OREGON
YOUTH AUTHORITY
CLOSE CUSTODY
DEMAND
FORECAST

Biennial Review of Methodology

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May 2004

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Table of Contents

I. Introduction

The Office of Economic Analysis (OEA) issues the Oregon Youth Authority Close Custody Demand Forecast. Executive orders EO-98-06 and 04-02 direct OEA to issue this forecast each April and October. The Oregon Youth Authority (OYA) uses the forecast for planning and budgeting. This paper describes the methods used to develop the forecast.

Two committees help OEA with the forecast. The Juvenile Correction Population Forecasting Advisory Committee consists of up to seven members who know about juvenile justice and trends that can affect OYA's population. Members are appointed by the Governor and serve four-year terms. The Committee helps OEA interpret current trends and set assumptions about the future.

A separate technical advisory committee consists of people who work with forecasting and criminal justice data. They provide critical review and advice about forecasting methods.

Readers with questions about this document may contact Suzanne Porter at (503) 378-5732. This document is available at our website: http://www.oea.das.state.or.us/.

II. Overview

The Oregon Youth Authority (OYA) close custody demand forecast projects 10 years into the future. *Close custody* means youth housed in secure facilities like MacLaren and Hillcrest, in youth accountability camps, and in work-study camps. The forecast does not cover youth in residential treatment, group homes, detention, or foster care.

There are no sentences in the juvenile justice system. A youth may be committed to OYA until age 25, but there is no minimum time to be served in close custody. Close custody facilities must limit their population to the designed capacity. OYA can manage the population and prevent overcrowding because there are no minimum sentences. In addition, OYA's close custody population can be limited by budget constraints. In 2003, for example, four of seven close-custody facilities were closed due to lack of operational funds.

Therefore, OEA forecasts demand for close custody beds, not the close custody population.

The close custody demand consists of several offender groups. These groups are defined below.

Adult Court (AC)
Youths aged 15 to 17 can be treated as adults in the justice system if they are charged with certain crimes. If convicted, these youths are placed in the legal custody of the Department of Corrections (DOC).

Measure 11 (ORS 137.707) requires that any youth aged 15 to 17 charged with one of 23 violent crimes be prosecuted as an adult. Measure 11 carries mandatory minimum sentences from 70 to 300 months. Oregon law also allows juveniles charged with *other* serious crimes to be *waived* or *remanded* to the adult system (ORS 419C.340). A waiver is a petition filed with the Court. If the Court grants the waiver, the juvenile is prosecuted as an adult. Adult court inmates have specific sentences ordered by the Court. DOC calculates the length of stay based on the Court's sentencing order.

ORS 420.011 directs adult court juveniles to be transferred to OYA. Inmates under age 16 must be housed at OYA. Inmates aged 16 or older *may* be housed at OYA until age 25. OYA may return inmates to DOC for discipline or security concerns any time after age 16. OYA may decide that older inmates can benefit from DOC programs.

Public Safety Reserve (PSR)
These are beds reserved for juveniles committed for certain serious felonies.[1] Measure 11 includes most of these crimes and applies to youth aged 15 or older. Consequently, the PSR applies mainly to youth aged 14 or younger at the time of their crime.

Discretionary Bed Allocation (DBA) Demand
Each county or group of counties may maintain a certain OYA population of offenders other than those mentioned above. This group was formerly known as the *Cap*.

Budget decisions determine the size of the DBA more than the other offender groups. For example, the total number of funded beds was reduced during the current and previous biennia. The effect on the DBA is clear. The DBA averaged 620 in the 1999-01 biennium, 529 in the 2001-03 biennium, and 369 so far in the current biennium. This is a 40 percent reduction since the 1999-01 biennium. The AC and PSR populations declined only slightly during the same period.

Because of funding's influence, forecasting the demand for DBA beds is more useful to decision makers than forecasting the actual number of beds. The DBA demand is composed of youth in close custody and those with similar criminal characteristics that remain in the community.

[1] Robbery I, Arson I, Murder, Attempted Murder, Unlawful Sexual Penetration I, Sodomy I, Rape I, Kidnap I, and Assault I.

We forecast the actual population of AC and PSR offenders and the estimated bed demand for DBA offenders. Added together, these groups comprise the total close custody bed demand

Model
We use a *flow model* for the forecast. It imitates the flow of offenders at various points in the juvenile justice system. These points are arrest (referral), disposition, commitment, incarceration, release, and revocation.

The forecast starts with the close custody demand as of a given date. This is called the *stock* population. April forecasts start with the January 1 stock population. October forecasts start with the July 1 stock population. The AC and PSR stock is the actual on-hand population as of the beginning date. For the DBA, the stock is the demand for DBA beds as of the beginning date.

Bed demand is calculated for the first day of each month. We derive demand for a given month by adding intakes and subtracting releases from the demand as of the first of the *previous* month. Therefore, we focus our efforts on forecasting intakes and releases.

Using February 1 as an example, the equation to forecast demand is:

FEBRUARY 1 DEMAND = JANUARY 1 DEMAND + INTAKES DURING JANUARY – RELEASES DURING JANUARY.

New intake demand is based on a forecast of *first-time* juvenile department referrals. For offenders entering OYA for a second or subsequent time, we compute the probability of parole failure each month after release. Releases are based on typical lengths of stay (LOS). LOS is expressed as the probability of release in each month after intake.

The source data are stored in SPSS. We use SPSS to extract cases, to perform calculations and statistical tests, and for survival probability analysis. The demand forecasting models are Excel spreadsheets. We use EViews for time series forecasting, seasonal indices, and the binary choice model used to identify DBA demand cases. All of these steps are explained in detail below.

III. Forecast Elements

A. Data Sources
Four data sources are used in the forecast:

- Juvenile Justice Information System (JJIS)
- DOC Corrections Information System (CIS)
- Law Enforcement Data Systems, Oregon Uniform Crime Reports (OUCR)

- U.S. Census Bureau and the Oregon Population Research Center, Oregon historical population by age
- Oregon Office of Economic Analysis, Oregon population forecast by age

JJIS provides two data sets. The OYA intake file contains data from 1992 to present on close custody intakes and releases. Some of the most important data elements for the forecast are listed below.

- Type of intake (offender group, first time admit, return admit)
- Major crime of commitment
- Date of intake
- Release date
- Birth date (age)

The JJIS referral/disposition file contains all juvenile department criminal referrals with dispositions. These are most accurate from 1996 to present. Some important data elements from this file are listed below.

- Date of referral
- Most serious allegation
- Most restrictive disposition to date
- Birth date (age)

CIS data pertain to adult court inmates, and it is used to identify juvenile offenders who have moved on to the adult system. CIS data elements include those listed above, plus a projected release date.

OUCR and population data are used to develop a forecast of arrests by age. This forecast is used to determine *new* intakes. [2]

B. INTAKE FORECAST - NEW CRIME COMMITMENTS

About two-thirds of the demand for OYA beds derives from youth entering close custody for the first time. The remainder derives from repeat intakes, either from technical violations or new offenses. This section describes the process used to forecast new commitments to OYA. *All references to close custody intakes in this section (III.B) refer only to first time or "new" intakes.* We use a different process to forecast intakes that are returning to close custody. That process is described in section III.C, below.

1. The Risk Pool

Using the data sources listed in section III.A, above, we forecast entries to the population of youth at risk of entering close custody. This is called the *risk pool*. The risk pool is the population of youth aged 12 to 17 who have been referred for a criminal offense. Youth aged 12 to 17 enter the risk pool the first time they are

[2] *New* means the offender is entering OYA for the first time.

referred for a criminal offense. Youth younger than 12 are very rarely sent to close custody, so youth first referred prior to age 12 enter the risk pool on their 12th birthday.

The process to forecast first-time referrals involves a time-series forecast of arrests, translation of arrests to referrals, and finally, first-time referrals. We do not start with JJIS referral data because of its limited history. JJIS data are considered complete beginning in 1996. Referrals have declined in each of the ensuing 7 years. The short history and consistent downward trajectory pose challenges for a time series forecast of referrals. Therefore, we begin by analyzing OUCR arrest rates by age group and offense type. [3]

Arrest rates fluctuate. For example, Oregon's juvenile arrest rate for major crimes increased nearly every year between 1989 and 1996, then fell every year between 1997 and 2001. [4] Behind the overall fluctuation, the relative contribution among age groups and between genders is widely considered invariant. [5] The arrest rate for 17 and 18 year-olds is higher than for other ages, and the arrest rate for males is higher than for females.

In Oregon, arrest rate changes have followed trends. That is, they undergo several years of consistent increase or decrease. Because arrest rates follow a trend, we use the ARIMA (Autoregressive Integrated Moving Average) method to forecast them. [6]

Once convicted, an offender's age also affects the way the case is adjudicated in the Oregon justice system. A 14 year old charged with a first-degree person crime cannot be waived to the adult justice system, but a 15 year old can. A 12 year old is far less likely to be committed to close custody than a 16 year old. We use age group divisions based on OUCR arrest data. The groups are 10 to 12 years old, 13 and 14 years old, and 15 to 17 years old.

We use the following process to forecast intakes:

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[3] *Offense type* means person, property, or behavioral crime. Behavioral crimes analyzed here exclude curfew, runaway, and liquor violations. These are not considered criminal violations in JJIS.

[4] *Report of Criminal Offenses and Arrests*, Law Enforcement Data System, 1988-2001. Rate is per 100,000 population. Population estimates provided by the Oregon Population Research Center and U.S. Census Bureau.

[5] Gottfredson, Michael R. and Hirschi, Travis, *A General Theory of Crime,* Stanford, CA: Stanford University Press, 1990, pp. 124-149.

[6] Box, George E.P. and Jenkins, Gwilym M., *Time Series Analysis: Forecasting and Control*, Holden-Day, 1976.

1. We separate arrest data by age group and then by offense type. For each group, we analyze the arrest rate from 1975 to present, then forecast the rate for the next decade using ARIMA.

2. If ARIMA returns a sudden change for the first forecast year, we distribute the change over several of the following years. The smoothed rates are applied to the forecast of population by age group. The result is a forecast of arrests by offense type and age group.

3. We regress historical JJIS referrals against historical OUCR arrests, year by year. The correlation between these data sets is high (R^2=.96). Using the regression equation, we forecast total referrals from the forecast of arrests. We then regress first-time referrals against all referrals (R^2=.69) and use that regression equation to forecast first time referrals (risk pool entries).

4. Using recent history as a guide, we subdivide risk pool entries according to the youth's age at entry. We now have annual risk pool intakes by age.

5. We develop monthly seasonal indices of risk pool entries by age. These are developed with the latest five years of historical data using EViews.[7] They are used to distribute annual intakes by month.

The next step is to calculate the probability of entering close custody. This is called the *terminal event.* The probability of a terminal event changes over time after an offender enters the risk pool. We run separate analyses for the three major offender groups mentioned in section II, above.

For a given offender group, the probability (*p*) of a terminal event occurring during a given month after entering the risk pool is calculated:

$$p_{x,m} = i_{x,m} / r_m$$

where: x = offender group
m = month after entering risk pool
i = number of terminal events
r = number of youth in risk pool

7 U. S. Department of Commerce, U. S. Census Bureau, X-12 Monthly Seasonal Adjustment Method, Release Version 0.2.7.

2. Adult Court Intakes

In SPSS, we extract a file of risk pool entries from the JJIS data. A youth enters the risk pool once, so the file contains one record per youth. We flag the records of youth whose first intake to custody was the result of an adult court conviction and DOC transfer (terminal event). We compute the variable ***t***, a measure of time, where:

t_o=date of risk pool entry
t_f=date of admission to close custody
t_c=date of 18th birthday
T=end of observation period

Each case is flagged and ***t*** is calculated in one of the following three ways:

- If the offender is under age 18 and is there is no terminal event, t=T- t_o; event flag=0

- If the offender has turned 18 and there is no terminal event, t= t_c - t_o; event flag=0

- If there is a terminal event, t= t_f - t_o; event flag=1

When the event flag and ***t*** have been calculated for all youth, we run the SPSS syntax:

```
SURVIVAL
  TABLE=t
  /INTERVAL=THRU 9999 BY 1
  /STATUS=event(1)
  /PRINT=TABLE .
```

SPSS returns the probability of AC intake in each month after risk pool entry. The output is similar to Table 1, below.

Table 1: Sample AC Intake Probability Data

This subfile contains: 110663 observations

Life Table
Survival Variable T

Intrvl Start Time	Number Entrng this Intrvl	Number Wdrawn During Intrvl	A Number Exposd to Risk	B Number of Termnl Events	C=B/A Propn Termi-nating	Propn Sur-viving	E Cumul Propn Surv at End
0	110399	2008	109395	98	0.0009	0.9991	0.9991
1	108293	2011	107287.5	14	0.0001	0.9999	0.999
2	106268	2137	105199.5	28	0.0003	0.9997	0.9987
3	104103	1942	103132	26	0.0003	0.9997	0.9985
4	102135	1817	101226.5	32	0.0003	0.9997	0.9981
5	100286	1857	99357.5	36	0.0004	0.9996	0.9978
6	98393	2157	97314.5	37	0.0004	0.9996	0.9974
7	96199	2118	95140	24	0.0003	0.9997	0.9971
8	94057	2105	93004.5	21	0.0002	0.9998	0.9969
9	91931	2041	90910.5	19	0.0002	0.9998	0.9967
10	89871	2115	88813.5	16	0.0002	0.9998	0.9965
11	87740	1903	86788.5	21	0.0002	0.9998	0.9963

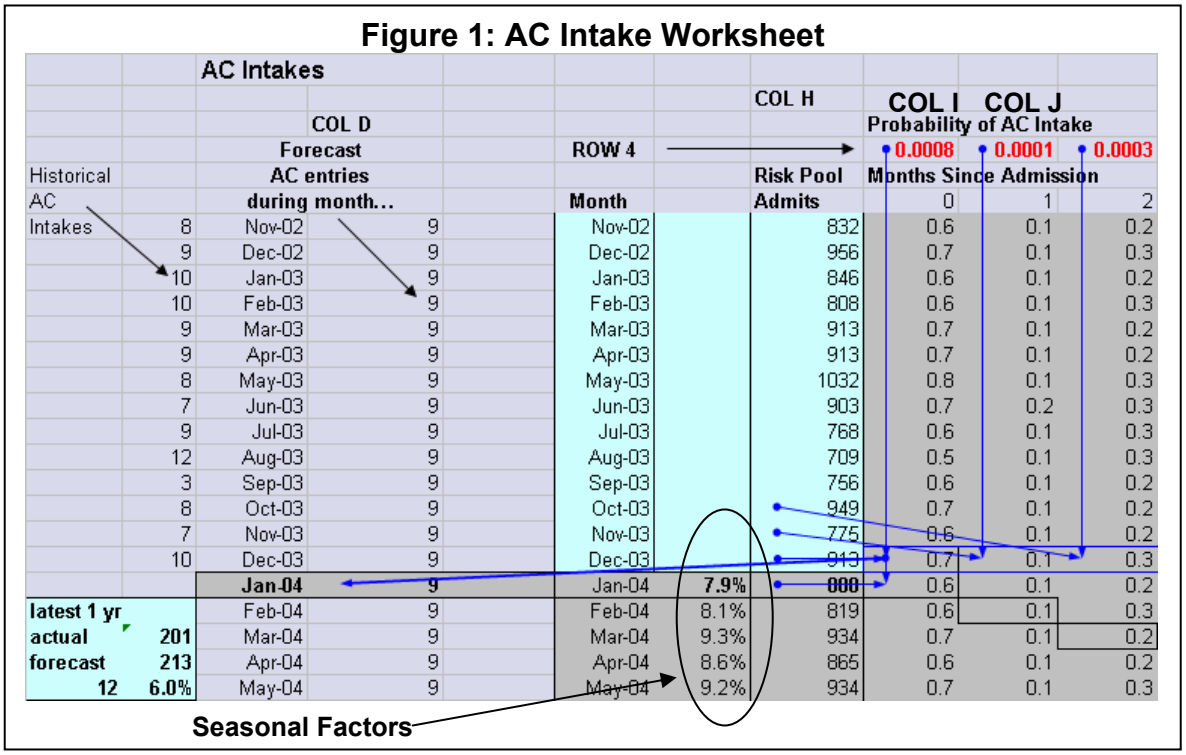
Continues

The array in column C, Table 1 is the probability of AC intake in each month after entering the risk pool. Probabilities change over time as prosecution and sentencing policies evolve. We develop probabilities based on several recent periods then apply them to historical risk pool intakes. We choose an array that accurately predicts AC intakes for the latest historical period – usually the last year or two. The final probabilities are applied to the forecast of risk pool intakes.

Figure 1 shows a sample of the worksheet that computes AC intakes to close custody. The number of risk pool entrants for a given month are in column H. Row 4 is based on column C, Table 1. The number in row x, column H is multiplied by the number in column I of row 4. The product appears in column I, row x. The number in row x, column H is multiplied by the number in row 4 column J. The product appears in column J of row x+1. This process continues as the number in a given row *x* in column H is multiplied by each variable in row 4, and the products appear diagonally across the table. These rows are summed in column D, the forecast of AC intakes for the month. Seasonal factors were developed in section III.B.1, page 6.

For example, the 9 AC intakes expected in January 2004 are based on youth who entered the risk pool in December 2003, November 2003, October 2003, and so on, back several years. We expect the 800 youth who entered the risk pool in January 2004 to affect AC intakes in February 2004, March 2004, April 2004, and so forth, several years into the future. The total intakes in column D, Figure 1 are

Figure 1: AC Intake Worksheet



divided between Measure 11 and Waived offenders using current commitment patterns.

Column C in Table 1 (page 8) is based on a declining denominator (column A). The worksheet in Figure 1 uses a fixed denominator (column H). To remedy this, the initial array in column C, Table 1 is multiplied by column E, Table 1. Column E is the percentage of the original intake cohort that remains in the risk pool. The number in *row x* of column C, Table 1 is multiplied by the number in *row x-1* in column E, Table 1.

3. Public Safety Reserve

We forecast PSR intakes in the same way as Adult Court intakes. In this case, the terminal event occurs when a youth's first OYA intake is PSR.

4. Discretionary Bed Allocation Demand

a. Binary Choice Model Prediction Equation

We forecast DBA demand intakes in the same manner as AC and PSR. However, the terminal event is becoming part of the DBA bed demand. The Advisory Committee defines DBA bed demand. The process of defining and identifying demand is described below.

The basic premise of the demand forecast is that the limited supply of beds only partially meets the demand for them. There are youth in the community who share the same delinquency characteristics as youth in the DBA. *The sum of youth in*

the DBA and similar youth in the community at any given time is the total DBA demand, or Total Demand Population (TDP).

The Committee advised us of observed, recorded, and quantifiable *predictive factors* that would most likely influence the decision to send a youth to the DBA. Our initial list of factors was:

Age at first referral
Severity of first referral
Age at current referral
Severity of current referral
Number of prior referrals
History of sex or weapons offense

The Committee also recommended that we focus on youth referred between 1996 and 2002.[8] These years reflect periods of expansion and contraction in the supply of DBA beds. This would give us a sense of recent, *average* practice. During this period 89,476 youth were referred and had not gone to close custody. This group is called the *community population.* There were also 3,023 youth that were committed as DBA during this period. This group is called the *mirror population*. The total study population totaled 92,499 youth.

First, we analyze the JJIS referral/disposition records for all 92,499 youth. We create a criminal history by computing a running total of prior referrals for each youth. Crime severity is captured by the severity score that JJIS attaches to each offense. These scores run from 1 to 19, so many different crimes have the same severity scores.

In addition to initial predictive factors, more seemingly predictive factors are considered. For example, we compute the total number of prior referrals, total number of prior referrals for felony person crimes, felony non-person crimes, and misdemeanors. The severity score is combined with the number of priors because a combination of severity and frequency often leads to a close custody commitment.

Next, we distill the file to one record per youth. For the community population, we use the last referral record. This record carries the youth's criminal history to that date, plus information about the first criminal referral (risk pool entry).

We combine the OYA intake and JJIS referral disposition files to obtain more information on the mirror population. To distill this file to one record per youth, we select the referral most closely associated with the OYA intake. Matching referrals to an OYA intake can be tricky. A youth is often committed on several referrals that can be years apart. The time between the referral and intake can be lengthy,

[8] 2003 was omitted because too many referrals would be unresolved. Also, the closure of the 4 Youth Correctional Facilities made 2003 incomparable to the other years.

as a youth may fail several less restrictive alternatives before being committed to close custody. To match files, we work backward from the OYA intake. First, we look for a referral with a disposition for close custody commitment. If there are multiple referrals with this disposition, we choose the most serious offense. If there are no referrals with this disposition, or there is still a tie between multiple referrals, we choose the referral with the shortest lag time to the OYA intake. *When the match is made, we recalculate the youth's criminal history up to the date of intake, not the date of the matched referral.*

The final file contains a single record for each of the 92,499 youth in the study group. Each record is marked according to whether the youth entered close custody or not. A value of 1 is assigned to close custody cases (marked as *yes* or *success*), and 0 otherwise (*no* or *failure*). This 0-1 outcome is the dependent variable in the model. [9] To select variables with significant predictive power, a stepwise regression is performed. This preliminary analysis serves as a guide in the next step, when we analyze the data with a binary choice model in EViews.

In EViews, we use a Logit model, which is based on the logistic distribution function as the cumulative distribution function for the 0-1 dependent variable.[10]

Table 2: Final Predictive Factors

Final Predictive Factors	
CUMSEVR	Cumulative severity score of all offenses
MISDO	Binary: 1=Current offense is a misdemeanor
AVGSEVR	Cumulative severity score of all offenses divided by number of offenses
ORSSEVER	Severity score of most severe current offense
MAJSEVR	Severity score of most severe offense ever
AGEDUM	Binary: 1=Age less than 16
FIRSTAGE	Age of first referral
AGE	Age at current referral
ADMIAGE	Age of close custody intake or current referral
WPFLAG2	Binary: 1=History of weapons offense
SXFLAG2	Binary: 1=History of sex offense
STAT	Binary: 1=Current offense is a behavioral crime
FIRSTFEL	Binary: 1=First offense was felony
WGTSEVR	Cumulative severity score of all offenses X number of offenses
REGION	OYA geographic area
NPF	Number of prior non-person felonies

[9] Suppose that a binary dependent variable takes on values of zero and one. Standard linear regression models are not appropriate in this case. (See William H. Greene, *Econometric Analysis*: New Jersey, Prentice-Hall, Inc., 1997.) Simple linear regression models are not appropriate, since among other things, the implied model of the conditional mean places inappropriate restrictions on the residuals of the model. Furthermore, the fitted values of dependent variable from the linear regressions are not restricted to lie between zero and one (Eviews 4 User's Manual).

[10] Probit and gompit models have been tried, with results being similar to those from the Logit specification.

The outcome is regressed against the pool of potentially predictive factors. The retained final predictive factors are shown in Table 2.

Efforts have been made to include any of the statistically significant predictive factors. All but one of the retained variables have a marginal significance level of 1 percent or lower. Despite the large number of explanatory variables, the model does not suffer from a multicollinearity problem.[11] McFadden R-squared, which is analogous to R-squared in linear regression models, is 0.59 in the model (Table 3).

Table 3: Model Estimation Result

Dependent Variable: YPG
Method: ML - Binary Logit (Quadratic hill climbing)
Date: 03/30/04 Time: 16:32
Sample: 1 92501
Included observations: 92499
Excluded observations: 2
Convergence achieved after 13 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-6.578745	0.504133	-13.04963	0
CUMSEVR	0.041755	0.002233	18.69605	0
MISDO	-1.153155	0.112591	-10.24203	0
AVGSEVR	-0.287932	0.01886	-15.26696	0
ORSSEVER	0.213098	0.015421	13.8191	0
MAJSEVR	0.129368	0.012426	10.41146	0
AGEDUM	0.726331	0.08907	8.15457	0
FIRSTAGE	0.133802	0.017048	7.848409	0
AGE	-4.33883	0.134313	-32.30377	0
ADMIAGE	4.287447	0.131125	32.69733	0
WPFLAG2	0.507481	0.067617	7.505209	0
SXFLAG2	0.231419	0.083853	2.759818	0.0058
STAT	-0.481331	0.0741	-6.49572	0
FIRSTFEL	-0.270393	0.070395	-3.841072	0.0001
WGTSEVR	-0.0007	5.97E-05	-11.71852	0
REGION	-0.126522	0.017338	-7.297367	0
NPF	0.056093	0.025004	2.243358	0.0249

Mean dependent var	0.032681	S.D. dependent var	0.177802
S.E. of regression	0.122544	Akaike info criterion	0.118875
Sum squared resid	1388.812	Schwarz criterion	0.120609
Log likelihood	-5480.919	Hannan-Quinn criter.	0.119403
Restr. log likelihood	-13314.58	Avg. log likelihood	-0.059254
LR statistic (16 df)	15667.32	McFadden R-squared	0.588352
Probability(LR stat)	0		
Obs with Dep=0	89476	Total obs	92499
Obs with Dep=1	3023		

The fitted equation generates scores between 0 and 1 for each observation or youth. For youth in the community population, those who score above the critical value should have gone to close custody according to their observed and recorded criminal characteristics. The mirror population was a small percentage (3.3 percent) of all youth in the study, so we choose a critical score of 0.1.[12] In the February 2004 analysis, this score accurately predicted 80 percent of the mirror population and 97 percent of the community population (Table 4).

Setting the critical score is a judgment call. It involves exchanging one kind of error (or correct prediction) for another.[13] For example, if we increase the cutoff score to 0.5, the correct prediction rate for the mirror population falls to 50 percent, but the correction prediction of the community population increases to 99.7

[11] Greene, 1997, lists some of the symptoms of multicollinearity (p. 420).

[12] Greene, 1997, pp.892-893.

[13] Eviews 4 User's Guide, Quantitative Micro Software (2000), ch. 17. In technical terms, the trade-off is between sensitivity (correct prediction of success) and specificity (correct prediction of failure).

percent. If we use a cutoff score of 0.05, the mirror prediction rate increases to 86 percent, but the community rate falls to 94 percent. The 0.1 critical score balances the error between the groups. Note that 0.1 is *not* the final score used to determine demand. We use 0.1 here to fit the model and validate the prediction equation.

Table 4: Logit Expectation-Prediction Table

Dependent Variable: YPG
Method: ML - Binary Logit (Quadratic hill climbing)
Date: 02/02/04 Time: 09:44
Sample: 1 92501
Included observations: 92499
Excluded observations: 2
Prediction Evaluation (success cutoff C = 0.1)

	Estimated Equation		
	Dep=0	Dep=1	Total
P(Dep=1)<=C	86706	618	87324
P(Dep=1)>C	2770	2405	5175
Total	89476	3023	92499
Correct	86706	2405	89111
% Correct	96.9	79.56	96.34
% Incorrect	3.1	20.44	3.66
Total Gain*	-3.1	79.56	-0.39
Percent Gain**	NA	79.56	-12.07

b. Setting Minimum Score

We use the prediction equation from the Logit model to calculate a score for each referral in the SPSS JJIS referral/disposition file. Then the file is distilled once again to one record per youth. For community youth, the retained record pertains to the highest prediction score ever received, and all criminal history up to that date. For the mirror population, we use the same file described in section 4.a, pages 10 and 11.

At this point the Advisory Committee must choose the minimum prediction score for community youth to be considered part of the total demand population (TDP).

The TDP will be composed of:

- Actual DBA: youth who went (*or will go)* to close custody as part of the DBA. The mirror population refers to actual DBA youth between 1996 and 2002. Actual DBA is not limited to those years. Actual DBA includes youth sent to the DBA in 2003, and those who will be sent in the future.

- Scorers: youth who remain in the community, but, on average, have the same criminal characteristics as those in the mirror population (based on the prediction score).

The Committee uses the following criteria from the mirror population for selecting minimum scores:

- The overall mean score for the total demand population (TDP) should be the same as the mean score for the mirror population.

- The age distribution for the TDP should be the same as for the mirror population.

In the February 2004 analysis, both criteria were met using this scoring scheme:

- For community youth aged 13 to 17 at the time of referral, the minimum score for inclusion in the TDP was the 45th percentile score for similarly aged youth in the mirror population.

- For community youth aged 12 at the time of referral, the minimum score for inclusion in the TDP was the 50th percentile (median) score for 12 year olds in the mirror population.[14]

Tables 5 shows the critical score by age and other characteristics of the mirror

Table 5 – Charcteristics of Mirror Population

Age at Admit	No. of Youth	Mean Score	Pct of Total
12	38	0.44	1.3%
13	132	0.51	4.6%
14	397	0.53	13.7%
15	638	0.53	22.1%
16	806	0.50	27.9%
17	879	0.50	30.4%
Total	**2890**	**0.51**	**100.0%**

Percentile Scores

Age at Admit	45th	50th (Median)	75th
12	0.43	0.46	0.75
13	0.45	0.52	0.91
14	0.44	0.51	0.91
15	0.45	0.55	0.91
16	0.37	0.43	0.92
17	0.35	0.43	0.94
Total	**0.39**	**0.47**	**0.92**

Table 6 – Charcteristics of Total Demand Population

Total DBA Demand = Community Cases with Critical Score + Mirror Cases

Critical Score	Age at Admit	No. of Youth	Mean Score	Pct of Total	Add'l Youth
0.46	12	70	0.52	1.8%	32
0.45	13	198	0.53	5.2%	66
0.44	14	517	0.53	13.5%	120
0.45	15	852	0.54	22.3%	214
0.37	16	995	0.50	26.0%	189
0.35	17	1191	0.49	31.2%	312
	Total	**3823**	**0.51**	**100.0%**	**933**

Percentile Scores

Age at Admit	50th (Median)	75th
12	0.55	0.69
13	0.53	0.76
14	0.52	0.81
15	0.55	0.80
16	0.44	0.84
17	0.44	0.79
Total	**0.49**	**0.81**

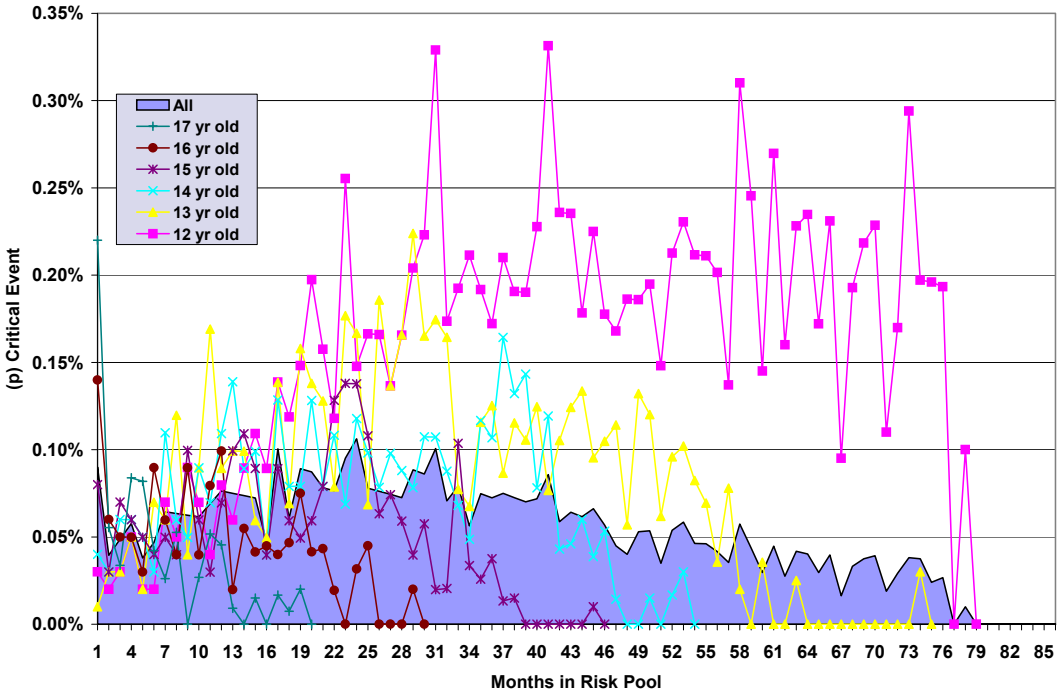
population. Table 6 shows some of the resulting characteristics of the TDP.

The TDP scores are mostly higher than the mirror population scores at the median and mean. The TDP 75th percentile is lower than the mirror population, but this is expected. The most serious cases were sent to the DBA, causing the mirror population scoring distribution to be skewed to the right.

When the critical scores are chosen, we forecast DBA demand intakes in the much same manner as AC and PSR. Again, the terminal event is becoming part of the DBA bed demand either as an actual intake or as a *scorer*. Community cases are again distilled to one record per youth. For youth who did not reach (or have not reached) the critical score, the retained record is the last referral on file.

[14] This reflects actual practice. 12 year olds are committed to close custody only in the most dire circumstances.

Figure 2: Probability of Terminal Event by Age of Risk Pool Entry



For youth who reached the critical score, the retained record pertains to the first time the youth attained the critical score.

DBA intakes are forecast separately according to the age of entry to the risk pool. The timing and probability of a DBA terminal event is affected by the age at which the youth entered the risk pool. Figure 2 shows that the earlier the age of entry, the higher the probability of a terminal event. For younger youth, the probability peaks a few years after entering the risk pool.

Hence, the probability (p) of a DBA terminal event is calculated slightly differently than for AC and PSR youth:

$$p_{x,m} = i_{x,m} / r_{x,m}$$

where x = age of entry to risk pool
m = month after risk pool entry
i = number of critical events
r = number of youth in risk pool

C. Intake Forecast - Return Admissions

OYA intakes also result from offenders released from OYA and returned to close custody. This can be due to a new offense or a violation of the terms of parole.

By studying historical data, we can estimate the rate at which offenders fail their parole during each month after release. This *failure rate* tends to peak during the first year, then decline rapidly over the next year. These intakes can be forecast by applying failure rates to a forecast of OYA releases.

In SPSS, we extract a file of all OYA releases. [15] For all released offenders, we determine which offenders came back to OYA close custody, which turned 20 without returning, which were convicted in the adult justice system before age 20, and which are still on parole. [16]

Each release is flagged as 1 if the offender was returned to close custody, 0 if not. We compute the variable ***t***, which is a measure of time, where:

t_o=date of initial release
t_f=date of next return to close custody
t_c=date of 20th birthday or transfer to adult system, whichever came first
T=end of observation period

For each case, ***t*** is calculated in one of the following three ways:

- If the offender is under age 20 and has not been returned, t=T- t_o; event flag=0
- If the offender has turned 20 or been convicted as an adult before age 20, t= t_c - t_o; event flag=0
- If the offender was returned to close custody, t= t_f - t_o; event flag=1

When event and t have been calculated for all releases, we run the SPSS syntax:

```
SURVIVAL
  TABLE=t
  /INTERVAL=THRU 9999 BY 1
  /STATUS=event(1)
  /PRINT=TABLE .
```

SPSS returns the probability of parole failure in each month after release. The output is similar to Table 7, below.

[15] We don't include releases from adult court sentences. Those offenders are on adult community supervision after release. If they are reincarcerated, they are nearly always sent to adult correctional facilities.

[16] OYA can have custody over youth until age 25, but few offenders aged 20 or older have been returned to close custody. As of this writing, 77 of nearly 17,000 intakes were aged 20 or older.

Table 7: Sample Parole Failure Probability Data

This subfile contains: 12530 observations							
Life	Table						
Survival	Variable		NEWLOS				
			A	**B**	**C=B/A**		**E**
	Number	Number	Number	Number			Cumul
Intrvl	Entrng	Wdrawn	Exposd	of	Propn	Propn	Propn
Start	this	During	to	Termnl	Termi-	Sur-	Surv
Time	Intrvl	Intrvl	Risk	Events	nating	viving	at End
------	------	------	------	------	------	------	------
0	12377	152	12301	238	0.02	0.98	0.98
1	11987	117	11928.5	95	0.01	0.99	0.97
2	11775	132	11709	120	0.01	0.99	0.96
3	11523	109	11468.5	146	0.01	0.99	0.95
4	11268	131	11202.5	156	0.01	0.99	0.94
5	10981	118	10922	168	0.02	0.98	0.92
6	10695	117	10636.5	173	0.02	0.98	0.91
7	10405	95	10357.5	143	0.01	0.99	0.90
8	10167	151	10091.5	171	0.02	0.98	0.88
9	9845	115	9787.5	163	0.02	0.98	0.87
10	9567	99	9517.5	166	0.02	0.98	0.85
11	9302	125	9239.5	177	0.02	0.98	0.83
12	9000	132	8934	168	0.02	0.98	0.82

The array in column C is the probability of failing parole in each month after release. We call the array the *parole failure profile*.

Figure 3 shows a sample of the worksheet that computes parole failure intakes to close custody. The expected number of releases for a given month is in column G. The parole failure profile is in row 4. The number in row x, column G is multiplied by the number in column H of row 4. The product appears in column H, row x. The number in row x, column G is multiplied by the number in row 4 column I. The product appears in column I of row x+1. This process continues as the number in a given row *x* in column G is multiplied by each variable in row 4, and the products appear diagonally across the table. These rows are summed in column D, the forecast of parole failure intakes for the month. Intakes are lagged by one month to avoid a circular reference error in the spreadsheet.

For example, of the 70 offenders released during July 2002, we expect 4 to fail parole in August, 4 in September, 4 in October, 3 in November, 3 in December, and 3 in January. The 26 parole failures expected in July 2002 are based on offenders released in June 2002, May 2002, and so on, back about two years.

Column C in Table 7 is based on a declining denominator. The worksheet in Figure 3 uses a fixed denominator (column G). To remedy this, the initial array in column C, Table 7 is multiplied by column E in Table 7. Column E is the percentage of the original intake cohort that remains in the risk pool. The number

Figure 3: Parole Revocation Worksheet

		OYA Parole Revocations				COL H	COL I						
					COL G	Cumulative Survival Rate							
			COL D	ROW 4 →		0.0588	0.053659	0.056826	0.043342	0.040843	0.040948	0.023737	
		Forecast revocations			Monthly	Months Since Admission							
		during month...			Releases	0	1	2	3	4	5	6	
Historical	15	Jun-01	29	Jun-01	71	4	4	4	3	2	2	1	
PVs	31	Jul-01	30	Jul-01	67	4	4	4	3	3	2	1	
	30	Aug-01	30	Aug-01	105	6	4	4	3	3	3	1	
	29	Sep-01	32	Sep-01	47	3	6	4	3	3	3	2	
	34	Oct-01	31	Oct-01	55	3	3	6	3	3	3	2	
	19	Nov-01	30	Nov-01	61	4	3	3	5	3	3	2	
	30	Dec-01	30	Dec-01	47	3	3	3	2	4	3	2	
	30	Jan-02	28	Jan-02	64	4	3	3	2	2	4	2	
	26	Feb-02	28	Feb-02	51	3	3	3	3	2	2	2	
	25	Mar-02	27	Mar-02	46	3	3	4	2	2	2	1	
	28	Apr-02	26	Apr-02	57	3	2	3	3	2	2	1	
	33	May-02	26	May-02	59	3	3	3	2	3	2	1	
	24	Jun-02	25	Jun-02	59	3	3	3	2	2	3	1	
		Jul-02	**26**	**Jul-02**	**70**	4	3	3	2	2	2	2	
FY 2002		Aug-02	27	Aug-02	70	4	4	3	3	2	2	1	
actual	**339**	Sep-02	27	Sep-02	64	4	4	4	3	2	2	1	
forecast	**344**	Oct-02	28	Oct-02	58	3	3	4	3	2	2	1	
	1.4%	Nov-02	27	Nov-02	60	4	3	4	3	3	2	1	
FY 2001		Dec-02	27	Dec-02	65	4	3	3	3	3	3	1	
actual	**304**	Jan-03	28	Jan-03	66	4	4	3	3	3	3	2	
forecast	**363**	Feb-03	28	Feb-03	62	4	4	4	3	2	3	2	
	19.3%	Mar-03	28	Mar-03	64	4	3	4	3	2	2	2	
cY 00 & 01		Apr-03	28	Apr-03	63	4	3	4	3	3	2	1	
actual	**643**	May-03	28	May-03	64	4	3	4	3	3	3	1	
forecast	**706**	Jun-03	28	Jun-03	64	4	3	4	3	3	3	2	
	9.8%	Jul-03	28	Jul-03	65	4	3	4	3	3	3	2	
last 6 mos		Aug-03	28	Aug-03	65	4	3	4	3	3	3	1	
actual	**166**	Sep-03	28	Sep-03	64	4	3	4	3	3	3	2	
forecast	**161**	Oct-03	28	Oct-03	65	4	3	4	3	3	3	2	

in row *x* of column C, Table 7 is multiplied by the number in row *x-1* in column E, Table 7.

The vast majority of youth who fail parole spent their first close custody episode as DBA, and they will be part of the DBA when they return. Since we are forecasting DBA demand, we must consider that past unmet demand for first-time DBA intakes would in turn suppress the demand for parole failure intakes. For example, if the demand for 2003 had been met, more DBA youth would have entered close custody, would have been released, and would re-enter on a parole failure in 2004. To capture this portion of demand, we *backcast* the DBA population. We create a historical forecast based on actual DBA intakes and *scorers.* We capture the releases from the historical demand population and apply the parole failure profile to them.

The probability of failing parole during any given month after release has changed over time with evolving supervision policies and the supply of close custody beds. In order to reflect average practice, our parole failure profile is based on releases during the *mirror population* years of 1996 through 2002.

D. Release Forecast and Length of Stay

The release forecast is based on length of stay (LOS). Close custody offenders serve *indeterminate* sentences. That is, there is no specified sentence to be served. Therefore, LOS is known only for offenders who have been released. By looking at recent history and current practice, we develop a LOS profile. It is based on the probability of being released in each month after intake. The profile

is used to release the beginning stock population and forecast intakes. The offender groups we forecast have significantly different lengths of stay, so we develop profiles for each group.

For the PSR and AC offender groups, LOS is based on current practice. To reflect average practice, the DBA LOS is based on the mirror population years of 1996 through 2002. It is possible that the limited number of beds caused some DBA offenders to be released earlier than they otherwise would have been. There is no way to determine this from the available data. Moreover, determining optimum lengths of stay is beyond the scope of the forecast and the charge of the Advisory Committee.

For each LOS profile, offenders who have been released are flagged, and their actual LOS is calculated. For offenders who have not been released, their LOS equals the time served so far. Using SPSS, we compute a survival probability curve using the "Survival – Life Tables" command syntax.[17] The terminal event is release from close custody.

For the AC and PSR, we compute several arrays and use them to develop a profile that returns each group's current population when applied to historical intakes. The *cumulative survival probability* (column G, Table 8) is applied to monthly intakes. The *survival probability* (column F, Table 8) is applied to the

Table 8: Sample Length of Stay Profile

This subfile contains 788 observations							
Life Table	Table						
Survival Variable NEWLOS							
	A	**B**	**C**	**D**	**E=D/C**	**F=1-E**	**G2=G1*F2**
	Number	Number	Number	Number			Cumul
Intrvl	Entrng	Wdrawn	Exposd	of	Propn	Propn	Propn
Start	this	During	to	Termnl	Termi-	Sur-	Surv
Time	Intrvl	Intrvl	Risk	Events	nating	viving	at End
------	------	------	------	------	------	------	------
0	774	8	770	31	0.0403	0.9597	0.9597
1	735	10	730	30	0.0411	0.9589	0.9203
2	695	8	691	43	0.0622	0.9378	0.863
3	644	7	640.5	49	0.0765	0.9235	0.797
4	588	4	586	72	0.1229	0.8771	0.6991
5	512	5	509.5	83	0.1629	0.8371	0.5852
6	424	10	419	67	0.1599	0.8401	0.4916
7	347	2	346	56	0.1618	0.8382	0.4121
8	289	6	286	51	0.1783	0.8217	0.3386
9	232	4	230	28	0.1217	0.8783	0.2974
10	200	1	199.5	34	0.1704	0.8296	0.2467
11	165	6	162	36	0.2222	0.7778	0.1919
12	123	3	121.5	28	0.2305	0.7695	0.1476

[17] See page 16 for example.

current stock population. Table 8 shows that 49.2 percent of intakes will stay longer than six months, and 83.7 percent of those who stay longer than four months will stay longer than five months.

Time served by DBA offenders typically varies based on the crime for which they were committed. Thus, DBA offenders are further divided into three groups based on length of stay: sex offenders, other person crimes, and non-person crimes. For the DBA demand, arrays are computed in the same way as for the AC and PSR populations. LOS is based on 1996-2002 to reflect average practice. No testing is possible because demand is a theoretical population based in part on the LOS being tested.

E. POPULATION

Annual intakes and the LOS profiles are entered into the model. The model returns a demand forecast for each month over the next decade. The forecast for each group begins with the group's stock population or current demand. Intakes are added and releases are subtracted from both intakes and the stock.

1. Population from Intakes

Figure 4 shows a sample portion of the intake forecasting model. The full spreadsheet covers ten years. Column I is linked to column D of the DBA intake forecasting worksheet.[18] Row 4 is the *cumulative probability of survival* (see Table 7, above). The number in row x, column I is multiplied by the number in column J of row 4. The product appears in column J, row x. The number in row x, column I is multiplied by the number in row 4 column K. The product appears in column K of row x+1. This process continues as the number in a given row *x* in column I is multiplied by each variable in row 4, and the products appear diagonally across the table. Column D, the population in month x, is the sum of row *x*. Monthly

Figure 4: Sample of Intake Forecasting Model

Population									
DBAN A&E	COL D	COL E			COL I	COL J	COL K		
ADMITNO=1						Cumulative Survival Rate			
					ROW 4 →	0.9724	0.9392	0.8854	0.837
Population as of		Monthly		Monthly	Monthly	Months Since Admission			
First Day of Month		Releases		Admits	Admissions	0	1	2	3
Feb-04	11	0		Jan-04	11	11			
Mar-04	21	1		Feb-04	11	10	10		
Apr-04	30	1		Mar-04	11	10	10	10	
May-04	39	2		Apr-04	11	10	10	9	9
Jun-04	47	3		May-04	11	10	10	9	9
Jul-04	54	4		Jun-04	11	10	10	9	9
Aug-04	60	5		Jul-04	11	10	10	9	9
Sep-04	65	6		Aug-04	10	10	10	9	9
Oct-04	69	6		Sep-04	10	10	10	9	9
Nov-04	73	7		Oct-04	10	10	10	9	9

[18] An example of this worksheet for the AC population is on page 9. For parole violation intakes, column I links to column D of the Parole Revocation Worksheet shown on page 18. Total DBA intakes are subdivided into sex offenders, other person crimes, etc. using historical commitment patterns.

releases in column E are the difference between the sum of row *x* and the sum of row *x-1*. The monthly releases in column E will be summed with releases from other populations and used to determine future intakes from parole failures. [19]

2. Stock Population

The method for releasing stock population is shown in Figure 5. The model begins with a *time served cohort*. In Figure 5, the stock population of 93 is arranged along row 6 according to truncated time served in months. In Figure 5, the starting population is actually current demand. It comes from our backcast of demand cases.[20] For AC and PSR, row 6 would contain the actual stock population.

Figure 5: Sample of Stock Release Model

					Stock Population					
COL A		COL C			dba a&e					
					Months Serve	0	1	2	3	4
				ROW 4 →	Survival Rate	0.9724	0.9658577	0.9427172	0.9453354	0.9076464
From spss survival function - los by release y or n						12/1/2003	11/1/2003	10/1/2003	9/1/2003	8/1/2003
93	ROW 6		tserved=trunc(los) →		Jan-04	7	15	9	6	8
stock		#of releases								
remaining										
85	91.6%	8	Jan-04		Feb-04		7	15	8	6
77	83.1%	8	Feb-04		Mar-04			6	14	8
69	74.8%	8	Mar-04		Apr-04				6	13
62	66.7%	8	Apr-04		May-04					6
55	58.8%	7	May-04		Jun-04					

In the example, we see that 7 offenders have served less than one month (or in the case of demand, became demand less than one month ago). We multiply the cohort by its survival rate (.9724) to obtain the number that will remain in stock as of February 1st. The 7 remaining on February 1st are multiplied by the next survival rate (.96585) to obtain the number that will remain on March 1st (6).

The 6 offenders who have served between 3 and 4 months are multiplied by the month 3 survival rate (.9453354) to obtain the number that will enter their fourth month (6).

The total stock remaining in a given month *x* is shown in column A and is the sum of row *x*. Releases are shown in column C and are the difference between row *x* and row *x-1* in column A. The monthly releases in column C will be summed with releases from other populations and used to determine future intakes from parole failures. [21]

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[19] See section III.C, above.

[20] See section III.C, page 18.

[21] ibid.

F. ADULT COURT POPULATION – SPECIAL CONSIDERATIONS

Measure 11 and Waived youth can serve time at either DOC or OYA. [22] The total population must be divided between the two locations. To do this, we forecast the total population, then the OYA portion of the total. The latter is subtracted from the former to obtain the DOC portion of the total.

Total Population

Adult court inmates serve determinate sentences and have projected release dates. Their total population is forecast in the same manner as other adult inmate groups. [23]

OYA Portion of Total

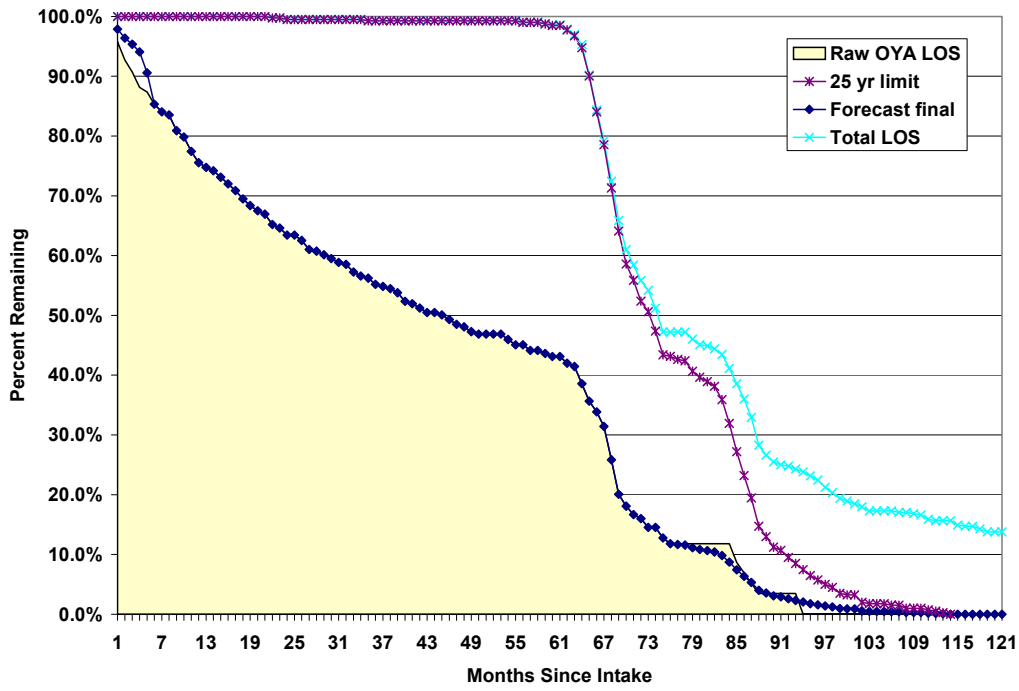
More than 75 percent of waived juveniles (not Measure 11) serve a total sentence of less than 3 years. There is ample history with which to determine the portion of the total sentence served in OYA facilities.

Under Measure 11, a youth could reach age 25 before completing the sentence. Using CIS data on date of intake, age at intake, and projected release date, we compute a maximum OYA length of stay based on the 25th birthday or projected release date, *whichever comes first.* Next, we look at the historical time served at OYA by Measure 11 youth. We have 8½ years of data. To finish the remaining 1½ years of the forecast, we use the rate of decline from the total Measure 11 sentence, then apply the 25 year age limit. Figure 6 (below) shows the current LOS profiles for the total Measure 11 sentence, the 25-year limit, the actual LOS spent by inmates at OYA, and the final LOS profile used for the forecast.

[22] See section II, above.

[23] Oregon Corrections Population Forecast Annual Review of Methodology, Oregon Department of Administrative Services, Office of Economic Analysis, May 2004.

Figure 6: LOS for Measure 11 Youth



Once the LOS profiles have been developed, the OYA population of Measure 11 and Waived is calculated in the same manner as other OYA offender groups.

IV. Model Performance and Planned Improvements

This model was implemented in 2004. We will monitor future performance and accordingly plan improvements.

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