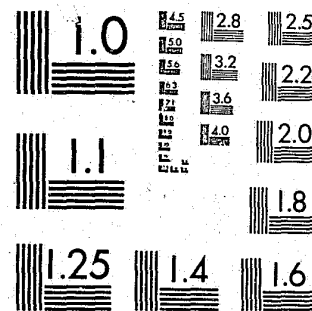


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**ILLINOIS
CRIMINAL JUSTICE
INFORMATION AUTHORITY**

**Research
Bulletin**

Number 2 - April 1986

The Pace of Recidivism in Illinois

SURVIVAL ANALYSIS: NCJRS AN OVERVIEW

Survival analysis is a methodology that has been developed and applied mainly in medical and engineering research. It analyzes rates over time in which "terminal events" or "failures" occur for a given population or group. Survival analysis has been used, for instance, to assess the rates over time in which cancer symptoms appear for a group of patients and to compare the rates across subgroups of patients receiving different treatments. The technique also has been used to assess "product life" or to compare rates at which different instruments break down in field settings.

Within the last decade, survival analysis has been used increasingly outside the fields of medicine and engineering. In criminal justice, for instance, it has proved valuable in assessing recidivism rates. If you consider the cancer treatment example above, the logic becomes clear. With recidivism, the observation period begins with each inmate's release from prison. The occurrence of recidivism--whether it be an arrest, conviction, or incarceration--marks the onset of "symptoms," or the failure. In effect, the three definitions of recidivism represent various levels in the severity of recidivistic activity. So just as a medical researcher develops different measures of success or failure based on different criteria used to define a symptom, the criminal justice researcher must choose the definition of recidivism that is most appropriate for answering the questions of his study.

Survival analysis provides many advantages over a "fixed interval observation," the methodology most often applied in recidivism studies. This method measures simply the proportion of a sample who recidivate by the end of a given period, typically a year. This traditional approach might reveal that 30 percent of the sample

Most studies of recidivism measure only the percentage of former offenders who return to crime by the end of a specified follow-up period (for example, a year). What these studies fail to account for is what the rate of recidivism was across that period. Did most repeat offenders recidivate during one part of the follow-up period, or did they recidivate at an even pace throughout the period? Are there specific and identifiable "critical periods" in which offenders, or certain types of offenders, are likely to recidivate? Are some subgroups within a sample of offenders more likely to recidivate sooner than other subgroups?

To help answer these and other questions about the pace of recidivism in Illinois, the Illinois Criminal Justice Information Authority decided to analyze repeat offenders using a methodology called "survival analysis." This bulletin employs this technique to examine the rate at which former inmates "survive" following their release from State prison--that is, the rate at which they do not recidivate for each month following release. By plotting these survival rates (and corresponding "failure" rates) throughout the follow-up period, we can uncover not only how many former prison inmates are apt to recidivate by the end of the period, but also the pace at which they are likely to recidivate during that period.

This bulletin is the second in a series of reports from the Authority's Repeat Offender Project (ROP), a multifaceted study of recidivism among a group of former inmates released from Illinois prisons during a three-month period of 1983. The first ROP bulletin, released in November 1985, analyzed the criminal activity of the inmate sample during the first 18 to 20 months following their release. The first report also discussed survival analysis briefly and presented some relevant findings. This bulletin uses survival analysis to examine a wider scope of issues, including a comparison of recidivism rates among various subgroups of the ROP sample. In addition, the survival analyses presented in this bulletin are based on the most recent arrest and incarceration data available (27 to 29 months following release).

The ROP Sample

The Repeat Offender Project is tracking the criminal activity of a cohort of 769 inmates who were released from custody of the Illinois Department of Corrections (IDOC) between April 1, 1983 and June 30, 1983. This time period provided a three-month "window" of varying release dates. The ROP sample also contains inmates who received a variety of release types, including parole, other types of conditional release, and unconditional release.

So far, analysis has been limited to 539 of the 769 releasees in the full ROP sample. Excluded have been 230 releasees who were previously on parole but received their final discharge status during the three months when the sample was drawn. These releasees were excluded because, theoretically, they could have already been in the community and committing crimes before their official discharge and inclusion in the ROP sample. A subsequent ROP report will analyze the criminal activity of this subgroup.

In addition, the composition of the ROP sample probably was affected by two criminal justice policies that were in place when the sample was drawn: the IDOC's "forced-release" program and the admission of misdemeanants in the general prison population.

The forced-release program was in effect from June 1980 until July 12, 1983, when the Illinois

Supreme Court struck down the practice. Under the program, the director of corrections could award to selected inmates (usually non-violent, property offenders) additional increments of good time on top of their regular statutory good-time credits. This practice allowed many offenders to be released from prison sooner and at a faster rate than prior or current correctional policies would permit. Consequently, more inmates were released during the time the policy was in effect, and some offenders who would not have been released under normal conditions of their sentences were set free during this period.

The other policy involved the detention of misdemeanants in State prisons. Before July 1983, persons convicted of misdemeanors in Illinois could be sentenced to the IDOC. After that date, however, State law was changed, and misdemeanants were no longer admitted to State prisons. Thus, if the ROP sample were drawn today, it would not include any misdemeanants, but would probably contain many more serious offenders than the 1983 sample.

It is difficult to assess precisely how these and other criminal justice policies affected the makeup of the ROP sample and the findings from the study. While these two policies represent pertinent issues to keep in mind, it is important to remember that there will always be historical events within the criminal justice system that affect the composition of both the prison population and the population of releasees.

Survival analysis is also a more practical approach for several reasons. First, the technique affords certain sampling advantages over the fixed observation method. As the ROP study has shown, individuals in a sample often are not all exposed to the risk of recidivism for the same period of time. While fixed interval methods do not control for different exposure times, survival analysis does. (This feature is discussed further in this bulletin.)

Second, survival analysis is well suited for comparing two different samples or different subgroups within the same sample. The benefits of precision and specificity are especially salient in these comparisons. For instance, the fixed interval method may reveal that an equal portion of two subgroups (for example, younger vs. older releasees) were arrested after two years. However, survival analysis could reveal that the rate of arrest of one subgroup was considerably higher during the first several months following

Data Sources and Definitions

The Computerized Criminal History (CCH) system, maintained by the Illinois Department of State Police (DSP), is the source of reported criminal history record information used in the Repeat Offender Project. The CCH transcript (or "rap sheet") is meant to be a cumulative record of an individual's activities within the Illinois criminal justice system. The rap sheet also contains identification information, such as the offender's race, sex, date of birth, physical characteristics, and fingerprint classification.

The Authority tracked the criminal activity of the 539 releasees in the ROP sample by periodically asking the DSP to search through the CCH database for additions to the offenders' rap sheets. Because the study depends solely on the CCH system for individual criminal records, only those events reported to the DSP could be analyzed.

For survival analysis, the ROP study uses two definitions of recidivism:

- Arrest after release, which refers to the first arrest recorded on the CCH system after the date

release from prison than the arrest rate of the other subgroup.

DEFINING AND MEASURING RECIDIVISM

Applying Recidivism Definitions for Survival Analysis

Generally, recidivism refers to the recurrence of criminal behavior following a given event, usually a correctional event such as release from prison. The length of time before an individual recidivates depends on both the starting event and the terminal event, or how recidivism is defined. Recidivism has been defined in various ways. The event that initiates the follow-up period, for instance, may be a release from prison, the onset of a probation term, or the completion of a community treatment program. Likewise, the event that defines the recurrence of criminal behavior may be an arrest, conviction, or incarceration that occurs during a specified follow-up period.

The events that define the "survival time" depend largely on the purpose of the study and the available data. For example, if a study is evaluating

the offender was released from prison; and

- Incarceration after release, which includes the first CCH-recorded incarceration in State prison occurring after the base prison release date. (This definition of recidivism requires special considerations when using survival analysis; these considerations are explained in the text.)

Another possible definition of recidivism, conviction after release, was not used because past audits of the CCH system have indicated that approximately 50 percent of the arrest events on the system lack final dispositions. This missing disposition information made convictions recorded on the CCH system an unreliable measure of recidivism.

It is important to use both measures--arrest and incarceration--when examining recidivism in Illinois. Each definition yields different results, and each set of results has unique policy implications for different criminal justice officials. For example, arrest as a measure of recidivism has implications for law enforcement and court personnel. Recidivism as measured by incarceration affects the decisions of State correctional planners.

how well probationers perform, it may consider every violation of probation conditions or every arrest during probation as an act of recidivism--a "failure." However, if the study is trying to determine what effect the probationers' recidivism has on prison population, the terminal event would be more narrowly defined as "return to prison." Of course, any approach is feasible only to the extent that an accurate, reliable, and complete source of data is available.

For the ROP study, recidivistic activity was defined both in terms of arrests and incarcerations in State prison that occurred during the specified follow-up period and were recorded on the Statewide Computerized Criminal History (CCH) system.¹ Analysis of recidivism based on conviction was impossible because of the extent of missing conviction information on the CCH system. Therefore, the ROP analysis includes two in-

¹ CCH system records contain felony and serious misdemeanor arrests that local law enforcement agencies report to the Department of State Police (DSP). These records do not necessarily contain all the arrests for an individual, since less serious arrests are excluded and because the DSP may experience delays in receiving or posting information to the CCH system. Incarcerations in the ROP study are limited to commitments to the Illinois Department of Corrections (IDOC) facilities. Commitments to local jails or Federal facilities do not routinely appear on the CCH system and were excluded from the study.

dependent survival analyses based on the two definitions of recidivism.

Measuring Recidivism Using Survival Analysis

The survival analysis for recidivism based on arrest defines the survival time for each of the 539 cases according to two possible outcomes:

- For cases that experienced a recorded CCH arrest during the follow-up period, the survival time was equal to the number of days between the date of release from prison and the date of the first CCH arrest. These cases become "failures" and are no longer considered as surviving past this point. The first arrest, then, is the "terminal event" that marks the end of survival time and, by definition, renders the individual no longer at risk.

- For cases that did not experience a recorded CCH arrest, the survival time was equal to the number of days between that individual's release date and August 28, 1985, the end of the follow-up period. These cases are defined as "censored observations" and are considered as surviving only as long as they were exposed to risk. (This concept is explained more fully later in the bulletin.)

For the survival analysis based on incarceration, the survival time was defined similarly, except that the "terminal" event was defined as the first recorded CCH incarceration, rather than the first arrest. Cases that did not experience an incarceration in the follow-up period were considered as surviving for the entire time the individual was at risk, based on the same censored observation technique.

The daily survival times were collapsed into monthly (30-day) survival periods. (Such monthly intervals are consistently used in recidivism research.) Thus, cases that had experienced an arrest or incarceration between 1 and 30 days following release were considered terminal events in the first month, between 31 and 60 days in the second month, and so forth.

For recidivism defined by incarceration, note that not all incarcerations were preceded by an arrest. There were a few incidents where arrest information was missing for an incarcerated person or where the individual was incarcerated for a technical violation of conditional release.

Controlling for "Censored Observations"

Incorporating "censored observations" into survival analysis controls for the possibility that cer-

tain cases may withdraw, or cease to be exposed to risk, for reasons other than terminal events. In medical research, for instance, if a cancer patient died by accidental causes before the onset of cancer-related symptoms, the individual should be considered as surviving up to that point. The individual would no longer be considered as "surviving," yet it would be inaccurate to count the case as a terminal event. Survival analysis statistically controls for such occurrences by treating them as withdrawing, but not terminating, from the sample at the point where they can no longer be considered at risk.

As in the medical example above, individuals in the ROP sample also may have "withdrawn" from the sample before terminating. It is likely that certain individuals, either through death or other events (such as an individual no longer residing in the State), were no longer at risk of being arrested or incarcerated. Unfortunately, reliable data were not available to determine these cases.

Censored observations were relevant in the ROP because of the three-month window of release dates used in selecting the sample. Given this three-month window and the fixed end date of August 28, 1985, actual exposure/survival time for those cases that survived the entire follow-up period without arrest or incarceration ranged between 27 and 29 months.

To give each surviving person credit for only that amount of time he or she was exposed to arrest or incarceration, cases were treated as censored observations at the appropriate monthly interval. An individual released in the last month of the window (June 1983) who remained unarrested for the entire follow-up period was considered as withdrawing in the 27th month following release. The survival rate and other measures were adjusted in the last three intervals to account for these censored observations. This technique ensures that individuals who withdrew from risk in a given interval were no longer considered at risk (that is, surviving) beyond that interval. (See the explanatory box for a more specific discussion of how censored observations affect various ROP calculations.)

Recidivism Rates and Measures

The remainder of this bulletin focuses on determining the rate at which the sample recidivated, both by arrest and incarceration, and on comparing recidivism rates across various subgroups of the sample. The rate of recidivism plots the proportion of the sample yet to be arrested or incarcerated at the end of each monthly interval. That

is, the rate represents the proportion "surviving" across successive monthly intervals of the follow-up period.

Another measure used in survival analysis is the hazard rate. The hazard rate measures the likelihood that an individual who survived to the beginning of an interval would terminate during that interval. For the ROP analyses, the hazard rate measures the proportion of the at-risk population (those who previously have not been censored or terminated) who failed sometime during a given interval.

PATTERNS OF RECIDIVISM FOR THE ROP SAMPLE

During the 27- to 29-month period following release, approximately 60 percent of the 539 prison releasees in the ROP sample were arrested, while approximately 42 percent of the sample were incarcerated either for a new offense or a violation of conditional release.² The fixed interval method would have yielded only the proportion "surviving" at the end of the entire follow-up period, not the proportion surviving at each monthly interval. By specifying monthly survival rates across the follow-up period, survival analysis produces more detailed and revealing findings.

As Figure 1 shows, the survival curve for arrest recidivism indicates that the rate was not constant across the 27- to 29-month follow-up period. Generally, the decrease in the proportion of releasees "surviving" (indicated by the slope of the survival curve) during each interval was greatest during the earlier intervals. These findings confirm what the previous ROP analysis (based on an 18- to 20-month follow-up) found: the "critical period" for arrest occurs in the first nine months following release, and the rate of arrest recidivism levels off after that time. The current analysis shows this leveling trend persists across the extended follow-up period.³

² In this analysis, no distinction was made between releasees who were returned to prison for violations of conditional release and those who were sentenced to prison for a new offense. A subsequent ROP publication will address this issue.

³ The arrest survival curve presented in the first ROP bulletin differs slightly from the comparable period of the present analysis (the first 20 months). The results differ because the present analysis included some arrests that had occurred in the 18- to 20-month period following arrest, but that had not been posted to the CCH system when the data were collected for the previous analysis. The present analysis indicates that 56 percent of the sample were arrested after 20 months, whereas the previous analysis indicated that 48 percent were arrested in the 18- to 20-month follow-up period. However, some of the dif-

The survival curve for recidivism defined by incarceration reveals a markedly different pattern from the arrest curve (see Figure 1). The "critical period," the intervals in which the rate of incarceration is highest, ranged roughly between the 6th and 18th month after release. These findings also reflect those of the previous analysis.⁴

When the survival plots for both definitions of recidivism are compared, the critical period for incarceration trails behind the critical period for arrest. This pattern probably results from the time it takes to process arrestees in those cases that result in incarceration. Whether the releasee was returned to prison for a new offense or for a violation of conditional release, the time between the arrest, prosecution, and court processing (or conditional release review proceedings) delays actual confinement in prison.⁵

Figures 2 and 3 plot the hazard rates for both definitions of recidivism. The hazard rate is presented in two ways for each definition of recidivism. The jagged plot line indicates the monthly hazard rate in each interval. A line segment fit (based on spline regression analysis) is superimposed on the raw data to reveal patterns more clearly.⁶

ference may be accounted for by the fact that certain individuals in the initial analysis were exposed for only 18 or 19 months at the time of the previous analysis (censored observations), but were arrested in the 19th or 20th interval and were included in the present analysis. It would also be expected that the later intervals in the present (27- to 29-month) survival analysis were subject to the effects of the data lag. The actual survival rate might have been slightly lower if the analysis had included such missing (or delayed) information.

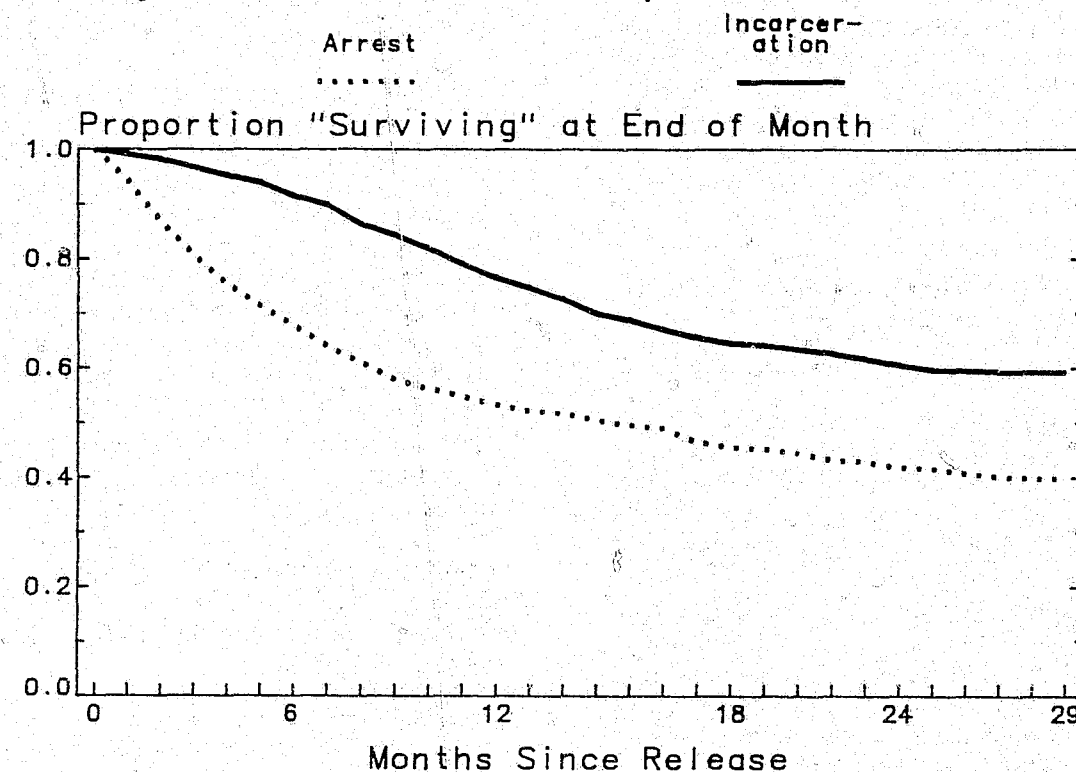
⁴ Again, the survival curve for incarceration in the previous 18- to 20-month analysis does not exactly mirror the comparable (20-month) period presented in this analysis. This analysis indicates that 37 percent of the sample were incarcerated 20 months after release, whereas the previous bulletin showed that 33 percent were incarcerated in the 18- to 20-month follow-up period. This difference results principally from a lag in posting information to the CCH system.

⁵ For purposes of the ROP analysis, the focus is on the length of time that elapsed between release and return to prison. The length of time it took a releasee to return to prison was determined by two events: (1) the length of time that transpired before a releasee was arrested (or a violation of a conditional release was filed), and (2) the criminal justice processing time between arrest and return to prison. However, if the focus of the research had been concerned only with the behavior of the releasees, the date of the arrest (or violation) which led to incarceration could have been used to define the survival time. This factor would eliminate the effects of processing time.

⁶ For a more specific discussion of spline regression analysis see, for example, Block and Miller (1982).

Recidivism Rates Based on Arrest and Incarceration Reveal Different Patterns

Figure 1: Recidivism Rates Defined by Arrest and Incarceration



These hazard rates underscore the information contained in the survival plots. Those intervals in which the hazard rate is high correspond to those intervals in which there are steep drops in the proportion of releasees surviving on the survival curve.

The plot of the hazard rate for recidivism defined by arrest reveals that the releasee's risk of arrest generally declined across time. Although the data plot fluctuates, the underlying pattern reveals that the longer an individual survives, the less likely that individual is to be arrested in subsequent intervals.

In this sense, the ROP sample parallels recidivism patterns revealed in other studies. As a whole, these studies suggest that the surviving portion of the sample will experience a continually diminishing risk of arrest over time. For instance, a 1977 analysis found this pattern existed for a cohort of Federal prison parolees tracked over an 18-year period.⁷ A 1984 study of IDOC parolees revealed

⁷ See Howard Kitchner, Annesley K. Schmidt, and Daniel Glaser, "How Persistent Is Post-Prison Success?" *Federal Probation*, 41, 9-15.

the same phenomena, although the follow-up period--22 months--was considerably shorter.⁸

The hazard rate for recidivism defined by incarceration indicates that the period in which the rate of return to prison is highest falls between the 6th and 18th month following release. The rate was initially low over the first several months, varied roughly between 2 percent and 4 percent for several months, and then generally diminished. Since our definition of survival time for recidivism based on incarceration is unique because it is affected by criminal justice processing time, there is little basis for comparing our findings with other studies. However, a comparison of the areas of highest risk for arrest recidivism with those for incarceration recidivism again reveals the lag caused by criminal justice processing time.

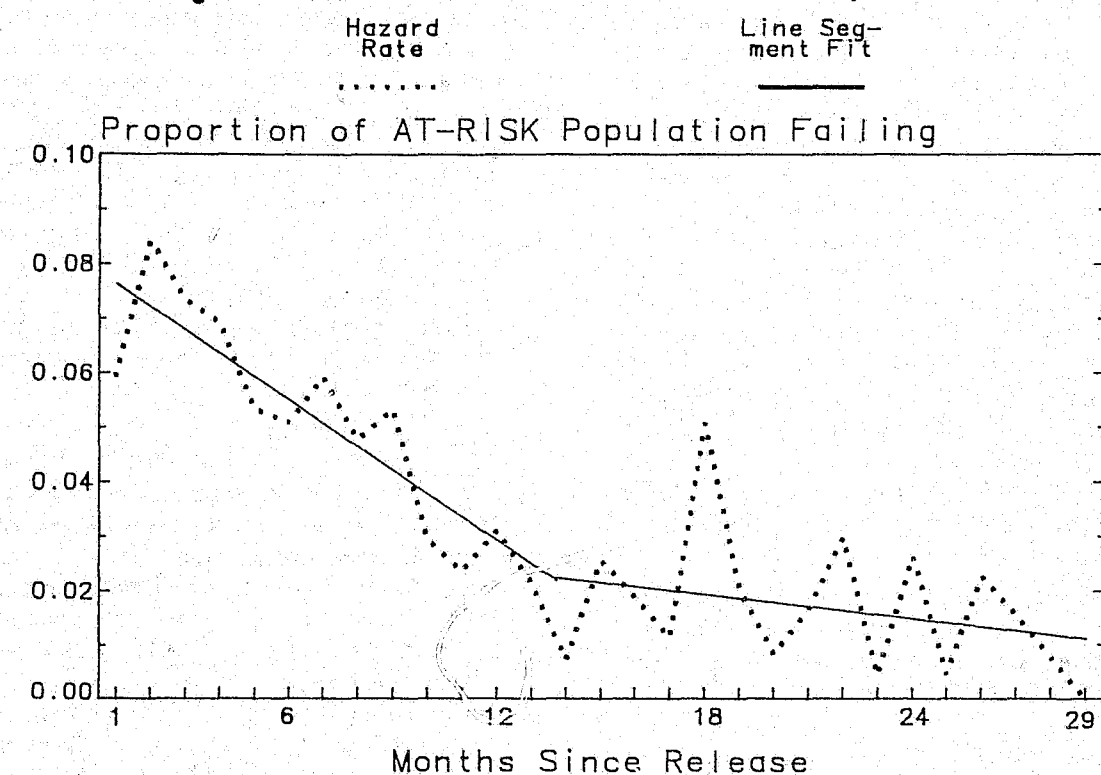
Using Models to Analyze and Project Recidivism

The ROP findings based on arrest recidivism confirm the general findings of other arrest recidivism

⁸ See Michael D. Maltz, *Recidivism*. Academic Press, Orlando, Florida.

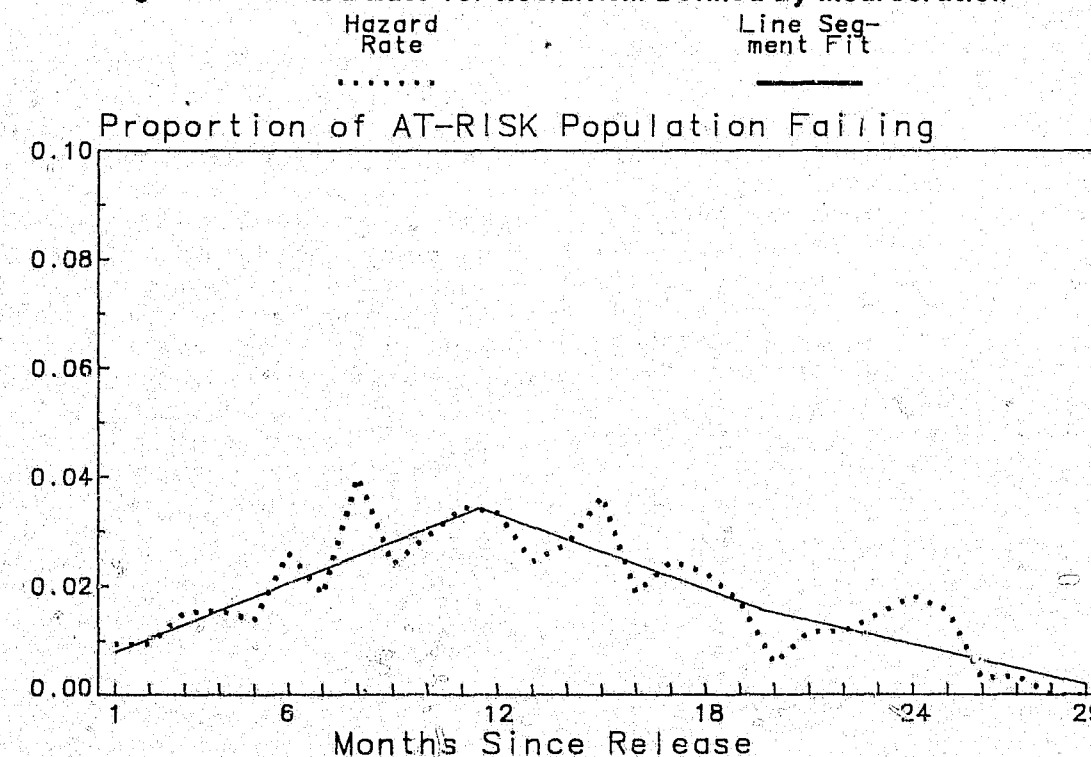
Risk of Arrest Generally Declines over Time

Figure 2: Hazard Rate for Recidivism Defined by Arrest



Risk of Incarceration Is Generally Highest between the 6th and 18th Months

Figure 3: Hazard Rate for Recidivism Defined by Incarceration



studies that have used survival analysis. These studies have consistently found the rate of arrest following a correctional event is highest soon after the starting event (usually release from prison, but sometimes specific types of conditional release or the onset of probation) and that this rate progressively declines over time. While there may be variations, especially among dissimilar populations or situations (for example, habitual offenders vs. minor offenders or probation vs. prison release), the general pattern persists. These studies also support the idea that a certain proportion of any sample can be expected to "survive" without arrest for the entire follow-up period. Again, this proportion varies greatly with different populations and across different situations, but there is no evidence of a sample (or subgroup) experiencing total failure (the proportion surviving reaching zero). After tracking arrest contacts during an exhaustive 18-year follow-up period, researchers in a 1977 study found that approximately one-third of the cohort had not failed and were not expected to fail.⁹

Given these patterns, coupled with the assumption that a proportion of the sample will "survive," numerous models based on arrest have been developed to help interpret and predict recidivism rates.

When the ROP arrest recidivism findings were analyzed using a model developed by Maltz (1984), they were found to be extremely close to a "normal" survival rate. Normal here connotes that there is a typical, or standard, rate of arrest recidivism to which specific findings can be compared. Its use here is analogous to that of depicting a normal distribution of a demographic variable by a bell-shaped curve.

The model also projected the proportion of the sample that ultimately would be expected to fail by arrest--63 percent (or between 58 percent and 67 percent, with a 95 percent confidence interval). The projected rate indicates that of the total proportion of the sample expected to fail (63 percent), a vast majority (60 percent of the total sample) will have failed within 29 months following release, based on model projections. Very few of those individuals who had "survived" without arrest through the most recent update would be expected to fail at some future date.

COMPARING RECIDIVISM RATES ACROSS SUBGROUPS

The ROP study used survival analysis to compare recidivism rates for various subgroups of the

⁹ Kitchner et al., 1977

sample. Subgroups were defined by age at release, the security level of the institution at release, violent vs. property offenders, prior arrest history, and prior incarceration history.

Note that these subgroup analyses do not afford the same attention to recidivism based on incarceration as to recidivism based on arrest. This is because different definitions of recidivism have different limitations and implications. As stated, the lag in recidivism measured by incarceration resulted, at least partially, from criminal justice processing time. In this sense, incarceration recidivism is an artifact of arrest recidivism. When subgroup comparisons were run for incarceration recidivism, the effect of criminal justice processing time was not necessarily constant across all subgroups.

Although criminal justice processing time had some effect on the rates of incarceration recidivism, it is impossible to determine how this factor affected incarceration time for the entire sample, nor why this effect varied across subgroups.¹⁰ To avoid introducing ambiguity to these subgroup analyses, the comparisons are summarily described at the end of this section. These findings should be viewed solely as a description of the rate at which these various subgroups return to prison. Comparisons should not be made across definitions of recidivism rates; for example, the age subgroup recidivism rates based on arrest should not be compared with the corresponding rates based on incarceration.

Arrest Recidivism: Comparing Across Age Subgroups

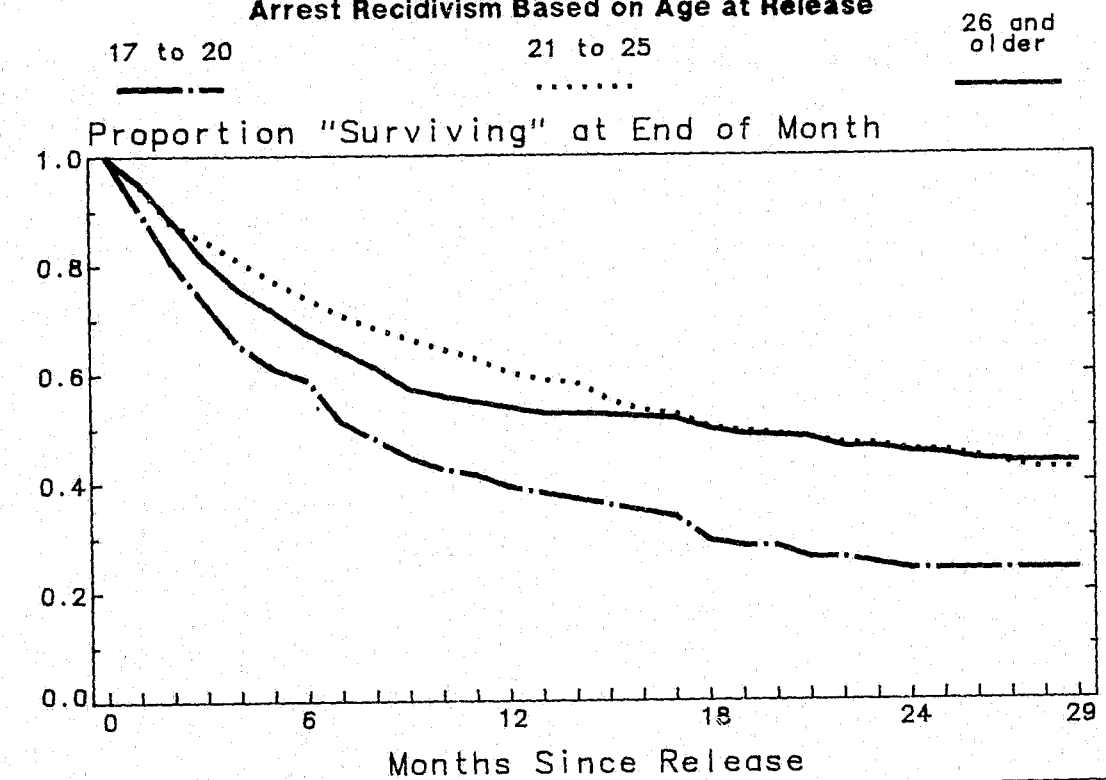
Figure 4 plots the rate of recidivism for three subgroups defined by age at release from prison: releasees age 17 to 20 (92 individuals), age 21 to 25 (160), and age 26 and older (287).

The graph shows the youngest subgroup of releasees, those age 17 to 20, were the most likely to be arrested during the 27- to 29-month follow-up period and were arrested at a more rapid pace. About 76 percent of the youngest subgroup were arrested by the end of the follow-up period. A majority of this subgroup (53 percent) were arrested within the first eight months after release, as the steep drop in the proportion surviving over the first eight months following release illustrates.

¹⁰ Maltz (1984) acknowledges the utility of return to prison as a recidivistic event for practical applications (that is, projecting occupancy rates for prisons), but he notes that it is not appropriate from a theoretical (and predictive) point of view in which the focus of analysis is the releasee's behavior. For these reasons, it is clear why incarceration recidivism receives scant attention in the literature, which is mostly theoretical in nature.

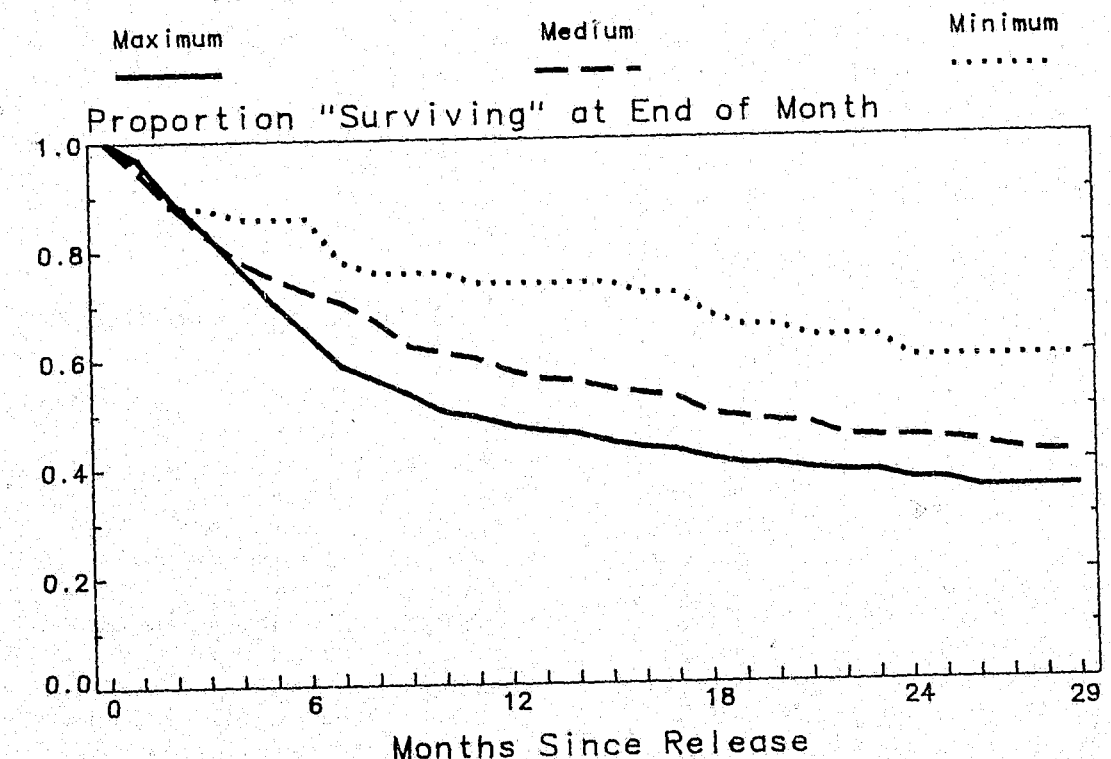
Younger Releasees Are More Likely to Be Arrested

Figure 4: Using Survival Analysis to Measure Arrest Recidivism Based on Age at Release



Releasees from Higher Security Prisons Are Arrested More and at a Faster Rate

Figure 5: Using Survival Analysis to Measure Arrest Recidivism Based on Security Designation



In contrast, the two older subgroups--those age 21 to 25 at release and those 26 and older--were less likely than the youngest subgroup to be arrested during the follow-up period. The proportion of releasees arrested by the end of the follow-up period was almost identical for both subgroups: 57 percent and 58 percent, respectively.

But, while the proportions failing and surviving at the end of 27 to 29 months were virtually identical, the two older subgroups demonstrated markedly different rates of arrest recidivism in the follow-up period, specifically during the first 16 months following release. During the first two months following release, both subgroups recidivated at a fairly equal rate. However, the 26-and-older subgroup continued to recidivate at a relatively rapid pace up until the ninth month; after that, the rate of recidivism decreased markedly. Conversely, for the 21-to-25 subgroup, the survival rate declined earlier, but more evenly, after the second monthly interval. In other words, this subgroup exhibited a more constant rate of recidivism and a more gradual leveling off.

At the interval representing 16 months after release, the proportions of the two older subgroups surviving were virtually identical: 52 percent of the subgroup 26 and older and 53 percent of the 21- to 25-year-old subgroup had been arrested. And from the 16th interval through the end of the follow-up period, the rates of recidivism for these two subgroups were almost indistinguishable.

In general, no clear relationship between age and recidivism emerged from the ROP sample. Although the relationship in the ROP sample between arrest recidivism and age at release does not suggest a direct, or linear, relationship, these findings do confirm a theme common throughout criminal justice literature: youthful offenders are more criminally active than their older counterparts.

Arrest Recidivism: Comparing Across Security Designations

Figure 5 compares the survival rates of three subgroups of releasees defined by the security level of the institution they were released from. This comparative analysis was based on 495 cases which allowed such a determination. Excluded were cases with missing information (26) and female releasees (18). All females in the sample were released from the Dwight Correctional Center, which, unlike the male institutions, does not have a unique security designation. Instead, Dwight is the only State institution for female of-

fenders across all security designations. The three institutional security levels that were compared were maximum (188 inmates), medium (258), and minimum (49).

The differences in the survival curves of these three subgroups are clear. While 65 percent of the releasees from maximum-security institutions were arrested in the 27- to 29-month follow-up period, approximately 59 percent of the medium-security releasees and 41 percent of the minimum-security releasees were arrested. Furthermore, the distinctions in the proportions surviving at monthly intervals persist throughout the follow-up period.

Of the three subgroups, the survival curve for the maximum-security releasees dropped most drastically in the early intervals and then levels off. By comparison, medium-security releasees recidivated at a nearly equal rate in the initial three monthly intervals, but their recidivism rate began to slow sooner than it did for the maximum-security releasees. Medium-security releasees generally demonstrated a more even rate of recidivism than the other two subgroups. Finally, releasees from minimum-security institutions generally recidivated at a slower rate than the others. The relative unevenness of this curve results from the low number of cases, 49. Even a minor numerical change in "survivors" in this subgroup causes a large proportional change.

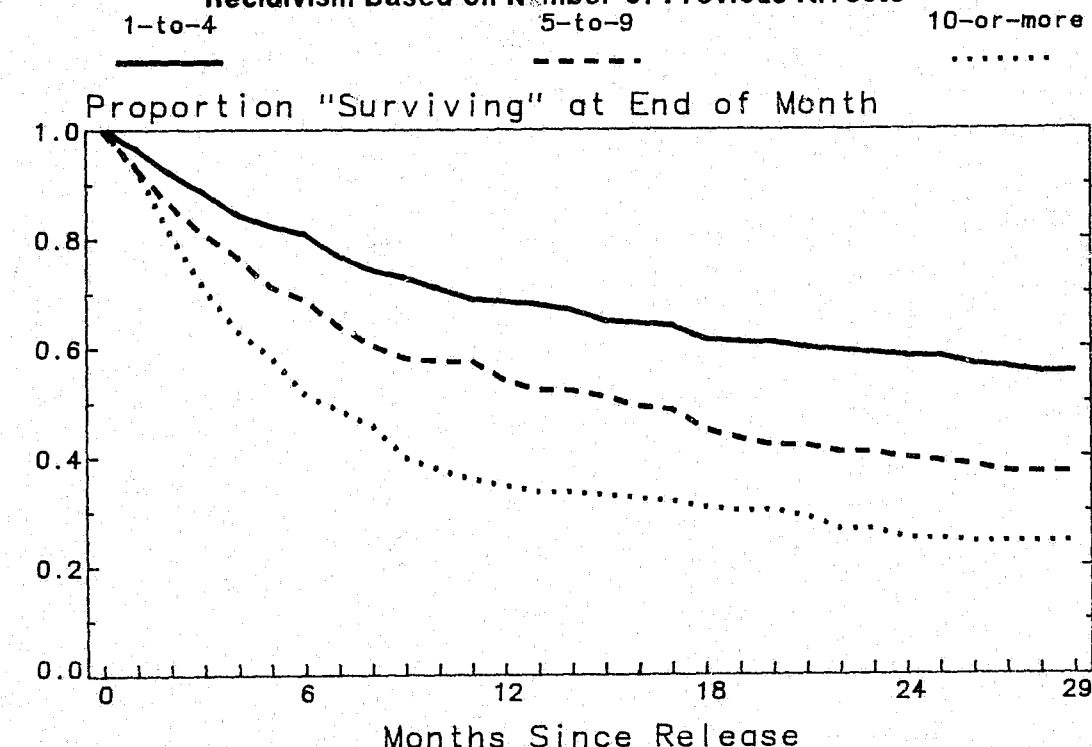
These findings seem to indicate that a relationship exists between recidivism and the security level of the institution the individual was released from. Based on this sample, prisoners released from higher security institutions were more likely both to have recidivated by the end of the follow-up period and to have recidivated at a faster pace than did prisoners released from lower security institutions.

Arrest Recidivism: Comparing Across Prior Arrest Histories

Figure 6 presents the arrest recidivism rates for three subgroups defined by the number of CCH-recorded arrests that occurred prior to the releasee's base incarceration (that is, the incarceration the sample was based on). The three subgroups were identified based on the frequency distribution of the number of previous arrests per releasee. With the sample divided roughly into thirds, the subgroups included releasees with 1 to 4 previous arrests (199), those with 5 to 9 previous arrests (167), and those with 10 or more previous arrests (173).

Arrest Rates Are Highest for Releasees with the Most Prior Arrests

Figure 6: Survival Analysis to Measure Arrest Recidivism Based on Number of Previous Arrests



The graph confirms expected overall patterns. In general, those releasees with a greater number of previous arrests were more likely to have been arrested in the follow-up period and were arrested at a more rapid pace. The proportions surviving for each subgroup remained distinct across the entire follow-up period. Seventy-six percent of the releasees with 10 or more previous arrests, 63 percent with 5 to 9, and 45 percent with 1 to 4 were arrested by the end of the follow-up period.

Arrest Recidivism: Comparing Across Prior Incarceration Histories

Figure 7 presents the arrest recidivism rates for three subgroups of releasees based on the number of prior incarcerations in Illinois prisons. The three subgroups included releasees with 1 previous incarceration (that is, the base incarceration; a total of 322 releasees), releasees with 2 incarcerations (105), and releasees with 3 or more incarcerations (112).

Again, these findings confirm the expected: the rates of arrest recidivism and the proportions arrested by the end of the follow-up period were clearly related to the number of previous incar-

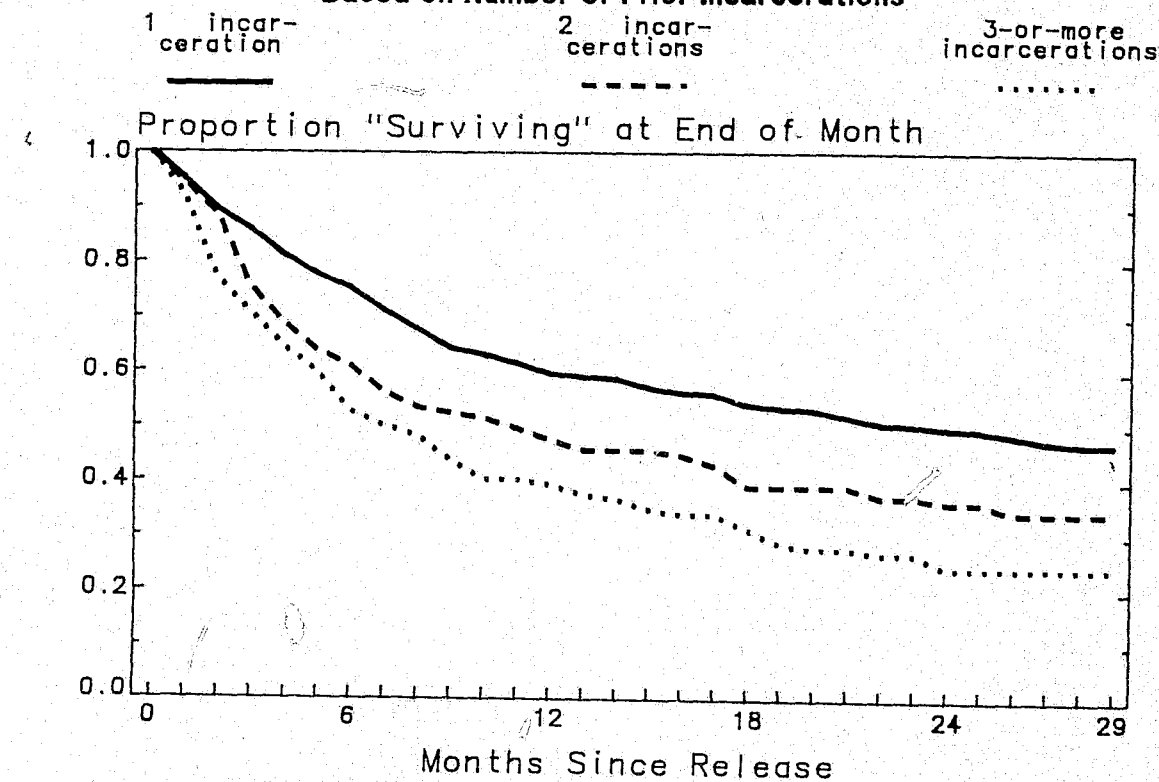
cerations. In general, releasees with a more extensive history of State incarcerations were more likely to be arrested during the follow-up period and were arrested at a more rapid rate. However, by comparing the subgroup with 2 incarcerations and the subgroup with 1 incarceration, we see nearly identical rates the first two monthly intervals. After this point, there is a steep drop in the proportion "surviving" for the subgroup with 2 incarcerations. For the rest of the follow-up period, the proportions surviving for the subgroups remained distinct. The proportions arrested by the end of the follow-up period were as follows: releasees with 1 incarceration, 53 percent; those with 2, 66 percent, and those with 3 or more, 76 percent.

Arrest Recidivism: Comparing Across Violent and Property Offenses

Figure 8 illustrates the arrest recidivism rates for two subgroups defined by the releasee's "holding offense." The holding offense is the offense for which the inmate was sentenced to State prison and which ultimately led to the inmate's inclusion in the ROP sample. The IDOC determines the holding offense for each inmate. When an offender is sen-

Arrest Rates Are Lowest for Releasees Completing Their First Prison Terms

Figure 7: Survival Analysis to Measure Arrest Recidivism Based on Number of Prior Incarcerations



tenced for multiple offenses, the holding offense is the one that carried the longest sentence. Two subgroups were analyzed: releasees with a violent holding offense (207) and releasees with a property holding offense (263). Releasees with holding offenses categorized as drug (19) and other (33) were excluded from this analysis because the subgroup size was insufficient to conduct survival analysis. Also excluded were 17 releasees whose holding offense was missing from the CCH system records.

The subgroup of releasees held for property offenses was more likely to have been arrested during the follow-up period, and they recidivated at a faster pace. The proportion of the property subgroup arrested by the end of the follow-up period was 76 percent, compared with 66 percent for the violent subgroup.

Incarceration Recidivism: Comparing Various Subgroups

This section describes the rates at which various subgroups of the ROP sample returned to Illinois prisons during the follow-up period. These subgroup comparisons of incarceration recidivism

revealed several trends.

- The younger the inmate was upon release from prison, the more quickly he or she was likely to return to prison. When three subgroups based on age at release were compared, the Authority found that the youngest subgroup (those 17 to 20 years old) returned to prison at the most rapid rate, while the incarceration survival rates for the two older subgroups (those 21 to 25 and 26 and older) were nearly identical across the 27- to 29-month follow-up period. For both older subgroups, approximately 38 percent had been incarcerated at least once by the end of the follow-up period, compared with 55 percent of the youngest subgroup.

- Incarceration recidivism rates increased with the level of institutional security inmates were released from. That is, the rate of incarceration recidivism increased progressively for minimum-, medium-, and maximum-security releasees. The proportions surviving for all three subgroups remained distinct across the follow-up period. By the end of that period, 31 percent of minimum-security inmates, 33 percent of medium-security inmates, and 45 percent of maximum-security

inmates had been incarcerated again in State prison at least once.

- The incarceration recidivism rate for violent offenders was almost identical to the rate for property offenders during the first six monthly intervals. After that, however, the incarceration recidivism rate for the subgroup of property offenders continued at a more rapid rate. By the end of the follow-up period, 35 percent of the violent offenders and 48 percent of the property offenders had been incarcerated.

- Offenders with the most previous arrests clearly were more likely to return to prison. Fifty-four percent of the subgroup with 10 or more previous arrests had been incarcerated at least once by the end of the follow-up period. This subgroup also recidivated at a more rapid pace. However, the two subgroups with fewer prior arrests, 1 to 4 and 5 to 9, did not exhibit different rates of incarceration recidivism until the 17th monthly interval. After the 17th month, the rate of the subgroup with 5 to 9 arrests grew more rapidly. Approximately 31 percent of the subgroup with 1 to 4 arrests had been incarcerated by the end of the follow-up period, compared with 40 percent of the subgroup with 5 to 9 arrests.

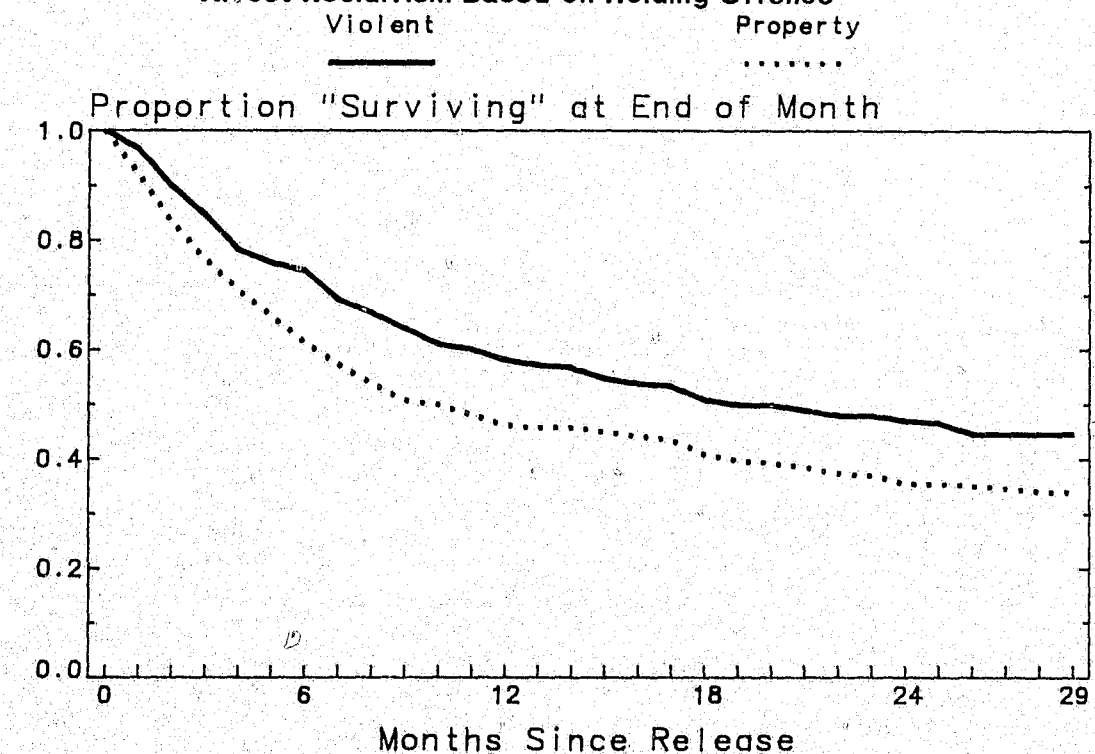
- Releasees who had completed their first incarceration were least likely to be incarcerated during the 27- to 29-month follow-up period; 35 percent had been incarcerated in State prison by the end of the follow-up period. This subgroup also returned to prison at the slowest rate. Meanwhile, the two other subgroups analyzed, those with 2 prior incarcerations and those with 3 or more, exhibited no clear difference in incarceration recidivism rates during the first 15 monthly intervals. After that, the rate of incarceration recidivism for the subgroup with 3 or more prior incarcerations continued at a relatively rapid pace. Forty-two percent of the subgroup with 2 prior incarceration had been incarcerated by the end of the follow-up period, compared with 55 percent of the subgroup with 3 or more.

SUMMARY AND CONCLUSIONS

Using the statistical technique of survival analysis to assess recidivism rates has revealed many findings that more traditional approaches would not. For example, survival analysis told us how quickly members of the ROP sample recidivated, in terms of both arrest and incarceration, during the

Property Offenders Are Arrested at a Faster Rate Than Violent Offenders

Figure 8: Using Survival Analysis to Measure Arrest Recidivism Based on Holding Offense



Survival Analysis Calculations

Survival analyses for the Repeat Offender Project were conducted using a procedure provided by the SPSS software package (update 7-9). This survival analysis procedure derives various measures that are based on two critical assumptions: 1) "terminal" cases cease to remain "exposed to risk" after they terminate (for ROP survival analyses, this assumption means that once a releasee recidivates, he or she is no longer at risk of "failing" again); and 2) "censored observations" are treated as non-terminating "withdrawals" when they no longer are at risk (for example, if a releasee dies, he or she is not considered to have "failed" or "survived," but is simply dropped from the analysis).

Several survival analysis measures were particularly relevant for analyzing recidivism in the ROP study:

- The proportion of arrests (or incarcerations) in each interval measures the likelihood that an individual "surviving" to the beginning of any monthly interval will be arrested (or incarcerated) during that interval.

The proportion of terminal events is most easily expressed for intervals without censored observations. In these instances, the proportion is simply the number of persons arrested (or incarcerated) during an interval, divided by the number of "survivors" who entered the interval. For example, suppose 100 releasees had not yet been arrested by the beginning of the 18th interval, but 20 of them were then arrested during that interval. The proportion of terminal events would be 0.2.

However, if some censored observations occurred during the interval, the number exposed to risk of recidivating would be adjusted. Based on the assumption that, on the average, censored observations remain exposed to risk for only half of the interval, the number exposed to risk would equal the number entering the interval, minus one-half the number of censored observations in that interval. Survival analysis assumes that the distribution of censored observations within an interval is evenly (randomly) distributed. Hence, the average exposure/survival of all censored observations for that interval is based on one-half the total number of censored observations.

For instance, suppose that in the example above, five people (none of whom had been arrested) became "censored" in the 18th interval. The proportion failing would be slightly higher than in the previous calculation because, on the average, the

five censored individuals were exposed for only half the month. When the censored observations are accounted for, the terminal rate would be 0.203, compared with 0.2 for the previous example.

- The proportion "surviving" in a monthly interval measures the proportion of releasees who enter an interval and do not terminate during that interval. In other words, the proportion surviving is simply the mathematical complement of the proportion of terminal events in an interval. Using the previous examples, the proportion surviving would be 0.8 without the five censored observations and 0.797 with the censored observations.

- The cumulative proportion surviving measures the proportion of the total sample surviving at the end of any given interval; these values constitute the "survival curve." The cumulative proportion surviving can be described as the proportion of the total sample who have not yet been arrested (or incarcerated) at the end of any given interval. For example, the cumulative proportion surviving at the end of the 18th interval is derived by multiplying the proportion surviving for intervals 1 through 18. However, since the cumulative proportion surviving is based on the proportion surviving in each interval, it also is subject to slight adjustments if censored observations occurred in any preceding intervals.

- The hazard rate measures the probability that an individual who survives to the beginning of an interval will fail during that interval. The hazard rate for any given interval is similar to the proportion terminating in the interval. However, the hazard rate computes the number exposed to risk of recidivating by adjusting the rate to assume that terminating cases fall out, on the average, halfway through the interval. (This is the same logic used to adjust for censored observations when calculating the proportion terminating.)

Both the hazard rate and the proportion terminating estimate the probability that a releasee will fail during a given interval. The proportion terminating is based on the assumption that all non-censored cases, whether or not they terminate in that interval, are exposed to risk for the entire interval. Since terminating events normally occur at different times within an interval, and releasees are actually exposed for only a portion of the interval, the hazard rate is a more logical and precise measure. However, unless the number of cases in a sample is very large, the difference between the proportion surviving in an interval and the hazard rate will be minimal. Such is the case in the ROP study.

follow-up period. The fixed interval approach would have determined only what proportion of releasees had been arrested or incarcerated by the end of the follow-up period. Using survival analysis also allowed us to compare recidivism rates across different subgroups of releasees in the sample. This analysis helped us determine whether these subgroups exhibited different rates of recidivism. As a result, we have begun to address the issue of what type of offender is more likely to recidivate.

For recidivism based on arrest, our analysis indicated that 60 percent of all releasees in the ROP sample had been arrested at least once during the 27- to 29-month follow-up period. Furthermore, the rate of arrest recidivism for the entire sample was highest in the earlier intervals, especially the first 9 months after release. The analysis also revealed that 42 percent of the ROP sample had returned to prison at least once by the end of the follow-up period. Releasees were most likely to return to prison in the middle of the follow-up period, somewhere between 6 and 18 months af-

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ter releasee.

Comparisons of subgroups of the ROP sample yielded diverse results. Younger offenders (those age 17 to 20 at release) were arrested more often following release and more quickly than were their older counterparts. Not surprisingly, releasees who had many previous arrests were arrested at a quicker pace than were individuals with fewer previous arrests. Similarly, releasees with several previous incarcerations were arrested more rapidly than those who had been released from their first State prison incarceration. Releasees incarcerated for property offenses were arrested more rapidly than those incarcerated for violent offenses. And inmates released from institutions with higher security ratings were arrested at a more rapid pace than those released from lower security institutions.

As these and other examples indicate, the various survival analyses applied to the ROP sample yielded more robust findings than traditional and simpler methods of assessing recidivism would. This bulletin forms a basis for applying survival analysis to other areas of recidivism research. The next ROP bulletin provides a comparative analysis of releasees who have recidivated vs. those who have not, a preliminary analysis of criminal career types, and a more detailed analysis of varying levels of prior criminal histories. A subsequent ROP report will present the survival data for those releasees excluded from this bulletin--those releasees who were on parole and released from prison before the ROP sample was drawn. The report also will compare that subgroup with other subgroups in the sample.

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