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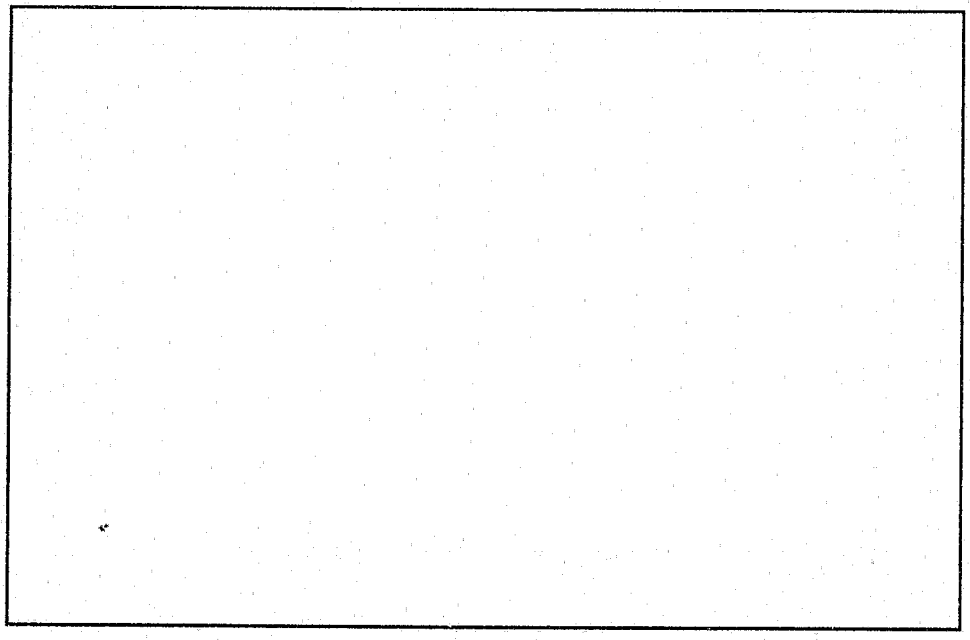

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# EVALUATION OF PROBATION/PAROLE SCHEDULING VIA SIMULATION

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# EVALUATION OF PROBATION/PAROLE SCHEDULING VIA SIMULATION

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## ABSTRACT

A simulation model of the operations of a proposed change in the frequency-of-contact rules for Hennepin County (Minnesota) was developed. In the proposed rules, a subset of criminal offenders is required to meet face-to-face with corrections officers at specified intervals. We report on the modeling activities and challenges, the experiments carried out, the results of the study, and public-policy implications.

## 1 INTRODUCTION

In 1991, Hennepin County (which includes the city of Minneapolis and many of its suburbs) represented 24% of the state's population, but 52% of the state's reported violent crimes and 34% of the state's reported property crimes. Public concern over crime and the manner in which the criminal justice system deals with convicted offenders is widespread. This concern is heightened whenever a convicted offender on probation or parole is arrested for a new offense.

Past philosophical notions of sentences shaped to each offender's particular circumstances or needs have come into conflict with the philosophy of *just deserts*, under which individual differences are largely ignored; offenders convicted of the same offense with the same prior criminal record are expected to receive identical sentences. At the same time, the number of new offenders has not abated. Agencies responsible for supervising offenders, such as Hennepin County's Bureau of Community Corrections, have had to deal with the increased numbers and the changing philosophies of punishment.

The Bureau, through its division of Adult Corrections, supervises adult offenders placed on probation by the courts as well as offenders paroled from prison. Typically, 4,000 to 5,000 adult offenders are under direct supervision, and this number has approximately doubled since 1988. Moreover, the number of probation and parole officers available to supervise offenders is fixed, currently at 66. Due to the increased volume of offenders, Bureau management was forced to reevaluate standards regarding which offenders should be directly supervised, and for how long. Other motivations for changing the contact standards stemmed from criminological considerations.

Management thus formulated a proposal for new contact standards. Trial implementation of the new standards was not possible due to the risk of inordinately increasing officers' workloads and creating conflicts in the contact schedules, either of which could result in chaos in a system that simply cannot be allowed to fail, even for a short while.

The proposed standards incorporated two key elements:

1. Probation/parole officers would directly supervise only the most serious offenders for a 24-month period. Serious offenders are determined from a matrix combining the conviction offense with the offender's prior criminal history. This contrasts sharply with current practice where officers supervise *all* types of offenders, from shoplifters to those convicted of criminal sexual conduct, and for periods that may exceed 24 months.

2. The intensity of supervision would be precisely designed to be more frequent at the beginning of the 24-month period (e.g., every week) and decline over time to, say, once a month (provided that the offender has no new convictions). The contact standards may be tighter for person offenders (e.g., sexual assault). This also differs greatly from current practice, where officers have nearly complete discretion over how often they meet with offenders on their caseload.

Since the number of offenders placed on probation or parole is not controlled by the Bureau, and since

the inflow rates have increased steadily, the current practice of directly supervising *all* types of offenders for their *entire* term is no longer workable. A major reason for this is the professional judgement that an officer's caseload should never exceed about 75 cases at any time, a threshold that is threatened by the increasing load on the system regardless of the effect of the new contact standards.

Thus, it is in the interest of all parties to have a general, flexible, and reliable tool to predict the impact on system performance (including caseload figures as well as other measures like failure to schedule an appointment) of changes in contact standards or inflow rates. Additional issues of direct interest to the Bureau include:

- The number and type of offenders who could be directly supervised by hiring additional officers with particular attributes.
- Degradation in the number and type of offenders who could be handled if the inflow of serious offenders were to accelerate rapidly.
- The effect of altering the length of each appointment (or, equivalently, the number of appointments an officer could handle per day).
- The implication of changing the number of required direct-supervision contacts, perhaps for certain categories of offenders.
- The impact of offenders who pick up a new conviction during the 24 months and who, depending on the situation, may either restart the contact period or leave the system (typically back to prison in the case of parolees).
- Identify other congestion points in the system and opportunities for savings and efficiencies.

Simulation models have been applied to court processing (see, for example, McAllister, Atchison, and Jacobs 1991), but we are unaware of any applications to corrections.

Sections 2 and 3 describe the system and our model of it, and experimental results to date are presented in Section 4. Conclusions and public-policy issues are discussed in Section 5, and we briefly indicate our plans for future work in Section 6.

## 2 OPERATIONAL DESCRIPTION

This section is intended to give a brief description of the proposed operation of the Hennepin County probation/parole system. While there are many more details than we can describe here, this should serve to indicate, at least roughly, the facility and policy studied.

Offenders arrive from three sources: probationers from the Courts, parolees from prison, and probationers from the county workhouse known as the Adult Correctional Facility (we have capability for a fourth source, inpatient treatment centers, but currently have deactivated this source from the model due to incompleteness of historical data). Depending on attributes like source, nature of offense (e.g., felony vs. misdemeanor, sex offense or not, etc.), an offender is given a particular schedule for face-to-face contacts over the course of two years (one year for misdemeanants); the maximum frequency of contact is once a week. Typically, contact is frequent at the beginning of the period (like every week), and then becomes less frequent as time goes by.

An offender is assigned to a particular officer upon arrival, and remains with this officer while in the system. Again, depending on attributes of the offender or offense, officer assignment can be restricted. For instance, parolees can only be assigned to parole officers (a subset of the staff) and probationers are only assigned to probation officers. Another example is that female parolees can only be assigned to certain officers. As described in Section 3, assignment to officers within these constraints is done in an attempt to balance the workload.

While the proposed system is not operational at the moment, we have made some assumptions about what will happen if an offender is not able to see his/her officer on the scheduled day; this can happen since an officer has only a fixed number of appointment slots in a day. If the officer has an open slot on either the day before or the day after the desired day, we deem this as acceptable, schedule the appointment, and go on. If not, though, the offender would report on his/her appointed day and fill out some forms in lieu of the face-to-face contact. If this happens for an offender's *first* visit, we call this a *pink slip* and regard it as a serious failure of the system; if it happens on a subsequent visit we call it a *blue slip*, which is still undesirable but probably not as serious as a pink slip.

One final issue to note is that an offender might be convicted of a new offense over the course of the two years in the system, an eventuality we have called a *failure*. Depending on the nature of the new conviction, the offender may go back and restart the two-year period (thus staying in the system), or may leave the system (typically back to prison in the case of parolees). Historical data on new convictions for offenders in Hennepin County were not readily avail-

Table 1: Initial Number-in-System Distributions

| Source | Distribution |
|---|---|
| Court | Discrete uniform(3093, 3347) |
| Prison | Discrete uniform(454, 801) |
| Workhouse | Discrete uniform(325, 364) |

Table 2: Interarrival-Time Distributions

| Source | Distribution |
|---|---|
| Court | Exponential(mean = 0.205 day) |
| Prison | Exponential(mean = 0.494 day) |
| Workhouse | Exponential(mean = 0.295 day) |

able; thus, we made educated guesses using a variety of state and national studies of recidivism to model the probabilities of failure and, given failure, the conditional probabilities of restarting or leaving.

## 3 THE SIMULATION MODEL

In this section, we describe our simulation model. We start with the initial conditions, and then describe the events in this simulation. Finally, we discuss our performance measures.

The current state of the system in terms of officer caseload was used as the initial condition for the simulation. Using the existing information (collected over a period of one year), we decided to load the system with a random number of offenders (of each type) using the probability distributions in Table 1.

The event structure consists of three basic events: arrival to the facility, end of appointment with an officer, and end of simulation. The arrival event is differentiated by the source of arrival. As described earlier, there are two types of arrivals to the system, from external sources (inflows) and from internal sources (from within the system). The interarrival times are described by the distributional forms in Table 2.

In the arrival event for each inflow, an arrival is assigned an appropriate officer based on the type of the arrival. If the offender arriving is new to the system, officer assignment is done by searching for an officer with the Least Work Remaining (LWR) in the class of assignable officers; ties are broken in favor of the first. "Work" is calculated as the total number of visits an arrival is scheduled to have in the duration of his/her stay in the system. If the arrival is reentering the system (for example, a person fails to complete his/her expected stay in the system, and may rejoin the system with some probability that depends on the offender's type) then, on reentry he/she is assigned the same officer as before, even if the officer does not have the LWR. After officer assignment, caseload and workload statistics for the officer are updated, and the next arrival event of the same type is scheduled.

Table 3: Attributes for the Event-List Records

| Attrib. | Possible values | Description |
|---|---|---|
| 1 | Positive real | Event time |
| 2 | | Event type |
| | 1,2,3 | Arrival |
| | 5 | End of appointment |
| | 6 | End of simulation |
| 3 | | Type of arrival |
| | 1 | Court |
| | 2 | Prison |
| | 3 | Workhouse |
| 4 | 1 | Male |
| | 2 | Female |
| 5 | 1 | Sex offender |
| | 2 | Not sex offender |
| 6 | 1–length of stay | Appointment number |
| 7 | 1–66 | Assigned officer |
| 8 | 1–104 | Time of failure |
| 9 | 1 | Will fail |
| | 2 | Will not fail |
| 10 | 1 | Misdemeanant |
| | 2 | Not Misdemeanant |

In the end-appointment event, a person either makes the next appointment according to schedule with the assigned officer, or, if this is the last visit, leaves the system; it is also at this point that the person might "fail" and in this case either rejoin the system or leave. Depending on the outcome, appropriate officer statistics are updated.

The last event is the end of the simulation; the simulation run length is six years for our experiments reported in Section 4.

The event list is used to store essential information regarding each offender, like the assigned officer, the week of the offender's most recent visit, etc. Each entry in the event list has 10 such attributes, described in Table 3.

The appointment schedule for each type of offender is stored in an array of length equal to the longest required stay in the system (which is 104 weeks at present). Each cell of this array represents a week in the offender's schedule. The week of the offender's visit with the assigned officer is represented by a one in the corresponding cell, and by a zero otherwise. This facilitates searching an offender's schedule for

the next appointment.

As mentioned before, the simulation was run for a period of six simulated years, and was replicated three times. Each run was expensive, and the three replications provided reasonably small standard errors of the desired estimates. We coded in FORTRAN, augmented by a modification of the SIMLIB utility routines from Law and Kelton (1991), and used CRAY-2 and CRAY X-MP supercomputers to run our simulations; the code is currently about 2,100 lines long. It took approximately 40 CPU-minutes for three replications of six simulated years each.

There were three primary measures of system performance:

- The time-average caseload per officer, as well as the maximum and minimum caseload.
- The number of "pink slips" (see Section 2) and their proportion of the total number of attempts to make initial appointments.
- The number of "blue slips" (see Section 2) and their proportion of the total number of attempts to make appointments.

We developed confidence in the model's validity and verified the code by exploring extreme regions of the input-parameter space as well as noting that the "base case," representing current parole practice as closely as possible, yielded performance results that agree very well with recent observation on the parole system's operation.

## 4 RESULTS

Based on the Bureau's most pressing questions, our initial experimentation considered three scenarios:

**Scenario 6:** This is the base case, setting all inflow rates, failure probabilities, etc., to values estimated directly from historical data. The "6" indicates that we assumed that each officer would be able to do six 45-minute face-to-face contact periods each day.

**Scenario 5:** This is the same as Scenario 6, except that the number of contact periods was reduced to five per day. It was felt that six periods per day might be unrealistic in view of officers' other responsibilities.

**Scenario 5S:** This is the same as Scenario 5, except that all sex offenders were required to come in every week for the entire first year of their sentence, representing a marked increase in contact intensity over the other two scenarios. We ran this scenario partly in response to public-policy considerations, as well as to experiment with how the model would react to this sort of stress.

Table 4: Caseloads for Scenario 6

| Officers | Avg. | Std. Dev. | Max. |
|---|---|---|---|
| All | 71.39 | 5.54 | 103 |
| Probation | 74.68 | 6.65 | 103 |
| Parole | 58.03 | 1.02 | 75 |

Table 5: Caseloads for Scenario 5

| Officers | Avg. | Std. Dev. | Max. |
|---|---|---|---|
| All | 71.81 | 5.50 | 106 |
| Probation | 75.09 | 6.67 | 106 |
| Parole | 58.44 | 0.72 | 79 |

Table 6: Caseloads for Scenario 5S

| Officers | Avg. | Std. Dev. | Max. |
|---|---|---|---|
| All | 71.81 | 5.50 | 101 |
| Probation | 75.09 | 6.67 | 101 |
| Parole | 58.44 | 0.72 | 82 |

We used common random numbers across all scenarios.

Tables 4–6 give results for officers' caseloads under the three scenarios. The first column indicates the range of officers over which the statistics in the later columns are taken: all 66 officers, the 53 probation officers, and the 13 parole officers. The average and standard deviations shown are averages over the three replications and the officers in each class, while the maxima are taken over all replications and officers in each class. These tables illustrate several points:

- The limit of 75 for officers' caseloads is severely pressured, especially for probation officers, and for all officers if the *maximum* caseload (rather than just the average) must stay below 75.
- There is very little caseload difference across the scenarios. This is because offenders *will* arrive and *will* be assigned to caseloads regardless of the number of appointments per day or frequency of contact. (As seen below, though, the scenario has a major impact on the pink-slip and blue-slip performance.)
- It appears that probation officers' caseloads are heavier and more variable than those of parole

Table 7: Percentages of Pink and Blue Slips

| Scenario | Pink Slips | Blue Slips |
|---|---|---|
| 6 | 0.08% | 5.02% |
| 5 | 1.50% | 16.69% |
| 5S | 1.57% | 20.70% |

officers. This is a function of the inflow rates of different types of offenders, as well as the number of officers of each type (recall that probationers are only assigned to probation officers, and parolees are only assigned to parole officers). A possible conclusion is that, if allowed, parole officers might be assigned some probationers to even out the load; on the other hand, it might be argued that parolees are inherently more difficult than probationers, so the differential in caseload statistics could be justified.

- The variability of the results appears to be quite low in comparison with the magnitudes, allowing us to get away with so few replications.

Our other performance measures, pink slips and blue slips, are summarized in Table 7; the values in the table are the number of slips issued as percentages out of the expected total number of appointments attempted. The effect of the scenario here is clear:

- Reducing the number of appointments from 6 to 5 per day dramatically increased the frequency of both kinds of slips. This is to be expected, since officers' appointment slots decreased by 1/6.
- Increasing the intensity of supervision for sex offenders further increased blue-slip frequency, but did not have much effect on pink-slip frequency. This is explained since sex offenders *still* arrive and face basically the same one-time pink-slip risk, but their increased supervision intensity exposes them to much higher blue-slip risk in the latter part of their first year of supervision.

Whether these levels of failure to meet face-to-face with an officer represent unacceptability is a matter for Bureau management to decide, but the simulation clearly indicates and quantifies the consequences of altering officer availability and intensifying some kinds of supervision.

## 5 CONCLUSIONS AND IMPLICATIONS FOR PUBLIC POLICY

The results of the simulation study have already stimulated and revised thinking about the proposed contact rules. Given the *average* caseload for probation was 75, management decided to implement new contact rules effective April 1, 1993. The new rules will directly affect probation and parole officers' caseload sizes and the manner in which they work. The simulation study will also greatly aid the Bureau in allocating its human resources more efficiently, both now and in the future. Given the state's concentration of crime in Hennepin County, the implications for corrections and public safety are clear.

Further, the simulation allows explicit communication of how human resources are being allocated to other relevant groups, such as the courts and the state legislature. For example, if the legislature mandates that all sex offenders be seen every week for two years, the simulation will illustrate who else would *not* be directly supervised as a result, given existing staff. Other divisions of Community Corrections could also benefit from simulation modeling (Juvenile Corrections has a similar caseload problem). Prior to implementing major new policies, a simulation will permit the Bureau to analyze their impact and avoid potential overloads and thus a breakdown of the system.

Once the new standards are implemented it will also be easier to address the issue of whether closer supervision of the most serious offenders results in lower recidivism rates. It is difficult to address this issue now since officers have discretion over which offenders they directly supervise.

## 6 FUTURE WORK

We have plans to extend our work with these kinds of models and simulations in several directions:

- Further experimentation with the existing model to identify which of the many input parameters are most critical for system performance.
- Generalize the model for more flexible and realistic appointment scheduling.
- Streamline the code so that it can be turned over to the Bureau for direct, hands-on use.
- Extend this modeling and simulation approach to related arenas, such as Juvenile Corrections and the courts.

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## AUTHOR BIOGRAPHIES

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