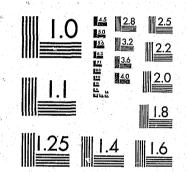National Criminal Justice Reference Service

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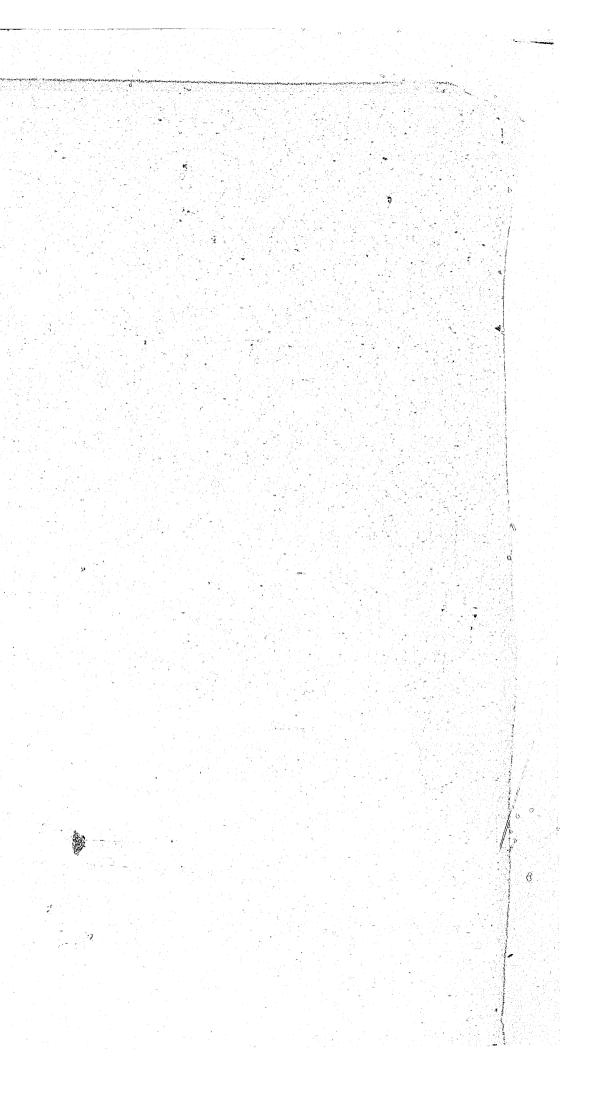the standards set forth in 41CFR 101-11.504.

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A PROPOSAL FOR DEVELOPING AN IMPROVED PRISON POPULATION PROJECTION METHODOLOGY

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COMMONWEALTH OF KENTUCKY

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Bureau of Corrections

Office of Administrative and Fiscal Affairs

Division of Management Information Systems

Research and Evaluation Unit

Prepared By:

James C. Warmbrodt
Pat Ray Reese

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Introduction

This report is the second phase of a study being conducted by the Research and Evaluation Unit to develop an improved method of population prediction. In the initial phase, projection techniques being utilized by other corrections agencies were examined through a review of current literature, as well as through a nationwide survey.[1]

The purpose of this report is to recommend a methodology to be used to project the future prison population in Kentucky. Areas to be discussed include: the dissatisfaction with current projection techniques; the need for improved projections; objectives in developing a new methodology; a review of various projection techniques; the recommended methodology; and implementation.

Current Methodology

The Kentucky Bureau of Corrections has prepared prison population projections on an irregular basis in the past using linear regressions of historical data. As was pointed out in an earlier feasibility study[2], projections using linear regression have been so inaccurate as to render them inadequate for administrative planning purposes. As an example of the fallibility of projections utilizing this technique, a two-year projection of monthly prison population figures from May, 1978 to April, 1980 was prepared based on the monthly population data from the two previous years (see Table I). A comparison of the projected figures

[1] A Nationwide Survey of Prison Population Projection Techniques, Kentucky Bureau of Corrections, Research and Evaluation Unit, July, 1980.

[2] Preliminary Proposal for a Prison Projection Technique in Kentucky, Susan Click, Kentucky Bureau of Corrections, Research and Evaluation Unit, December, 1978.

with the actual population over the two-year period shows that the projected

figures fell within the $\pm$5% margin of error generally considered acceptable

for projections for only slightly more than half the months. The error in

projection was as high as 12.4% after only the fifth projected month, when

the projected figure exceeded the actual population by 407 inmates. In

addition, while the linear regression projection suggested a steady increase

in population, the actual population figures showed two marked changes in

trends; first decreasing rapidly by two hundred, then steadily increasing

to a point where it exceeded the projection. The general inconsistency and

the inability to forecast changes in trends greatly limits the degree of reli-

ability which can be expected from projections which utilize only linear regres-

sions.

The Need for Reliable Projections

The ability to make accurate predictions of the future prison population can

be an invaluable asset to the corrections administrator. Population projections

are routinely used by corrections agencies throughout the country for budget

preparation, determining needed bedspace in connection with capital/facility

development, as an aid in policy and program planning, and to determine the

impact of legislative changes.[3] In Kentucky, there have recently been several

situations for which prison population projections and/or impact statements

have been requested. The following are some examples of these requests:

--In 1978, the Governor's Commission on Sentencing and the Release of Criminal

Offenders was created to study the feasibility of adopting determinate sentencing.

The Commission requested impact statements on the effects that several proposed

changes in sentencing and release procedures would have on the prison population.

--Several bills proposing changes in the criminal statutes were introduced

during the 1980 General Assembly. The Governor's Office requested that the

[3]A Nationwide Survey

Research and Evaluation Unit prepared impact statements on the effects these

changes would have on the inmate population. Projections calculated using an

untested modeling methodology were instrumental in the Governor's veto of a

bill which would have enhanced the penalties for certain drug offenses.

--During the recent litigation involving the Reformatory and the Penitentiary,[4]

the Research and Evaluation Unit prepared population projections to be used in the

Bureau of Corrections' defense. The consent decree which settled the litigation

in April, 1980, has as one of its requirements, that the populations of the

Reformatory and the Penitentiary, Kentucky's two largest correctional institutions,

be reduced by a total of 600 inmates within six months. In response to this

mandate, the Parole Board requested an impact statement on the effectiveness that

changes in their release policies would have in reducing the prison population.

It seems likely that the need for prison population projections similar to

those requested in the past few years will continue. To better respond to the

increasing information demands from within the Bureau and from other agencies,

it is imperative that a reliable projection methodology be developed. The advances

being made by other states, as well as the rapidly improving information sources

here in Kentucky, will soon make the adoption of a better, more sophisticated

methodology possible. Now is the time to develop a technique which will meet

the needs of Kentucky's Bureau of Corrections.

Objectives of Methodology Development

In tailoring a projection methodology to meet the specific needs of Kentucky's

system, certain criteria must be met:

1) The projection must use available and easily accessible data. The

Offender Records Information Operations Network (ORION), which is soon

to be in operation, will be essential in providing the sizeable data base

[4]Kendrick vs Bland

needed to make accurate population projections. No sample of inmates currently exists which will provide the data on commitments and releases necessary to develop a more sophisticated projection technique. The massive collection effort necessary to accumulate this information by hand would be unfeasible. In addition, a sample such as this would be limited in its utility, as such information quickly becomes outdated.

2) Projections must be responsive to fluctuations in prison populations. One of the most notable shortcomings of the projection methodology currently being utilized is its inability to predict changes in population trends. Perhaps the most important capability of a projection technique is that it must be able to forecast when the population will begin to increase or decrease.

3) The projection methodology must be able to incorporate hypothetical "what if" scenarios to analyze possible policy alternatives. Projections must be able to determine what impact proposed policy or statutory changes will have on the inmate population.

4) The projection methodology must be adaptable. It should be flexible enough to be updated or refined as better information or more sophisticated techniques become available.

5) The projected technique must be converted to a computerized form. Members of the Research and Evaluation Unit should be able to prepare projections using electronic data processing equipment with a minimum of manual calculations.

6) Projections must produce consistently valid and reliable predictions. Time, energy, and money should not be wasted developing a sophisticated projection technique if the projections themselves are no more reliable than those resulting from the present linear regression method.

If these objectives can be realized in developing a projection methodology, the end result will be a versatile information resource which can be utilized by the various facets of the Bureau.

Review of Methodologies

This section will provide a brief review of prison population projection techniques being utilized by other corrections agencies. The information was obtained through a review of current literature on the subject, as well as the Evaluation Unit's survey of corrections agencies. The main focus will be to describe in general how the projection is prepared, and what are the advantages and limitations of each technique.

Ratios

This projection technique assumes that the prison population will fluctuate directly in proportion to some segment of society whose change is an indicator of change within the prison population. Indicators often used are the general population or that portion of the population most likely to commit crimes.

Ohio and Wyoming are two states which enjoy success using this technique. The greatest advantage of using ratios is that projections are relatively simple to prepare. They are probably most useful to corrections researchers and administrators as a preliminary predictions to be refined using other information about the system.

Although ratios have the potential to warn of changes in population trends, it is doubtful that changes in the prison population can be explained by fluctuations in one segment of the population. There is also a problem in determining how long a period of time will elaspse before changes in the indicator group will become evident in the prison population.

Linear Regression

Linear regression projects population based on trends in historical data. This

report has already touched on some of the criticisms of this projection technique as they apply to past projections prepared by the Kentucky Bureau of Corrections. Because populations are projected linearly, they cannot predict changes in population trends. Furthermore, they fail to consider the composition of the inmate population in terms of those variables such as sentence length which affect the inmate population.

Linear regression is the most commonly used projection technique. Despite the numerous criticisms which have been leveled at it, most states consider their linear regression projections to be at least fairly reliable. Besides Kentucky, only Indiana rates these projections as being poor. These projections are probably most useful in making short-term predictions for as long as trends remain the same.

Multiple Regression

Multiple regression is used to predict both the prison population as a whole and components of the population. In addition, regression analysis is used to identify those factors which indicate changes in the prison population. Like ratios, multiple regression assumes that the prison population will fluctuate according to changes in predictor factors.

Although multiple regression is a more sophisticated projection technique than either ratios or linear regression, it is subject to many of the same limitations. Since it projects linearly, multiple regression may fail to identify changes in population trends. Due to the lack of data, the predictive variables are often chosen according to convenience rather than validity.

The advantage of multiple regression over either ratios or linear regressions is that they consider a greater number of variables which increases the potential for more valid projections.

Simulation Models

This projection technique attempts to project the future rates of those components of the system which combine to form the prison population. Other projection techniques are used to project future commitments and releases, which are then combined with the current population to arrive at a future population. The system's components are combined using the following formula:

future population = future admissions + current population
- future releases.

Criticisms of this system focus on the attempt to describe a complex system using only a few simplified components. Computerized simulation models such as Florida's Simulated Losses/Admissions Model (SLAM) require a great deal of data not often accessible by the corrections agency. In addition, computerized models require substantially more expense and a greater degree of technical expertise than do less sophisticated techniques.

Advantages of this methodology are that it provides a description of offenders entering the system, and follows them as they progress through each component until they exit the system. Also, the ability to use any type of projection technique to project the future rates of each component allows the individual agency to develop the methodology according to available information and/or the methods which are most valid for the state.

Recommendation

The National Institute of Law Enforcement and Criminal Justice, in its preliminary report to Congress on prison populations, in September of 1977 stated that:

"Prison population is not a natural phenomenon responding solely to the dynamics of past trends. It is subject to social and political influ-

ences, ranging from the availability of community corrections resources
to political pressures on parole boards and state legislators."[5]
It is for this reason that they maintain that any reliable projection of future
inmate populations requires at least some understanding of the individual
corrections system and the policy decisions that may affect it.[6]

With this in mind, I propose that the Kentucky Bureau of Corrections develop
a simulation model to project the future prison population. This methodology
will incorporate knowledge of policies and procedures within the justice system
to project the commitment, incarcerated population, and release components of
this model.

Knowledge about those factors which affect the inmate population, in the form
of key assumptions, will determine the information to be used to project each
component, as well as the method of projection. In reality, all projection
statistics are the consequence of one or a series of assumptions rather than a
statement about the future. The accuracy of the resulting projections depends
on the validity of the assumptions.[7] For example, linear regression projections
assume that historical trends will continue into the future, while multiple
regression projections assume that the prison population will fluctuate accord-
ing to changes in several predictor variables. Projections developed as a result
of combining the future projections of each component allow the utilization of an
optimum number of key assumptions concerning those variables which can produce
the most valid results.

[5]Prison Population and Policy Choices, Volume 1: Preliminary Report to Congress,
National Institute or Law Enforcement and Criminal Justice, LEAA, U.S. Department
of Justice, September, 1977, p. 131

[6]Ibid, p. 139

[7]Ibid, p.132

Commitments

Commitment to a Bureau of Corrections institution will be the entry stage
of this methodology. Commitment is recommended as the entry point because projec-
tions based on entry at an earlier stage, such as at arrest or conviction, would
have to be based on too many subjective assumptions. In addition, the Research
and Evaluation Unit's experiences in these areas indicate that available data
would be unreliable for our use.

There is presently no single most acceptable method of projecting future
commitments. Either linear regression or multiple regression utilizing unemploy-
ment and "population-at-risk" would be best suited for preliminary projection
attempts. This is where the use of key assumptions will be valuable. Based on
anticipated changes in policies and/or procedures, as well as an examination of
existing trends, several assumptions can be formulated about future admissions.
These assumptions can be used to prepare a series of projections, such as "low",
"high", and "most likely" projections of future admissions. Along these same
lines, the assumptions of anticipated changes can be used to determine the impact
that such changes will have on the inmate population.

An inspection of demographic information about those admitted to the system,
especially their sentences should become a routine procedure. Besides providing
insight into sentencing trends, it will serve as an indication of the composition
of the future inmate population as well as a predictor of changes in the expected
time to be served.

Incarcerated Population

Changes in the incarcerated population are not really considered in projecting
the future inmate population. Although the time served by incarcerated inmates
can be used to modify the time served figures obtained from releases, the incar-
cerated population figure is basically the end result of the projection process.

Information pertaining to the incarcerated population, however, is more frequently requested than that for either admissions or releases. The demographic information that will become available concerning current and projected incarcerated populations will be an invaluable data resource.

Releases

Two primary factors will be used to determine releases; the average time served by offenders according to their sentences, and an analysis of Parole Board actions to ascertain the percent who serve to expiration, the percent deferred, and the average length of deferment. A comprehensive examination of a sample of releases over several years must be conducted to determine each of these factors. Once this information is derived, offenders committed to the system can be charted through the system from admission, to parole review, to deferment, to release.

Special Considerations

In addition to the usual factors which can influence population projections in unpredictable ways, such as changes in statutes, policy shifts and political pressures, projections of Kentucky's prison population will have to address several special considerations. First, the previously mentioned consent decree mandates the establishment of maximum capacity levels at the Reformatory and the Penitentiary. A similar mandate in Oklahoma prompted their Department of Corrections to remark that the capacity limit negated their need to project populations. I must disagree with this remark when considering the potential ramifications of such a mandate. To observe this limit, some drastic changes in sentencing, release, and classification policies must be made. The potential increase in the probation and parole caseload may require that we extend our projections to this area.

Also, the opening of the new forensic unit will compound the problems applying to institutional capacity. Admissions and transfers to the new facility may offset current population trends. Key assumptions may be the only means of dealing

with these unforeseen or unpredictable major changes in the corrections setting.

Data Resources

The rapidly improving information systems in Kentucky have developed to the point that the Bureau will soon have access to accurate and current population and offender data. Previous data collection efforts required manipulation of unwieldly hand-maintained records.

The ORION information system currently being developed by Computer Services is the key to this proposed projection model. The vast amounts of demographic information essential to these projections are not available from any other source. Other sources of information which may be used routinely to prepare projection includes the Department for Human Resources, Bureau for Manpower Services, which provides unemployment statistics to the Research and Evaluation Unit on a regular basis. Another source of unemployment statistics is the Kentucky Council of Economic Advisors, who have developed a computer-based econometric model which projects future unemployment rates. Also, the State Data Center of Kentucky, a statewide computer information system, could be especially useful in preparing projections because they provide future projections of both unemployment and general population figures based on U.S. Census data.

Projection Format

Once the projection methodology is fully developed, it will be converted for use on electronic data processing equipment. I suggest that information from ORION, along with past inmate population figures, unemployment and general population data be incorporated into a single computer program using the Statistical Package for the Social Sciences (SPSS) computer language. SPSS is the computer language most familiar to members of the Research and Evaluation Unit, so its use would seem to be the most logical choice. Having all this information available in one centralized data base will enable the user to prepare the projections

easily, with few manual calculations. This should facilitate the ability of the Bureau to project the prison population on a regular basis, as well as making information updates and refinements to projections more convenient.

Testing the Methodology

A limitation involved in adopting this proposed projection model will be the difficulty in testing reliability of the projections. The most common method of testing prediction techniques is to develop projections based on historical data. The projected population estimates are then compared with actual population figures to determine the reliability of the predictions. However, due to the absence of easily acquired historical data, this prior testing is virtually impossible. The only recourse available is to prepare the actual future projections, evaluating the results and modifying the model as the reliability of the projections become apparent.

Summary

The proposed technique meets the objectives which have been set for a projection technique. It will require no information, facility, or personnel resources not already available or being developed. It has the capability to incorporate those variables into the projection which may forecast changes in population trends. It is flexible enough to be prepared using assumptions about real or proposed conditions in relation to commitments or releases, and can be refined as new or better methodologies become available. The projections will be simple to prepare and replicate, using information converted to a computer program. Finally, the use of more sophisticated information and projection methods should result in much more reliable projections than have been available in the past.

From a practical standpoint, the implementation of the projection model will require a substantial expenditure of time and energy to convert the various data

resources into a form which corresponds to the model's requirements. Cooperation with the Computer Services section is essential to the success of this project, due to the vast amount of programmer assistance which will be needed to draw out specific variables in the form needed for the model from the broad base of information contained in ORION.

The adoption of a simulation model to project the inmate population will provide a statistical technique to replicate the movement of offenders through the corrections system. Hopefully, this technique will provide not only more reliable projections, but also an improved information resource capable of providing information consistent with needs within the Bureau.

TABLE I

A COMPARISON OF PROJECTED PRISON POPULATIONS*
TO ACTUAL POPULATION FIGURES

MONTH	PROJECTED POPULATION	ACTUAL POPULATION	ERROR IN PROJECTION	% ERROR IN PROJECTION
May, 1978	3,676	3,454	222	6.4
June	3,678	3,414	264	7.7
July	3,680	3,363	317	9.4
August	3,683	3,355	328	9.8
September	3,685	3,278	407	12.4
October	3,687	3,363	324	9.6
November	3,690	3,389	301	8.9
December	3,692	3,390	302	8.9
January, 1979	3,694	3.416	278	8.1
February	3,697	3,488	209	6.0
March	3,699	3,482	217	6.2
April	3,701	3,526	175	5.0
May	3,704	3,540	164	4.6
June	3,707	3,555	152	4.3
July	3,708	3,583	125	3.5
August	3,711	3,602	109	3.0
September	3,713	3,611	102	2.8
October	3,715	3,663	52	1.4
November	3,718	3,712	6	.2
December	3,720	3,692	28	.8
January, 1980	3,722	3,730	-8	-.2
February	3,725	3,775	-50	-1.3
March	3,727	3,833	-106	-2.7
April	3,729	3,824	-95	-2.5

*Prepared using a linear regression of the monthly population figures of the previous two years.

END