Organizing Data and People for Juvenile Justice Population Forecasts

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The Urban Institute's Juvenile Forecaster website (http://jf.urban.org) provides easy-to-use methods of projecting the number of young offenders expected to enter juvenile justice programs in future months, years, or decades. The website is designed to support a forecasting process that draws upon the judgment and experience of juvenile justice decision-makers in addition to the technical skills of researchers and data analysts. Juvenile justice officials can use the website to create forecasting scenarios based on varying assumptions about future trends in youth populations, juvenile crime, and justice policies. The results can be displayed during forecasting meetings and alternate forecast scenarios can be re-calculated and shared immediately.

Background

At some point, every juvenile justice agency will be asked to estimate the future demand for its services, whether this includes detention and correctional space or treatment programs and community supervision. Projections of future demand are essential during debates over agency budgets, staffing levels, construction plans, and program locations.

Efforts to anticipate the future demand for facilities and services are generally known as forecasting. Forecasting efforts typically begin with an analysis of demographics, juvenile crime, and juvenile justice caseloads. Even the best statistical models, however, will never fully account for the complex forces that actually shape the demand for juvenile justice resources (Butts and Adams 2001). Demographic shifts and juvenile crime trends usually turn out to be less important than changing patterns in juvenile justice policy and practice. Unfortunately, there are no convenient data sources for tracking policy preferences and juvenile justice practices. This information can only be obtained by investigating the opinions and beliefs of individuals and agencies in the juvenile justice system.

When forecasting is viewed as a purely statistical exercise, the responsibility for generating forecasts will likely be delegated to researchers and technical staff. Yet, elected officials and administrators have unique access to information about future trends in policy and practice, and they are ultimately accountable for the policy and budgeting decisions that depend on forecasting.

The Juvenile Forecaster website encourages policymakers and professionals in the juvenile justice system to participate actively in forecasting. Using the website, juvenile justice agencies can manage the forecasting process and ensure that it adheres to the following indicators of quality:

- Statistical analysis should support a forecasting effort, but not control it;
- A juvenile justice forecasting process should be guided by the judgment and experience of people involved with and knowledgeable about the juvenile justice system;
- The responsibility for guiding and managing a forecasting effort should be assumed by a diverse group of stakeholders, including practitioners, policymakers, and community leaders;
- Forecasting models should focus on the smallest possible set of key factors and not be paralyzed by large amounts of unnecessary data;
- On the other hand, a forecasting process should not be constrained by data availability – important data elements should be estimated rather than omitted;
- A successful forecasting effort allows decision-makers to identify and understand departures from expected trends – the accuracy of past predictions is not the best measure of success; and
- Forecasting should be an ongoing effort and not a one-time exercise.

Organizing Data

Early in a forecasting process, analysts should begin to assemble a data matrix for each facility or program type likely to be included in the forecast — one matrix may be needed for the probation population, another for intensive supervision cases, another for residential treatment and detention, etc. The rows of a matrix represent important offender groups within each facility or program type (e.g., males and females, younger and older juveniles, violent and non-violent offenders). The columns in a matrix represent key data elements required for forecasting.

Defining Offender Groups

Within each program type, forecasters should identify offender groups that are most relevant for program operations and system management (service delivery, facility security, transportation, building management, etc.). Offender groups would typically be differentiated according to age, sex, geographic region, offense severity, and treatment needs. The rows in a data matrix should contain each possible combination of the categories that make up the relevant characteristics.

The number of rows that will be necessary depends on now many categories are used for each characteristic. For example, assume a forecasting committee wanted to divide offenders into groups based only on age and sex, and assume the committee was willing to consider just two age groups (under and over age 16). In this forecasting effort, each matrix would consist of just four rows:

Row 1 — males / age 15 or younger;
Row 2 — males / age 16 older;
Row 3 — females / age 15 or younger;
Row 4 — females / age 16 older.

If, however, the committee wanted to divide offenders according to offense severity in addition to age and sex, the number of rows needed for each matrix could increase sharply.

Even if offenses were to be divided into just two categories (violent and non-violent), the number of rows would increase from four to eight:

Row 1 — males / age 15 or younger / violent;
Row 2 — males / age 15 or younger / non-violent;
Row 3 — males / age 16 older / violent;
Row 4 — males / age 16 older / non-violent;
Row 5 — females / age 15 or younger / violent;
Row 6 — females / age 15 or younger / non-violent;
Row 7 — females / age 16 older / violent;
Row 8 — females / age 16 older / non-violent.

If the committee chose to divide offenses into four categories of offense severity (e.g., person, property, drug, and public order), the number of rows needed for each matrix would increase from four to sixteen. Adding just one more 2-category factor (e.g., high versus low treatment needs) would require the number of rows to double again, to 32.

Sample Data Matrix for One Facility or Program Type

	Forecasting Data Elements						
Offender Groups	Starting Pop.	Admission Rate	Length of Stay	Cost per Day	Recidivism*	Change in Admissions	Change in ALOS
Male-Low Risk	985	1900/yr	188	$65	28%	4%	1%
Male-Med Risk	744	1100/yr	250	$60	30%	2%	1.8%
Male-High Risk	352	375/yr	355	$120	52%	-1%	2%
Female-Low Risk	684	2900/yr	85	$25	20%	1%	-1%
Female-Med Risk	562	1150/yr	180	$40	25%	1.5%	8%
Female-High Risk	259	1000/yr	90	$20	38%	1.8%	-7%

Elements provided by juvenile justice agencies using real data or estimates.

Elements developed by forecasters in discussions of future scenarios and informed by statistical analysis.

*** Recidivism estimates are not essential for forecasting population trends but may be helpful for fiscal analysis.**

To keep forecasting data matrices from becoming too large, a forecasting effort should use the smallest possible set of population characteristics to distinguish offender groups and it should include only those characteristics which are essential for planning the capacity and distribution of placement and supervision resources. Some population characteristics that would be highly salient for research and evaluation efforts may not be as critical for forecasting purposes – e.g., race and ethnicity, family composition, school status, etc.

Note: It is possible to limit the size of each data matrix by using population characteristics to define the matrices themselves. For example, rather than including geography (region of the state) as a characteristic of offenders, the matrices could include geographic region as definition of program type. Thus, the forecasting analysis could compile one data matrix for detention cases in urban areas and another for detention cases in rural or suburban areas.

Data Elements

The first five data elements in each matrix should be available from juvenile justice agencies. As much as possible, each element in the data matrix should be completed using real data. If certain elements for a particular program type cannot be filled in with actual data, they should be estimated, either by the forecasting committee or by individuals and agencies in the best position to guess. The extent of estimation needed will increase as the number and variety of forecasted programs grows, and as the number of offender groups increases.

> Note: The scope of a forecasting effort and the number of programs to be projected should be determined by policy and management concerns and not be constrained by data availability. Estimating a missing data element is better than omitting an important element from a forecasting scenario.

Each of the following data elements should be collected and organized for use in the forecasting committee meetings.

Starting Population

Starting Population refers to the number of juveniles currently in a facility or program – the number of youth currently on probation, currently receiving drug treatment, in a particular form of out-of-home placement, etc. Ideally, the starting population would be the actual number of juveniles in the population on the exact day a forecast is calculated. More practically, however, it will be a recent count of the population (as of last month, on the last day of the previous quarter, etc.).

Admission Rate

The Admission Rate is the rate at which juveniles are added to a population, stated as the number currently being added per time-period (day, month, or year). The number of youth "admitted" to a population could mean the number of youth entering a facility, the number placed on probation, the number beginning treatment or supervision, etc.

Length of Stay

The length of time juveniles are expected to remain in the population after being admitted, measured as the average number of days between "admission" and "release." Although this estimate is used to quantify the current length of stay, it must be based on recent (i.e., past) measures of length of stay.

Cost per Day

The average daily cost (in dollars) incurred by a facility or program for each juvenile served. This would usually be available as the per diem cost of services or placement.

> Note: Per-diem charges do not usually account for capital or construction costs, so this measure of "cost per day" does not capture the total costs of services and placements. It is useful, however, in projecting the daily costs of supervision, treatment, and placement for juveniles in each forecasted population group.

Recidivism

Some forecasting committees may want to incorporate recidivism as a source of new admissions. In other words, if one-fifth of youth released from probation supervision are

expected to return as new probation cases within one year, then growth in the probation population in year 1 should be expected to increase detention admissions in year 2.

Definitions of recidivism will vary. Many forecasting efforts will likely define recidivism as the percentage of youth re-arrested within one year of release or case closure. Others may want to use shorter time frames (e.g., one month) or even different triggering events (e.g., re-adjudication or re-incarceration rather than re-arrest).

Most juvenile justice systems maintain at least some data about recidivism, but few agencies will be able to generate separate recidivism measures for a large number of offender groups and many program types. When detailed information does not exist, it is acceptable to use a single recidivism estimate for multiple program types and offender groups.

Expected Change in Admissions

The final two data elements cannot be measured with real data. They are predictions, derived from the subjective beliefs and past experiences of the members of each forecasting committee. The most critical data element in any population projection is the extent to which the rate of admissions is expected to change in the future, expressed as a percentage. Whether this is over a period of weeks, months, or years, generating estimates of future admissions will never be an exact science. It is best to use a combination of statistical analysis, policy judgment, and the best guesses of practitioners.

Expected Change in Length of Stay

Finally, forecasters should indicate the extent to which lengths of stay are expected to change in the future – expressed as a percentage change per time-period. As with the expected change in admissions, it is best to create these estimates using data about historical patterns but also considering policy judgments and the views of experienced practitioners.

Calculations Used in Juvenile Forecaster

Once all of the data elements are filled in with real data or committee estimates, the Juvenile Forecaster website will create population projections for each program type and each offender group. Population projections for time *t* are calculated for each offender group using the following equation:

$$P(t) = A(t) \cdot L(t) \cdot \left(1 - e^{-1/L(t)}\right) + P(t-1) \cdot e^{-1/L(t)}$$

The first term represents juveniles admitted between time *t-1* and time *t*, and the second term represents members of the population at time *t-1* who have not been released by time *t*. The population at time 0 is the initial **population** parameter. Admissions are assumed to be a Poisson process, and individual lengths of stay are assumed to have an exponential distribution. Both admissions and length of stay can vary over time. *A(t)* is the **admissions rate** at time *t*. This is Ae^{rt}, where *r* is the **percent change** in admissions during each **time-period** of analysis divided by 100. If the percent change is 0, this is the constant value *A*. Similarly, *L(t)* is the **length of stay** at time *t*. This is Le^{st}, where *s* is **percent change** in length of stay divided by 100. In traditional models, the equation is given in a non-recursive form with admissions and length of stay constant:

$$P(t) = A \cdot L + \left(P - A \cdot L\right) \cdot e^{-t/L}$$

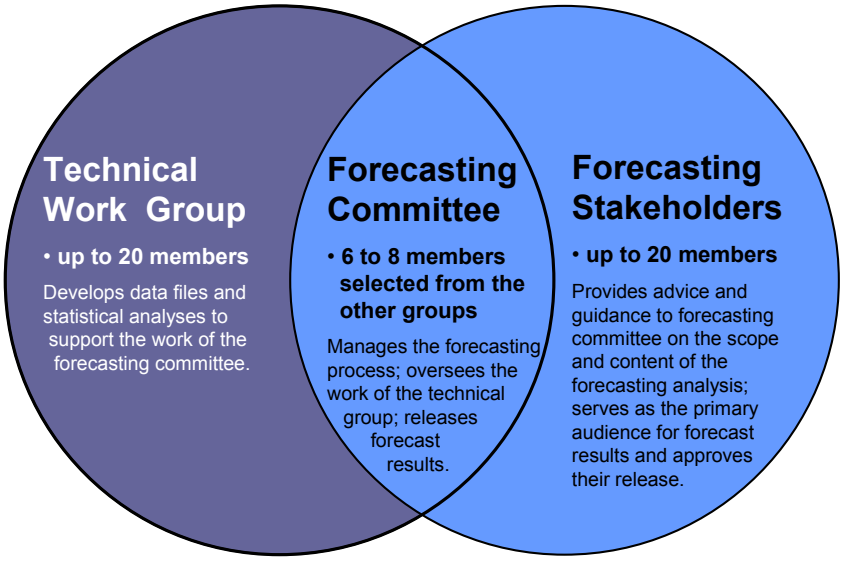
If length of stay in this equation is replaced by a function of length of stay over time, the traditional model will overestimate population if length of stay is increasing and underestimate it if length of stay is decreasing. Juvenile Forecaster uses the recursive form to model varying lengths of stay.

Organizing People

To begin a juvenile justice forecasting effort, state or local officials should identify and recruit members for two large groups that will meet periodically during each round of population forecasting: 1) a technical work group and 2) a group of forecasting stakeholders. Several members from both groups should be appointed to a "forecasting committee" that will oversee and manage the forecasting process.

The technical work group will be charged with organizing the data elements necessary to use the Juvenile Forecaster website. Whenever actual data are unavailable for certain elements, the technical work group will also be asked to devise a process for estimating the missing data. Technical work group members will likely include personnel from a number of agencies, such as law enforcement, courts, probation or court services, social service agencies, drug and alcohol treatment providers, mental health agencies, and other allied organizations with responsibility for components of the juvenile justice system. Most members will be drawn from the administrative support, research and planning, or information management divisions of their respective agencies.

Recommended Groups for a Juvenile Justice Forecasting Effort



Members of the "forecasting stakeholders" group should be recruited from among the policy and management levels of the same organizations. Members would likely include judges, program directors, court administrators, facility superintendents, chiefs of police, prosecutors, public defenders, and elected officials. The stakeholder group should meet independently of the technical work group. Stakeholders should set the agenda for the

forecasting effort and be the primary audience and consumer of forecasting information. Final approval of official forecasting results should rest with the stakeholders.

The management of the forecasting process should be coordinated by a forecasting committee with members drawn from both the technical working group the forecasting stakeholders group. Ideally, the forecasting committee should include no more than 8 people, with roughly equal members from the technical group and the stakeholder group. The forecasting committee should serve as the liaison between the two other groups, helping to formulate and share the forecasting agenda with the technical group members and relaying any data shortcomings and analytical concerns to the stakeholder group.

Much of the work of these groups must occur sequentially, but in most cases, it should be possible to complete the entire process in approximately 10 weeks. Forecasting efforts may follow a schedule like the following:

WEEKS 1 AND 2

Meeting 1 – Forecasting Committee (2 hours)

- Greetings and introductions – 20 minutes
- Review of forecasting methods/the limits of predictive models – 30 minutes
- Introduction to Juvenile Forecaster (Internet demonstration) – 40 minutes
- Questions, closing business, schedule for next meeting – 30 minutes

Meeting 2 – Forecasting Stakeholders (1 hour)

- Greetings and introductions – 10 minutes
- Background and orientation of project – 15 minutes
- Introduction to Juvenile Forecaster (Internet demonstration) – 20 minutes
- Questions, closing business, schedule for next meeting – 10 minutes

Meeting 3 – Technical Work Group (3 hours)

- Greetings and introductions – 20 minutes
- Review of forecasting methods/the limits of predictive models – 20 minutes
- Introduction to Juvenile Forecaster (Internet demonstration) – 40 minutes
- Data file structures for Juvenile Forecaster– 15 minutes
- *10-minute break*
- Discussion of likely data obstacles – 45 minutes
- Task assignment (organizing data elements) – 20 minutes
- Questions, closing business, schedule for next meeting – 10 minutes

WEEKS 3 THROUGH 8

Meeting 4 – Forecasting Committee (1.5 hours)

- Report of progress made by technical work group – 15 minutes
- Review of data obstacles and plan for addressing them – 60 minutes
- Closing business, agenda and schedule for next meeting – 15 minutes

Meeting 5 – Forecasting Committee (2.5 hours)

Review of data compiled by technical work group – 30 minutes
Creation of forecasting scenarios with Juvenile Forecaster – 90 minutes
Strategy for addressing ongoing data challenges – 15 minutes
Task assignment (summary memo for stakeholders) – 10 minutes
Closing business, agenda and schedule for next meeting – 5 minutes

Meeting 6 – Technical Work Group (1.5 hours)

Review of forecasting scenarios – 60 minutes
Comments and criticisms, plan for making adjustments – 30 minutes

Meeting 7 – Forecasting Stakeholders (1 hour)

Review of forecasting scenarios – 45 minutes
Comments and criticisms, plan for making adjustments – 15 minutes

WEEKS 9 AND 10

Meeting 8 – Forecasting Committee (1 hour)

Review of comments and criticisms and adjustments made – 30 minutes
Task assignment (prepare forecasting results for stakeholders) – 10 minutes
Plan for releasing official forecast – 10 minutes

Meeting 9 – Forecasting Stakeholders (1 hour)

Review of official forecasts – 30 minutes
Discussion and approval vote to release official forecast – 20 minutes
Closing business, schedule for next round of meetings – 10 minutes

Conclusion

Forecasting efforts are likely to take many twists and turns, and no jurisdiction will experience the process exactly as described here. Each jurisdiction needs to develop its own preferred method, its own way of running meetings and assigning tasks to individuals and agencies. In general, however, a practical, policy-oriented forecasting process should include structures and procedures something like those listed above.

As the work of forecasting begins, the forecasting committee should keep these key points in mind:

- Learning to routinely generate and use population forecasts is more important than the content or accuracy of any one forecast.
- An effective forecasting process is not necessarily expensive and does not have to require a large investment of time and personnel.
- Even nominal forecasting efforts may produce considerable improvements in the efficiency and effectiveness of juvenile justice planning.
- The most important improvement an agency can make in its forecasting process is not to increase its statistical sophistication, but to increase the number and diversity of key stakeholders involved directly in forecasting.

Sources

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