Table 12.

It should be noted that there are also differences in the units being measured, and the percentage differences shown in Table 12 reflect these units. The forecasts for

Table 12

Accuracy of Forecasts Used in Preparing the FY 1999 Budget

Program Area	Units of Measurement	Accuracy of Initial FY 1999 Forecast[1]	Accuracy of Revised FY 1999 Forecast[2]
Elementary & Secondary Education Enrollment	Average Daily Membership	+0.3%	+0.1%
Higher Education[3]	Headcount	-0.4%	-0.4%
	FTEs	-0.6%	0.0%
Medicaid	Expenditures	+0.71%	-0.83%
State-Responsible Inmate Population	Population	+0.8%	+0.04%

See text for explanation of underlying units of measurement.

[1]Generally 20-month forecasts generated in fall 1997, and used during the 1998 General Assembly.

[2]Generally 8-month forecasts generated in fall 1998, and used during the 1999 General Assembly.

[3]The higher education forecast was not used in budget development for FY99.

Source: JLARC staff review of agency data.

elementary and secondary education, and for higher education, are enrollment forecasts, as explained in Chapters II and III. In the case of elementary and secondary education, average daily membership is being predicted; in the case of higher education, a fall headcount of students and full- time equivalent students are the forecasted units. The Medicaid forecast is the only forecast under review that directly predicts, as the final product, dollars to be expended. Lastly, the inmate population forecast generates a headcount as of June 30.

Because the 1998-2000 biennial budget was adjusted again by the 1999 General Assembly, the accuracy of forecasts compiled in the fall of 1998 and used in making budget adjustments for FY 1999 during the 1999 Session can also be assessed. The error in these mid-biennium updated forecasts for FY 1999 was generally better, ranging from zero to +0.83 percent (Table 12).

Assessment of Budget Impact

Although some error is an inevitable part of forecasting, the question of how much forecast error may be acceptable in developing the State's budget remains unresolved. While the ranges shown in Table 12 appear low, the budgetary impact of relatively small errors can be quite high. In the case of elementary and secondary education enrollment, for example, a forecasting error of 0.3 percent led to an initial over-appropriation of $8.8 million to the Department of Education's ADM-based accounts in FY 1999. In the case of corrections, a one percent error could result in the development of housing for an additional 300 inmates. Despite the different impacts that can result from a fairly small percent difference between a forecast and the actual population or expenditure, a single standard for forecasting error, for all forecasts, may not be practical.

Any expectation of accurate forecasts that require no adjustments over a two- to three-year period will be unrealistic. However, the annual process for budget adjustment tends to mitigate the need for a highly accurate biennial forecast. All forecasts reviewed in this report are revised and updated at least annually.

Accuracy over a fiscal year generally is expected, however, and this objective has not always been met in recent years. Two instances were identified in FY 1999:

> *One instance was the transfer of $19.7 million from the FY 2000 budget into Medicaid's FY 1999 budget, due to a "funding shortfall." This created a "hole" in the agency's FY 2000 budget, which was addressed by the Governor in the "caboose" budget bill (HB 29) submitted to the 2000 General Assembly. This suggests that at least in part, the initial forecast was too low.*

* * * * *

> *The second case was an initial FY 1999 appropriation to Direct Aid for Public Education that was $8.8 million (0.4 percent) more than was ultimately needed for the ADM based accounts. DOE staff indicate that this resulted in large part from an initial ADM projection for the year that was high by 0.3 percent. Appropriation adjustments and reprogramming of the funds took place throughout FY 1999.*

While both of these cases were handled in compliance with provisions of the Appropriation Act, the Medicaid example reflects an unusual budget action. Reprogramming of funds within a fiscal year, as in the Education example, is somewhat routine across State agencies. Unusual budget actions, such as the transfer of appropriations from the second to the first year of a biennium, may provide an important "safety valve" in the budget process, but also highlight the potential impact of forecasting error (it should be noted that other factors also contributed to need for the Medicaid transaction).

HOW THE FORECASTS ARE FINALIZED

The process for selecting a forecast and reaching agreement that it is the most appropriate or "best" forecast is an important part of the budget process. Ideally, agreement on a particular forecast should promote agreement on the amount of funding needed to meet the forecast. The JLARC staff review found that the processes for reaching agreement in the four areas appear to be guided by a common overall strategy.

This general strategy involves comparing forecasts which are independently generated, as noted in Exhibit 11. This process can bolster confidence in the forecast that is selected, because it requires somewhat broader participation in the forecasting process than would otherwise be the case. This general approach stops short of constituting a review process that involves external review by non-stakeholders. When fully implemented, an external review of this type would include outside personnel, and could yield some checks and balances which may help identify less obvious trends or underlying factors, "reality checks" that can then be used to improve the forecasts.

Selection Processes Are Not All Consensus-Based

All four forecasting efforts reviewed in this report have been labeled "consensus" forecasting processes by various individuals. The agreement of most, though not necessarily all, of the parties who participate in a forecasting effort may not be required, however, since DPB generally has the final say as to which forecast to adopt, and what adjustments to make, during the budget process.

The potential for broader involvement also varies across the four programs. The process which yields the inmate population forecast has the broadest participation, since seven agencies plus additional nonstate personnel are involved, and vote on a recommended forecast. By contrast, only one State agency participates in the elementary and secondary education enrollment forecast. However, DOE does use the Center for Public Service forecast and consults with some local school divisions regarding their forecasts. In the case of the Medicaid forecast, two agencies (DMAS and DPB) participate, with DPB charged by statute with, in effect, making the final decision. The higher education forecast involves each higher education institution, with both SCHEV and DPB also developing forecasts and reviewing the results.

The amount of information brought to bear on the decision of whether to accept a particular forecast also varies across the four under review. When there is an independent forecast to consider, more information is brought to bear on the decision of whether to accept a particular forecast. For three programs (higher education enrollment, Medicaid, and the State-responsible inmate population), DPB prepares an independent forecast. DPB does not prepare a forecast for elementary and secondary enrollment.

Whether the forecasts reviewed in this report warrant description as consensus forecasts is not as important as ensuring that the forecasts are reliable and accepted for use in the budget process. Confidence in a forecast and agreement to use a particular set of numbers for budget-making may be almost as important as the eventual accuracy of the selected forecast. Over the long term, continued confidence in a forecast depends on its accurate performance.

Exhibit 11

Procedures for Finalizing Forecasts in Four State Programs

Elementary and Secondary Education

Department of Education staff compare forecasts of fall membership with the forecast produced by Center for Public Services at the University of Virginia, and selects as final the DOE-generated forecast which is closest to the Center's forecast. Center staff do not participate in this process. Fall membership is used to project Average Daily Membership (ADM), upon which funding is based. DOE also compares final ADM forecasts with those produced by local school divisions.

Higher Education

SCHEV and DPB staff meet with staff from each four-year institution of higher education to compare forecast results. The SCHEV and DPB forecasts are used to ensure that the institutions' forecasts are within a 'reasonable' range.

Medicaid

Forecasts are produced separately by DMAS staff and by DPB staff. Meetings are held between the agencies to compare and analyze results, and to select a forecast. DPB staff make the final selection.

State-Responsible Inmate Population

Forecasts are produced separately by DOC staff and by DPB staff. Results are shared with the Technical Review Committee, comprising staff from seven State agencies, and with the Policy Committee, which includes State agency heads and personnel from outside State government. The Policy Committee votes on a forecast to recommend to the Secretary of Public Safety. The Secretary makes the final decision on the forecast.

Source: JLARC staff analysis of agency information

How Forecasts Are Translated into Appropriations

With the exception of the higher education forecast, all of the other forecasts discussed in this report are used in calculating appropriations for the respective State programs. The higher education forecast is used on an *ad hoc* basis to develop budget initiatives, although it is not systematically used during the budget development process. A variety of non-forecasted amounts, such as policy initiatives and other adjustments, are also typically included in the final appropriation, so a particular forecast may not directly account for a particular dollar figure in the State budget.

The personnel who generate the forecasts are typically not involved in the final steps of budget preparation. DPB budget staff are generally key to the conversion of forecasts into budgets and proposed appropriations. Some budget adjustments are made, DPB staff have indicated, on the basis of their judgement and experience with prior forecasts. While these adjustments generally take place outside the forecasting processes described in this report, they are subject to further review and additional adjustments during the General Assembly's review of the budget.

Documentation of Some Forecasting Processes Is Minimal

Only one of the forecasting efforts generates a publication documenting the final or official forecast. At the conclusion of the inmate population forecasting process, the Secretary of Public Safety issues a report describing the major components of the forecast.

While staff involved with the forecasts provided documentation as requested by JLARC staff, and upon request conduct briefings for staff of the Senate Finance and House Appropriations Committees, the overall scarcity of documentation hinders broader review of assumptions and conclusions. In the case of both Medicaid and the elementary-secondary enrollment forecasts, documentation consists mainly of spreadsheets and printouts from other computer applications, which generally provide only basic notations as to assumptions and formulas used in the calculations. In addition to complicating external review, the apparent lack of documentation could be problematic in the event of unexpected staff turnover or staffing continuity problems.

Given the budgetary impact of these forecasts, and the legislature's desire to expose them to more scrutiny, the scope and adequacy of documentation should be expanded. This would also facilitate some uniform reporting of such aspects of the forecasts as the time periods over which forecasting errors are measured.

CONCLUSION

This report has described four major State forecasts. All but the higher education forecast are strongly linked to the State budget. All derive from statistical procedures and data sources which appear appropriate. Perhaps the best gauge of forecasting accuracy is the budget impact of any observed forecasting error. By this measure, forecasts in these four areas have been relatively accurate, yielding well-informed appropriations. Error in one forecast during FY 1999 – Medicaid – partially contributed to a transfer of funds late in the year, and in that case, it appears that additional factors may also have contributed to the need to move funds.

All the forecasts derive from decision processes which are said by their respective agencies to be consensus-based, although in some cases there is not broad enough participation to warrant this label.

Even with a well-managed participative process, there is no guarantee that the resulting forecasts will be highly accurate. The State-responsible inmate population forecasts of 1996-98, which stemmed from a broadly participative process, incurred error of as much as 17 percent. Clearly, no process can guarantee an accurate forecast. However, where forecasting processes have more limited participation, the potential for overlooking an important factor appears more likely.

The issue of process is also important because even a small error, which may be quite acceptable in statistical terms, may result in an over- or under-commitment of substantial resources. For example, the 0.3 percent over-forecast of elementary and secondary enrollments in FY 1999 led to an over- appropriation of $8.8 million. In the case of Medicaid, a one percent error could amount to about $10 million too much or too little. Broader participation may help protect the budget process from such consequences, and can also help build confidence in the forecasts which are adopted.

FUTURE DIRECTIONS

This preliminary report has reviewed the forecasts and the processes which generate them in four major State programs. Although three of these forecasting processes play key roles in determining State appropriations in their respective programs, documentation of the processes and forecasts as well as review by external sources, such as the legislature, should be strengthened.

To that end, this status report is the first in a series of JLARC reports dealing with forecasting in major State programs. The next report, set for late in 2000 or early in 2001, will deal more extensively with the Medicaid forecast. This will also provide JLARC staff an opportunity to respond to the new requirement, adopted by the 2000 General Assembly in SB 515, for the Department of Planning and Budget (in cooperation with the Department of Medical Assistance Services) to provide JLARC with a two-year forecast of Medicaid expenditures by November 15 of each year.

Appendixes

Appendix A

Study Mandate

ITEM 16 K – 1999 APPROPRIATION ACT

Out of this appropriation, funds are provided to expand the technical support staff of the Joint Legislative Audit and Review Commission, in order to assist with legislative fiscal impact analysis when an impact statement is referred from the chairman of a standing committee of the House or Senate, and to conduct oversight of the expenditure forecasting process. Pursuant to existing statutory authority, all agencies of the Commonwealth shall provide access to information necessary to accomplish these duties.

Appendix B

ADM Projections Compared to Actual ADM Levels
(1998 – 2000 Biennium)

	Initial GA Budget		Final Amended GA Budget		Actual	Initial GA Budget		Final Amended GA Budget		Actual
County	FY 1999	% Var	FY 1999	% Var	1999	FY 2000	% Var	FY 2000	% Var	2000
Accomack	5,342	1.1%	5,323	0.7%	5,284	5,305	1.3%	5,159	-1.5%	5,239
Albermarle	11,756	-1.1%	11,837	-0.4%	11,883	12,021	-0.3%	12,045	-0.1%	12,061
Alleghany	2,302	12.0%	2,270	10.5%	2,055	2,283	10.9%	2,021	-1.8%	2,059
Amelia	1,773	-0.5%	1,786	0.2%	1,782	1,788	-0.4%	1,790	-0.3%	1,795
Amherst	4,645	-0.3%	4,639	-0.4%	4,657	4,626	-0.1%	4,598	-0.7%	4,630
Appomattox	2,344	-1.6%	2,384	0.1%	2,381	2,355	-0.9%	2,373	-0.2%	2,377
Arlington	18,174	1.4%	17,960	0.2%	17,930	18,544	2.7%	18,033	-0.1%	18,055
Augusta	10,848	-0.2%	10,860	-0.1%	10,869	10,910	1.0%	10,806	0.0%	10,804
Bath	897	2.4%	890	1.6%	876	901	7.0%	843	0.1%	842
Bedford	9,544	2.7%	9,277	-0.2%	9,291	9,825	3.5%	9,463	-0.3%	9,494
Bland	955	-0.9%	966	0.2%	964	926	1.6%	916	0.5%	911
Botetourt	4,669	1.3%	4,636	0.6%	4,608	4,758	4.6%	4,538	-0.2%	4,547
Brunswick	2,532	-1.4%	2,554	-0.5%	2,567	2,532	1.8%	2,500	0.5%	2,487
Buchanan	4,467	0.0%	4,456	-0.2%	4,466	4,261	0.2%	4,283	0.7%	4,253
Buckingham	2,338	4.5%	2,223	-0.6%	2,237	2,384	7.8%	2,195	-0.7%	2,211
Campbell	8,595	1.4%	8,507	0.4%	8,473	8,658	0.6%	8,569	-0.4%	8,607
Caroline	3,776	0.6%	3,794	1.1%	3,754	3,789	1.5%	3,733	0.0%	3,732
Carroll	3,989	0.1%	3,991	0.2%	3,985	3,992	0.4%	3,988	0.3%	3,978
Charles City	983	-3.0%	1,026	1.3%	1,013	974	2.3%	954	0.2%	952
Charlotte	2,305	2.4%	2,269	0.8%	2,251	2,343	4.9%	2,245	0.5%	2,234
Chesterfield	50,616	0.4%	50,494	0.1%	50,436	51,355	1.0%	50,669	-0.3%	50,844
Clarke	1,917	0.8%	1,885	-0.9%	1,902	1,957	0.8%	1,953	0.6%	1,941
Craig	717	0.1%	715	-0.1%	716	723	1.3%	702	-1.7%	714
Culpeper	5,370	-1.9%	5,542	1.3%	5,473	5,434	-2.4%	5,560	-0.1%	5,568
Cumberland	1,324	5.8%	1,268	1.3%	1,252	1,375	5.7%	1,302	0.1%	1,301
Dickenson	2,940	1.3%	2,899	-0.1%	2,901	2,859	3.6%	2,768	0.3%	2,759
Dinwiddie	4,313	1.4%	4,265	0.3%	4,253	4,453	5.0%	4,234	-0.2%	4,241
Essex	1,596	-3.7%	1,650	-0.4%	1,657	1,607	-1.2%	1,635	0.6%	1,626
Fairfax	144,276	-0.9%	145,378	-0.2%	145,614	146,093	-2.4%	149,318	-0.3%	149,724
Fauquier	9,254	-0.2%	9,277	0.1%	9,269	9,310	-0.5%	9,400	0.4%	9,358
Floyd	1,916	0.3%	1,911	0.1%	1,910	1,941	1.8%	1,910	0.2%	1,906
Fluvanna	2,938	2.3%	2,892	0.7%	2,871	3,072	4.7%	2,911	-0.8%	2,934
Franklin	7,017	1.0%	6,957	0.1%	6,947	7,123	1.2%	7,031	-0.1%	7,039
Frederick	10,488	1.6%	10,350	0.3%	10,323	10,810	3.3%	10,485	0.2%	10,467
Giles	2,591	1.4%	2,553	-0.1%	2,556	2,607	2.4%	2,548	0.0%	2,547
Gloucester	6,638	0.4%	6,629	0.2%	6,613	6,673	2.3%	6,524	0.0%	6,526
Goochland	2,004	2.0%	1,959	-0.3%	1,964	2,060	6.5%	1,943	0.5%	1,934
Grayson	2,353	2.0%	2,308	0.0%	2,307	2,388	5.3%	2,271	0.1%	2,268
Greene	2,536	2.1%	2,497	0.5%	2,484	2,615	3.4%	2,514	-0.6%	2,528
Greensville	1,622	0.4%	1,685	4.3%	1,615	1,602	-0.5%	1,597	-0.8%	1,610

County	Initial GA Budget FY 1999	% Var	Final Amended GA Budget FY 1999	% Var	Actual 1999	Initial GA Budget FY 2000	% Var	Final Amended GA Budget FY 2000	% Var	Actual 2000
Halifax	6,056	-1.9%	6,177	0.0%	6,176	5,954	-2.0%	6,127	0.8%	6,077
Hanover	15,789	-0.3%	15,809	-0.1%	15,829	16,416	0.8%	16,321	0.2%	16,290
Henrico	39,983	0.2%	40,015	0.3%	39,899	40,763	0.1%	40,630	-0.3%	40,736
Henry	8,964	-0.9%	9,032	-0.1%	9,042	8,917	-0.1%	8,923	0.0%	8,927
Highland	333	-3.2%	354	2.9%	344	321	-9.6%	350	-1.4%	355
Isle of Wight	4,896	0.0%	4,947	1.1%	4,894	4,992	2.7%	4,876	0.3%	4,862
James City	7,260	1.2%	7,247	1.0%	7,175	7,365	0.2%	7,221	-1.7%	7,348
King George	2,913	-2.0%	2,994	0.7%	2,973	2,959	-0.8%	2,980	-0.1%	2,982
King & Queen	944	3.3%	924	1.1%	914	956	3.7%	906	-1.7%	922
King William	1,762	0.4%	1,746	-0.5%	1,755	1,821	2.4%	1,769	-0.5%	1,778
Lancaster	1,609	2.9%	1,568	0.3%	1,564	1,604	5.7%	1,526	0.5%	1,518
Lee	3,989	1.3%	3,972	0.8%	3,939	3,931	1.8%	3,873	0.3%	3,863
Loudoun	25,837	-0.5%	26,085	0.4%	25,977	28,198	-1.0%	28,575	0.4%	28,470
Louisa	4,068	-0.4%	4,070	-0.4%	4,086	4,134	-0.8%	4,219	1.3%	4,166
Lunenburg	1,926	0.3%	1,914	-0.3%	1,920	1,879	2.1%	1,831	-0.5%	1,841
Madison	1,885	2.3%	1,842	-0.1%	1,843	1,866	1.2%	1,822	-1.2%	1,844
Mathews	1,337	2.5%	1,305	0.1%	1,304	1,342	5.2%	1,276	0.0%	1,276
Mecklenburg	5,005	-0.1%	4,965	-0.9%	5,008	4,971	0.5%	4,932	-0.3%	4,945
Middlesex	1,433	4.4%	1,355	-1.3%	1,373	1,460	6.9%	1,359	-0.5%	1,366
Montgomery	9,274	0.9%	9,151	-0.4%	9,190	9,370	3.1%	9,098	0.1%	9,085
Nelson	1,911	-7.6%	2,088	1.0%	2,068	1,882	-9.8%	2,050	-1.8%	2,087
New Kent	2,359	2.2%	2,318	0.4%	2,309	2,445	4.0%	2,357	0.3%	2,351
Northampton	2,296	-2.4%	2,366	0.6%	2,352	2,252	0.0%	2,250	-0.1%	2,252
Northumberland	1,559	3.7%	1,527	1.5%	1,504	1,561	3.7%	1,476	-1.9%	1,505
Nottoway	2,528	2.7%	2,470	0.4%	2,461	2,542	3.0%	2,455	-0.5%	2,467
Orange	3,820	0.3%	3,814	0.2%	3,808	3,814	-0.9%	3,837	-0.3%	3,847
Page	3,577	0.5%	3,555	-0.1%	3,559	3,609	0.7%	3,618	0.9%	3,584
Patrick	2,676	-1.5%	2,745	1.0%	2,717	2,685	0.7%	2,700	1.2%	2,667
Pittsylvania	9,242	0.2%	9,216	-0.1%	9,224	9,225	0.2%	9,205	0.0%	9,204
Powhatan	3,395	1.6%	3,328	-0.4%	3,341	3,610	4.0%	3,508	1.1%	3,471
Prince Edward	2,650	0.0%	2,685	1.3%	2,650	2,662	1.3%	2,619	-0.4%	2,629
Prince George	5,423	-3.8%	5,634	0.0%	5,636	5,426	-6.0%	5,775	0.1%	5,771
Prince William	50,425	0.3%	50,421	0.3%	50,291	51,928	-0.3%	51,742	-0.7%	52,109
Pulaski	5,036	0.2%	5,041	0.3%	5,027	5,011	0.1%	5,070	1.2%	5,008
Rappahannock	1,081	2.8%	1,046	-0.6%	1,052	1,094	6.5%	1,038	1.1%	1,027
Richmond	1,338	3.6%	1,297	0.4%	1,292	1,354	8.7%	1,243	-0.2%	1,246
Roanoke	14,031	1.2%	13,794	-0.5%	13,862	14,139	2.0%	13,827	-0.2%	13,856
Rockbridge	3,019	0.7%	3,005	0.3%	2,997	3,026	3.8%	2,906	-0.3%	2,915
Rockingham	10,664	0.8%	10,563	-0.2%	10,580	10,687	1.1%	10,591	0.2%	10,570
Russell	4,343	-1.0%	4,400	0.3%	4,388	4,276	-1.6%	4,336	-0.2%	4,344
Scott	3,736	0.4%	3,724	0.1%	3,722	3,701	0.4%	3,663	-0.7%	3,687
Shenandoah	5,417	1.4%	5,351	0.1%	5,344	5,472	2.7%	5,321	-0.1%	5,327
Smyth	5,239	0.4%	5,229	0.2%	5,218	5,245	1.0%	5,168	-0.5%	5,195
Southampton	2,941	2.8%	2,873	0.4%	2,861	2,980	6.4%	2,772	-1.1%	2,802
Spotsylvania	17,078	-0.9%	17,229	-0.1%	17,238	17,749	-1.3%	18,036	0.3%	17,990
Stafford	18,952	-0.4%	19,017	0.0%	19,025	19,975	0.1%	19,939	-0.1%	19,949

County	Initial GA Budget FY 1999	% Var	Final Amended GA Budget FY 1999	% Var	Actual 1999	Initial GA Budget FY 2000	% Var	Final Amended GA Budget FY 2000	% Var	Actual 2000
Surry	1,169	-4.4%	1,223	0.0%	1,223	1,162	-3.5%	1,194	-0.8%	1,204
Sussex	1,550	3.3%	1,480	-1.4%	1,501	1,562	6.8%	1,472	0.7%	1,462
Tazewell	7,622	0.3%	7,610	0.2%	7,598	7,467	1.6%	7,354	0.1%	7,346
Warren	4,673	-1.7%	4,742	-0.3%	4,754	4,711	-2.2%	4,865	1.0%	4,819
Washington	7,527	1.1%	7,431	-0.2%	7,444	7,540	2.5%	7,373	0.2%	7,355
Westmoreland	2,106	1.5%	2,085	0.5%	2,075	2,121	2.8%	2,031	-1.6%	2,063
Wise	7,362	1.2%	7,316	0.5%	7,276	7,212	1.6%	7,040	-0.8%	7,097
Wythe	4,356	-0.1%	4,354	-0.2%	4,362	4,364	0.3%	4,363	0.3%	4,350
York	11,422	-0.1%	11,415	-0.2%	11,434	11,671	0.0%	11,657	-0.1%	11,667
City										
Alexandria	10,800	-0.3%	10,763	-0.6%	10,829	11,041	0.6%	11,009	0.3%	10,974
Bristol	2,430	2.0%	2,369	-0.6%	2,383	2,402	3.4%	2,354	1.3%	2,324
Buena Vista	1,059	-3.8%	1,094	-0.6%	1,101	1,064	-5.0%	1,131	1.0%	1,120
Charlottesville	4,224	-1.9%	4,315	0.2%	4,307	4,202	-2.9%	4,313	-0.3%	4,326
Clifton Forge	651	-26.3%	661	-25.1%	883	645	-21.9%	868	5.1%	826
Colonial Heights	2,806	2.7%	2,744	0.5%	2,731	2,829	1.9%	2,779	0.1%	2,777
Covington	941	1.2%	936	0.6%	930	934	0.3%	901	-3.2%	931
Danville	7,875	1.6%	7,694	-0.8%	7,753	7,799	2.7%	7,569	-0.4%	7,596
Falls Church	1,481	-4.5%	1,536	-1.0%	1,551	1,516	-10.2%	1,696	0.4%	1,689
Fredericksburg	2,206	2.2%	2,160	0.0%	2,159	2,208	4.3%	2,069	-2.2%	2,116
Galax	1,291	0.9%	1,277	-0.2%	1,279	1,311	0.5%	1,309	0.3%	1,305
Hampton	23,663	0.4%	23,353	-0.9%	23,559	23,741	1.0%	23,405	-0.4%	23,509
Harrisonburg	3,501	-1.6%	3,584	0.8%	3,557	3,515	-1.7%	3,551	-0.7%	3,575
Hopewell	4,222	5.5%	4,011	0.2%	4,002	4,242	7.7%	3,918	-0.6%	3,940
Lynchburg	9,381	1.2%	9,287	0.2%	9,267	9,330	1.2%	9,166	-0.6%	9,221
Martinsville	2,686	1.0%	2,743	3.1%	2,660	2,654	1.3%	2,640	0.7%	2,621
Newport News	31,879	0.1%	31,909	0.2%	31,853	32,172	1.2%	31,988	0.6%	31,789
Norfolk	36,274	1.6%	35,749	0.1%	35,709	36,491	3.3%	35,306	-0.1%	35,326
Norton	787	2.9%	761	-0.5%	765	778	5.7%	733	-0.4%	736
Petersburg	6,188	1.3%	6,150	0.7%	6,107	6,196	3.8%	5,970	0.1%	5,967
Portsmouth	17,470	0.5%	17,384	0.0%	17,378	17,393	2.1%	16,901	-0.8%	17,030
Radford	1,588	1.9%	1,561	0.2%	1,558	1,618	0.8%	1,598	-0.4%	1,605
Richmond City	26,656	0.8%	26,932	1.8%	26,445	26,435	-1.5%	26,330	-1.9%	26,833
Roanoke City	13,352	1.2%	13,188	-0.1%	13,197	13,470	2.2%	13,208	0.2%	13,177
Staunton	2,890	0.2%	2,897	0.5%	2,884	2,872	2.5%	2,814	0.4%	2,803
Suffolk	11,019	-0.7%	11,022	-0.7%	11,099	11,287	-0.9%	11,368	-0.2%	11,387
Virginia Beach	77,771	1.1%	76,811	-0.2%	76,949	78,292	2.0%	76,758	0.0%	76,773
Waynesboro	3,006	1.5%	2,962	0.0%	2,961	3,007	2.8%	2,920	-0.2%	2,926
Williamsburg	758	4.8%	759	5.0%	723	769	9.7%	690	-1.6%	701
Winchester	3,284	-0.1%	3,277	-0.3%	3,287	3,307	-0.8%	3,360	0.8%	3,333
Fairfax City	2,476	-2.3%	2,563	1.1%	2,534	2,507	-3.8%	2,600	-0.2%	2,606
Franklin City	1,725	4.8%	1,635	-0.7%	1,646	1,719	13.5%	1,469	-3.0%	1,515
Chesapeake City	36,817	0.5%	36,542	-0.2%	36,627	37,399	0.2%	37,232	-0.3%	37,335
Lexington	625	-3.3%	648	0.3%	646	604	-4.9%	633	-0.3%	635
Emporia	1,087	3.6%	1,026	-2.2%	1,049	1,074	0.6%	1,065	-0.3%	1,068
Salem	4,044	3.1%	3,925	0.1%	3,923	4,119	3.2%	3,993	0.0%	3,992

County	Initial GA Budget FY 1999	% Var	Final Amended GA Budget FY 1999	% Var	Actual 1999	Initial GA Budget FY 2000	% Var	Final Amended GA Budget FY 2000	% Var	Actual 2000
Bedford City	1,087	10.4%	1,040	5.6%	985	1,119	18.7%	969	2.8%	943
Poquoson	2,496	2.5%	2,440	0.2%	2,436	2,506	1.2%	2,490	0.6%	2,476
Manassas City	6,220	1.2%	6,120	-0.4%	6,145	6,419	4.0%	6,215	0.6%	6,175
Manassas Park	1,769	0.6%	1,762	0.2%	1,758	1,857	1.3%	1,810	-1.3%	1,833
Town										
Colonial Beach	709	11.0%	624	-2.3%	639	718	20.1%	606	1.3%	598
West Point	796	-0.7%	815	1.6%	802	818	-0.2%	821	0.1%	820

Appendix C

Agency Responses

As part of an extensive data validation process, each agency involved in a JLARC assessment effort is given an opportunity to comment on an exposure draft of the report. Because agency responses are based on an earlier, double-spaced draft, page numbers cited in the attached letters do not correspond to those in this final report. A careful reading of this report will show that appropriate technical changes suggested in the agency responses have been incorporated.

This appendix contains the responses of the Secretary of Public Safety, the Council of Higher Education, the Department of Medical Assistance Services, the Department of Planning and Budget, the Department of Education, and the Department of Corrections.

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