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# User Report

PREDICTING VIOLENT RISK FOR  
PENITENTIARY INMATES

1992-08

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H28  
1992

Solicitor General Canada  
Ministry Secretariat

Canada

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1992

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The Research Group

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**PREDICTING VIOLENT RISK FOR  
PENITENTIARY INMATES**

1992-08

This report was prepared on contract for the Corrections Branch, Ministry of the Solicitor General of Canada and is made available as submitted to the Ministry. The views expressed are those of the author and are not necessarily those of the Ministry of the Solicitor General of Canada.

This document is available in French. Ce rapport est disponible en français, sous le titre: "Prévision du risque de violence chez les détenus des pénitenciers"  
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*Thanks are also extended to Jim Bonta of the Ministry Secretariat who was instrumental in facilitating the final documentation tasks and providing valuable comments on the final drafts of the report — and to the many other members of the National Parole Board, Correctional Services Canada and the Royal Canadian Mounted Police who were especially gracious and helpful in assisting in the collection and interpretation of data throughout the project.*

*Robert Hann and William Harman were the principal investigators on the project. However, key roles were played by each member of the project team. First of all, Carolyn Canfield was jointly responsible (with Bob Hann) for much of the prior research that led to the general design of the early parts of this study. She also played a critical role in identifying and assessing the different sources of data that needed to be collected. Second, one of the more difficult tasks that had to be undertaken focused on the accessing of manual files and the extracting of the data that eventually comprised the File Review data base. Jean Pierre Leroux played the lead role in refining data collection instruments and procedures and in managing the whole of that part of the data collection and data verification effort. He was ably assisted in the coding and correction efforts by Rena Frankel, Dorota Geissell, Dany Gouthier, Robert Joseph, Susan Mickus, Danielle Paris, and Jody Streat — and by Alice Boyle who undertook the keypunching of the data.*

*Third, Charles Figueiredo played an important part in developing the computer programs during the early stages of the project, and especially programs to convert the File Review data to machine processable form and programs to ensure the integrity of that data. Finally, Cobie Wesseling and Rosemary Adams ably and cheerfully undertook the administrative and report production tasks at different stages in the project.*

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**A Note Regarding the Appendices**

An appendix was prepared to accompany the present report. Since this appendix was highly technical it was not reproduced with the present User Report. It is, however, available upon request from Corrections Branch, Ministry Secretariat of the Solicitor General of Canada.

## Chapter 1

### Overview

#### 1.1 Background: The Parole Decision Making and Release Risk Project

The Ministry of the Solicitor General of Canada has initiated a number of studies to improve Canadians' understanding both of the decision making processes leading to the release of inmates from penitentiary to Parole and Mandatory Supervision programs, and of the impacts of those decisions.

Since 1986 the authors of the current report have been involved in one of the most significant of these studies, *The Parole Decision-Making and Release Risk Assessment Project*.

The key results of that study, initiated by the Corrections Branch of the Ministry Secretariat, are documented in 3 other reports.

One of those reports,

- Data Files Created for the Parole Decision-Making and Release Risk Prediction Project<sup>1</sup>,

provides detailed descriptions of some of the most important products of this project — the data sets prepared to support subsequent investigations of topics such as: the characteristics and criminal histories of inmates, parole release decision-making, and understanding and predicting post-release offender behaviour and risk. Some of the data sets provide information for exploring decisions and activities that occurred during a relatively short period of time, while other data sets allow the investigation of changes and trends in activities and decisions over quite extensive periods of time.

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1. Hann, Robert G. and William G. Harman (assisted by: Jean Pierre Leroux, Carolyn Canfield, Rena Frankel, and Charles Figueiredo)....., submitted to the Ministry of The Solicitor General of Canada by The Research Group, (forthcoming, 1991)

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A second report,

- Predicting General Release Risk for Canadian Penitentiary Inmates<sup>2</sup>,

includes an overview of the project data bases but focuses on the task of predicting the *General Release Risks* of recidivating for Non-Aboriginal inmates released from penitentiary. The report begins with an examination of the key characteristics of penitentiary releases, and then assesses the system now used by the Ministry (i.e., the Nuffield or S.I.R. system) to predict the General Release Risks for those inmates. This assessment utilizes a range of traditional and new theoretical and operational tests of predictive accuracy and usefulness to compare the Nuffield system with alternative risk prediction systems that were developed especially for the project. The report ends by comparing actual parole release decisions with those decisions that would have been made if releasing authorities had relied solely on the available General Release Risk prediction systems.

The third project report ,

- Predicting Release Risk for Aboriginal Penitentiary Inmates<sup>3</sup>,

addresses similar issues, but concentrates on the prediction of General Release Risk for a special group of inmates, Male Aboriginals.

## 1.2 Format of the Current Report

Both of the latter two "risk prediction" reports are concerned with the prediction of one type of release risk, *General Release Risk*, defined as:

- conviction for *any* indictable offence leading to a custodial sentence within 3 years of release.

The current report focuses, not on *General Release Risk*, but on the risk of *Violent* recidivism. In addition, the report investigates whether or not defining violence in a Broad or Narrow fashion has any implications for the nature and effectiveness of risk scoring systems.

### Chapter 2: Background

Chapter 2 begins with a summary description of the data base upon which the analysis in the report is based, and then continues with a description of the specific offences that were included within the *Broad* and *Narrow* Violent Categories of offences used in that analysis.

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2. Hann, Robert G. and William G. Harman (assisted by: Carolyn Canfield, Jean Pierre Leroux, Rena Frankel, and Charles Figueiredo),....., submitted to the Ministry of The Solicitor General of Canada by The Research Group, (forthcoming, 1991)
  3. Hann, Robert G. and William G. Harman (assisted by: Carolyn Canfield, Jean Pierre Leroux, Rena Frankel, and Charles Figueiredo), ..... submitted to the Ministry of The Solicitor General of Canada by The Research Group, (forthcoming, 1991)

The companion report on General Release Risk for Non-Aboriginals<sup>4</sup> contains a quantitative description of the characteristics of inmates released from penitentiary and the different types of release risk associated with those inmates. The last part of Chapter 2 of the current report contains a summary of the parts of that material that relate to Violent Risk, and uses that information to support a discussion of the problems likely to be encountered by this or any other study attempting to predict events (such as violent recidivating) that are relatively rare.

### **Chapter 3: Broad Violent Risk**

Chapter 3 focuses on the prediction of *Broad Violent Risk*.

The Chapter begins with a description of a (regression-based) system for predicting Broad Violent Risk that was developed especially for the project. The system is then compared to analogous systems that were developed for predicting *General Release Risk* and for predicting *Narrow Violent Release Risk* — with special attention given to differences in the offender characteristics and criminal history that made significant contributions to the prediction of the different types of risk. Finally, a battery of statistical tests are used to test the extent to which the Broad Violent Risk prediction system yields predictions that are accurate and useful from a policy and operational perspective.

### **Chapter 4: Narrow Violent Risk**

Chapter 4 completes the report with an analogous investigation focused on the prediction of the second type of violent risk, *Narrow Violent Risk*.

---

4. Hann, Robert G. and William G. Harman (assisted by: Carolyn Canfield, Jean Pierre Leroux, Rena Frankel, and Charles Figueiredo), Predicting General Release Risk for Canadian Penitentiary Inmates, *op. cit.*

## Chapter 2

### Background

#### 2.1 Database for Prediction

A separate report<sup>5</sup> describes a number of major data bases developed by the Parole Decision-Making and Release Risk Assessment Project. However, since the analysis in this report is based on one of those data bases, a summary description is provided here.

This *Risk Prediction* File is composed of over 170 variables for each of 3180 male offenders and 94 female offenders who were admitted to penitentiary for reasons other than parole or mandatory supervision violations and who were released in 1983/84<sup>6</sup>. Those data were collected from 3 sources:

- the *Penitentiary History* file,  
(data on each of 81,203 penitentiary terms served by 50,776 penitentiary inmates<sup>7</sup>),
- additional data elements specially extracted from *CSC data bases* (i.e., information on marital status, and whether or not the inmate was in a maximum security institution at time of release), and
- the *Criminal Offences and Sentences* file.  
(the full offence and sentencing histories of over 3,000 released inmates).

The current report focuses on the Violent release risks associated with the roughly 2,900 Non-Aboriginal male offenders in this Risk Prediction File.

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5. Hann, Robert G. and William G. Harman (assisted by: Jean Pierre Leroux, Carolyn Canfield, Rena Frankel, and Charles Figueiredo), Data Files Created for the Parole Decision-Making and Release Risk Prediction Project, op. cit.

6. Sufficiently complete data could not be collected for 282 of the 3556 such inmates released in that year.

7. The data in this file had been previously extracted from the CSC automated "Offender Information System".

Figure 2.1

BROAD AND NARROW(*) VIOLENT OFFENCES					
Internal Code	Description	CCC Section	Internal Code	Description	CCC Section
049	* cause bh to her majesty	049(b)	231	* traps to cause bh	231(1,2)
0761	* hijacking	076.1	232	* interfere w/transportation facil.	232
0762	endang. safety aircraft	076.2	2333	danger op vehicle cause bh	233(3)
078A	* breach duty cause death	078(a)	2334	danger op vehicle cause death	233(4)
078B	* breach duty cause bod. harm	078(b)	2392	impaired driving caus bh	239(2)
079A	* causing injury w/intent	079(1)(a)	2393	impaired driving caus death	239(3)
079B	* exp w/int cbh	079(1)(b)	241A	* Impeding att save life (OLD)	241
079C	* exp. w/int damage prop.	079(1)(c)	2432	Impeding att save life	243.2
079D	* poss. explosives	079(1)(d)	2434	* Ut threat cs death/bh	243.4
083	use of firearm	083	245	* assault	245
084	pointing a firearm	084	2451	* asslt weap or cs bod harm	245.1
132	prison breach	132	2452	* aggravated assault	245.2
144	* rape (OLD CCC)	144	245A	common assault (OLD CCC)	245(1)
145	* attempt. rape (OLD CCC)	145	245B	* assault cause bod	
149	indecent assault female	149(1)		* harm (OLD CCC)	245(2)
150	* incest	150	2453	unlawfully cause bod harm	245.3
156	indecent assault on male	156	2454	torture	245.4
157	acts of gross indecency	157	246	* assault peace officer	246
203	* caus. death crim neg	203	246A	assault with intent - ind off	246
204	* caus bod harm crim neg	204	246B	assault resist (OLD CCC)	246
2141	* 1st degree murder	214	2461	* sexual assault	246.1
2142	* 2nd degree murder	214	2462	* sexual assault - weapon or cbh	246.2
2143	* cap.murder pers less 18	??	2463	* aggravated sexual assault	246.3
218	punishment for murder	218	247	* kidnapping - confined	247(1)
219	* manslaughter	219	2471	hostage taking	247.1
219	* murder red. to manslaughter	219	302	robbery	302
220	* punishment for infanticide	220	302D	robbery - armed	302(d)
221	* kill unborn child	221(1)	389	arson (specific enum)	389(1)(2)
222	* attempted murder	222	390	set fire to defraud	390
228	* cause bod harm intent	228	392	* setting fire by negligence	392(1)
229A	* admin. obnoxious thing - cbh	229(a)	687	* dangerous offender	688
229B	* admin. obnox. thing - annoy	229(b)	688	* dangerous offenders	688
230	* overcome resist. commis.	230	689	hear application dang off	689

\* Offences within the "Narrow Violent" category are marked with an "\*"

## 2.2 Broad and Narrow Violent Offences

Extensive consultations with members of the Project Working Group produced definitions of two groups of violent recidivism that were of special interest to Ministry, National Parole Board and Correctional Services Canada officials:

- **Broad Violent Risk**  
conviction of at least one of a *Broad Range of Violent* indictable offences (for which a custodial sentence was handed down by the courts) — for any of the offences listed in Figure 2.1; and
- **Narrow Violent Risk**  
conviction of at least one of a *Narrow Range of Violent* indictable offences (for which a custodial sentence was handed down by the courts) — offences marked with an asterisk in Figure 2.1.

Figure 2.2 (reproduced from the companion project report on General Release Risk for Non-Aboriginals) compares statistics on each of these two indicators — for both Non-Aboriginal and Aboriginal releases<sup>8</sup>. For comparison, information is also presented for two other types of risk:

- **Revocation Risk**  
revocation of Parole Supervision or Mandatory Supervision and return to a penitentiary, and
- **General Release Risk**  
conviction of *any* indictable offence for which a custodial sentence was handed down by the courts within 3 years of release from penitentiary.

Particularly relevant highlights from the analysis of this information in the companion report include:

- For the full sample of 1983/84 male releases, these four indicators took the following values:

- Revocation Risk	30%
- General Release Risk	49%
- Broad Violent Risk	19%
- Narrow Violent Risk	10%;
- Each of the four release risk measures indicates that Non-Aboriginals have significantly lower levels of release risks than do Aboriginal inmates;
- Non-Aboriginals had a Broad Violent Release Risk rate 10 percentage points below that of Aboriginals (8% vs. 23%); and
- Non-Aboriginals had a Narrow Violent Release Risk rate 15 percentage points below that of Aboriginals (18% vs. 28%).

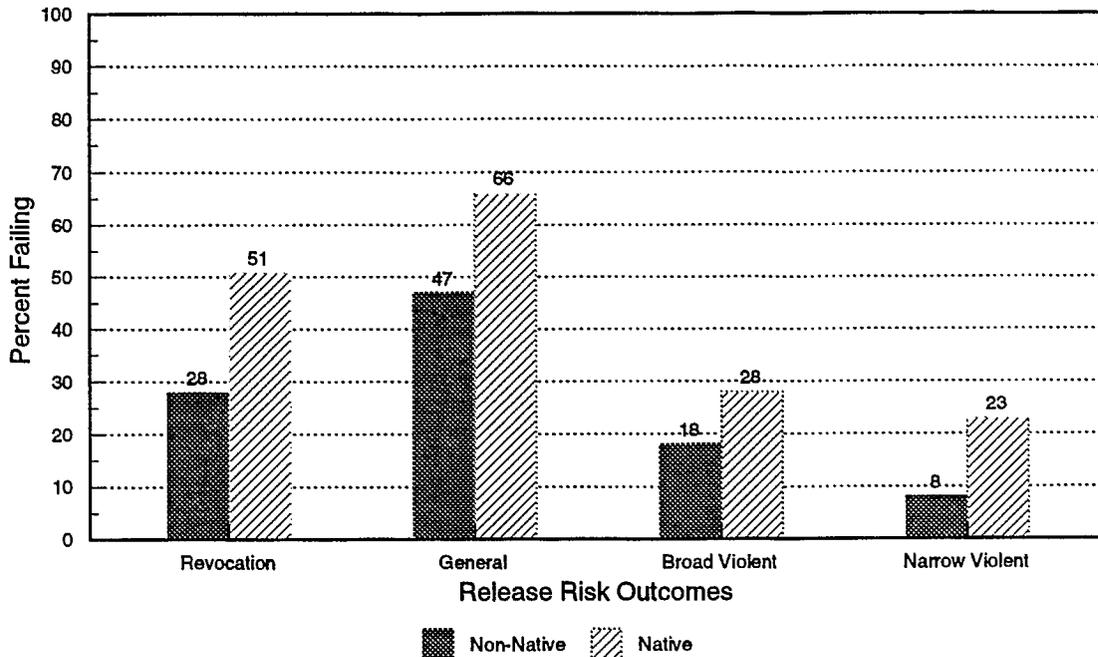
---

8. The companion project report also provides information on the likelihood of a released inmate's being convicted of any one of a large number of *individual* offences.

As explained later, for most parts of the prediction analyses the full data base was divided into two parts, a *Construction* sample and a *Validation* sample. The statistics in Figure 2.2 and Figure 2.3 are based on analysis from the Construction sample only.

Figure 2.2

**Release Outcome By Ethnicity:  
Male Releases in 1983/84**



All Sampled male Warrant of Committal Admissions released in 1983-84

In addition, the companion report also explored whether or not there were differences in the different types of risks associated with inmates released to parole — as compared to inmates denied parole. Highlights of the information reproduced in Figure 2.3 include:

- (using any one of the four different indicators of risk) for both Non-Aboriginal and Aboriginal offenders, those released on Parole represent lower risks than those denied parole.
- In particular, with respect to Broad and Narrow Violent risk, the risks associated with inmates denied parole are over 3 times the risks for inmates granted parole.
- However, although the risks associated with Aboriginal Offenders were uniformly greater than for Non-Aboriginals, the risks associated with *Non-Aboriginal parolees* are very similar to the risks associated with *Aboriginal parolees*. This observation holds for all risk indicators for parolees:
  - Broad Violent Risk (8% vs. 9%), and
  - Narrow Violent Risk (4% vs. 7%).

- Finally, although with respect to *Broad Violent Risk*, an analogous conclusion applies to releases **denied parole** ( 27% for Non-Aboriginals vs. 33% for Aboriginals), there were sizeable differences between the *Narrow Violent* recidivism rates for Non-Aboriginals and Aboriginals denied parole ((13% vs. 27%).

Figure 2.3

RELEASE OUTCOME  
BY RELEASE TYPE BY ETHNICITY:  
Male Releases in 1983/84

	Non-Aboriginal		Aboriginal		TOTAL SAMPLE	
	Full Parole Release	Other Release Type	Full Parole Release	Other Release Type	Full Parole Release	Other Release Type
INDICTABLE CONVICTION/CUSTODY WITHIN 3 YEARS						
Returns.....	415	958	19	159	434	1,117
% of Subsample.....	29%	66%	33%	75%	29%	67%
REVOCATION (PENITENTIARY) WITHIN 3 YEARS						
Revocations.....	236	573	12	125	248	698
% of Subsample.....	16%	39%	21%	59%	16%	42%
BROAD VIOLENT IND CONV/CUSTODY WITHIN 3 YEARS						
% of Subsample.....	8%	27%	9%	33%	8%	28%
NARROW VIOLENT IND CONV/CUSTODY WITHIN 3 YEARS						
% of Subsample.....	4%	13%	7%	27%	4%	15%
TOTAL SUBSAMPLE.....	1,451	1,458	58	213	1,509	1,671
% of Subsample.....	100%	100%	100%	100%	100%	100%

Construction sample of Male Warrant of Committal Admissions released in 1983/84.

### 2.3 Predicting Rare Events

The companion General Release Risk project report also made the point that one of the main determinants of the difficulty and complexity of efforts to produce scoring systems to predict risk is the frequency with which the "risk" event to be predicted occurs.

In particular, if the likelihood of recidivating is very low (or very high) — if either recidivating or succeeding is a very rare event — then those developing risk prediction scoring systems face a dual edged challenge. On the positive side, and say the actual chances of an inmate's recidivating are 5%, then it is very easy to get a very high rate of successful predictions simply by predicting that all released inmates will not recidivate. That simple prediction rule will result in decisions that have an error rate of only 5%. However, on the negative side, there is very little *practical scope* for building a more sophisticated risk prediction scoring system that would improve the

decisions that would be made using that simplest of prediction models (i.e. paroling all of the inmates.). The absolute best one could hope to achieve would be to reduce the error rate 5 percentage points (from 5% to 0%). Given the costs of developing such prediction systems, this type of situation clearly presents fewer opportunities for undertaking prediction efforts that justify themselves on a cost-benefit basis.

As shown in the previous section, this is precisely the situation that exists for prediction efforts focusing on predicting Narrow Violent Risk for Non-Aboriginals — with only 8% of Non-Aboriginals recidivating with a Narrow Violent offence. Although the situation is not as extreme for Broad Violent Risk for Non-Aboriginals (Broad Violent overall Risk Rate of 18%), there too one is dealing with fairly *rare* events.

Developing methods of predicting Broad or Narrow Risk should be seen as a particularly challenging task.

## Chapter 3

### Broad Violent Risk

#### 3.1 Introduction

The companion project report that focuses on predicting General Release Risk for Non-Aboriginals contains a description of the Nuffield (or S.I.R.) risk prediction system that is currently used by the National Parole Board — for predicting *General Release Risk*. That report also describes a number of alternative systems that were developed by the current project to predict General Release Risk. One of these alternative systems was developed using a statistical method, *Burgess Scores*, that was similar to the method used by Nuffield. Other alternative systems were based on different statistical techniques, namely *Linear Regression*, and *Logistic Regression*.

As noted earlier, The National Parole, Correctional Services Canada, and other criminal justice agencies also have a special interest in being able to predict particular kinds of risk, especially the risk of violent recidivism. Unfortunately, methods for providing adequate predictions of violent risk do not currently exist. This Chapter begins to address this problem by presenting the results of initial efforts to use one type of statistical technique — *Linear Regression* — to develop a scoring system to predict *Broad Violent Release Risk* for Non-Aboriginals. (Chapter 4 following focuses on the task of predicting *Narrow Violent risk*.)

#### 3.2 Significant Predictors of Violent Risk

As noted earlier, the Broad Violence Regression equation estimated<sup>9</sup> for this report was based on data from the Risk Prediction File, a file which included data on 170 variables that described each of nearly 3,000 male Non-Aboriginals released in 1983/84<sup>10</sup>.

- 
9. The statistical techniques underlying the Nuffield, Burgess and Linear Regression techniques are explained in other project reports. It is assumed here that the reader is familiar with those reports.
  10. In fact, the regression analysis was performed on a subset of the 170 variables — a subset of variables having a statistically significant Pearson correlation with General Release Risk (using a two-tailed .01 test of significance).

However, the regression analysis resulted in only 10 variables being included in the regression equation because they were found to have an independent statistically significant relationship with Broad Violent release Risk — that is, independent of, and in addition to, the effects of other variables. Inclusion of additional variables did not improve the statistical predictive qualities of the regression.

The included variables, the order in which those variables entered the equation<sup>11</sup>, and the values of the corresponding regression coefficients<sup>12</sup> are shown in Figure 3.1. For purposes of comparison, Figure 3.1 also shows the variables that were found to make a statistically significant contribution (in analogous regression equations) to predictions of *General Release Risk*<sup>13</sup>, and those variables (denoted by an "(N)") that are used by the Nuffield system to predict General Release Risk.

The variable that statistically explained the largest part of the variation in Broad Violent Release Risk was:

*1st the Security Classification of the Releasing Institution.*

That variable that also played a significant role in **both** the Nuffield and the Regression systems for predicting General Release Risk. In fact Security Classification was the third variable to enter the General Release Risk regression equation.

The next variable that explained the most variation in Broad Violent Release Risk — after the effects of Security Classification were accounted for — was

*2nd the total number of all convictions for Robbery offences in the prime term.*

Although this second variable played a significant role in predicting General Release Success in the Nuffield System, it **did not** play a significant role in the alternative regression based system for predicting General Release Risk.

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11. The (Step-wise Ordinary Least Squares Linear Regression) procedures used to calculate the Broad and Narrow Violent regression equations were identical to those described in the companion project report for General Release Risk for Non-Aboriginals. All discriminant and regression analysis was performed on a microcomputer using SPSS/PC+ (Versions 3.1, 4.0 and 4.1). In addition, certain bivariate statistical tests and other data manipulation were performed using custom programs written in MS Fortran. All graphs in this report were prepared with Lotus Freelance Plus (V.3.01) and all word processing used WordPerfect (V5.1).

12. The total sample of 2909 male Non-Aboriginal cases was split into a **Construction** sample (1455 cases) and a **Validation** sample (1454) — with the regression coefficients estimated using data from the Construction sample only.

Further, since the regression exercise was structured so that the dependent variable took on a higher value if the offender failed after release, a positive coefficient for any predictor variable indicates that the General Release Risk *increases* with increases in the values of the predictor variable.

13. Figure 3.1 also shows the variables that were found to make a statistically significant contribution (in analogous regression equations) to predictions of *Narrow Violent Release Risk*. However, these latter results will be deferred to the next Chapter.

Figure 3.1

Coefficients & Order of Entry of Significant Variables							
Variable/ Description	General Release Risk	Broad Violent	Narrow Violent	Variable/ Description	General Release Risk	Broad Violent	Narrow Violent
<b>PRIOR CRIMINAL RECORD</b>				<b>CURRENT TERM ADMISSION</b>			
(N) Total of All Previous Custodial Sentences	+ ( 7)			(N) Age of Inmate at Prime Term Admission	- (6)	- (4) .006766	- (4) .003921
Total # of all previous Summary & Indictable Convictions				(N) Time at Large before prime term admission	- (1)		
(N) - Drugs	+ (11)			Total # of all Prime Term Summary and Indictable Convictions for:			
(N) - Break and Enter	+ (15)			(N) - Drugs	- (10)		
(N) - Property	+ ( 2)			(N) - Break & Enter	+ (14)		
(N) - Weapons	+ ( 9)	+ (7) .046865	+ (5) .035111	(N) - Escapes/ Failures	+(4)		
(N) - Escapes/ Failures	+ ( 5)	+ (3) .018590	+ (1) .024765	(N) - Property			
(N) - Against Person		+ (8) .026300	+ (3) .029367	(N) - Robbery		+ (2) .042417	
(N) - Violent Sexual			+ (8) .084525	- Against Person			+ (6) .043316
Previous CSC Penitentiary Terms		+ (5) .026317		(N) Prime Term Aggregate Sentence (maximum = 10950 days)	- (8)	- (9) 1.24E-05	
Total Number of Summary & Indictable Convictions During the Last 5 Years				(N) Security Classification of Releasing Institution	+ ( 3)	+ (1) .142164	+ (2) .054960
(N) - Property	+ (13)	+ (6) .051622		Total Number of Previous convictions for (Section 20)			
(N) - Robbery		+ (10) .020399	+ (7) .018585	(N) Revocation Offences	+ (12)		
(N) - Motor Vehicle			- (9) .195546				
(N) - Violent Sexual							
Total Number of Summary & Indictable Convictions During the most recent set of sentence dates preceding the prime term for:							
(N) - Break and Enter	- (16)						
(N) - Violent Sexual			+ (10) .199901				

Next, as was the case for Security Classification, four additional variables that entered the Broad Violent Release Risk regression —

- 3rd the total number of all previous convictions for Escapes/Failures,*
- 4th the Age of the inmate at Prime Term Admission,*
- 7th the total number of all previous convictions for Weapons, and*
- 9th Aggregate Sentence for the Prime term —*

also played a significant role in **both** the Nuffield and Regression systems for predicting General Release Risk.

It is also of interest that each of these variables had the same directional impact in all three prediction systems. Both the Nuffield and Regression General Release Risk systems and the Broad Violent Regression Release Risk systems indicate that Risk **decreases** with increases in both

- 4th the Age of the inmate at Prime Term Admission, and*
- 9th Aggregate Sentence for the Prime term.*

Increases in the two other variables (and all other variables in the Broad Violent Risk system) were associated with **increases** in Broad Violent Risk.

On the other hand, four other Broad Violent Release Risk regression predictor variables —

- 5th the number of previous CSC Penitentiary terms,*
- 6th the total number of convictions during the last 5 years for Robbery Offences,*
- 8th the total number of all previous convictions for Against the Person Offences, and*
- 10th the total number of convictions during the last 5 years for Motor Vehicle Offences —*

did not play a statistically significant role in **either** the Nuffield or the Regression based systems for predicting General Release Risk.

In summary therefore, certain variables that were useful for predicting *General Release Risk* were also helpful in predicting *Broad Violent Release Risk*. However, to predict Broad Violent Release Risk also requires information on additional variables that were not found useful in the Nuffield and/or the regression General Release Risk systems.

Conversely, information that was of predictive value for the Nuffield and/or General Release Risk systems was **not** found to be of value for predicting Broad Violent risk. The two most obvious examples include the two variables that statistically were the first and second most important in explaining the variation in General Release Risk:

- *Time at Large before Prime Term Admission, and*
- *Total number of Previous convictions for Property Offences.*

### 3.3 Assessing Predictive Accuracy and Usefulness

#### 3.3.1 Regression Statistical Measures of Fit

Although those concerned with the ease and costs of implementing a risk prediction system would be concerned about the types of information going *into* a risk prediction system, a more important consideration would be the value of the predictions that are *produced* by the system. Other reports of this project stress that no one measure is likely to be able to measure this value. In addition, although the purely statistical properties of a prediction system cannot be ignored, of more importance are measures of the practical usefulness of a prediction system — in situations that are policy or operationally *relevant*.

Figure A3.2 in the Statistical Appendix contains some of the more traditional statistics that measure the purely statistical accuracy with which the Regression Risk Prediction Scoring System "fits" (i.e., statistically explains) past variations in Broad Violent Release Risk. Certain of those statistics are presented in Figure 3.2<sup>14</sup>.

Figure 3.2

```

Non-Aboriginal Broad Violent Release Risk:
Statistics from Step 12 of Regression

Equation Number 1      Dependent Variable..  SUCFAIL3
                               SUCC/FAIL 3: BROAD VIOLEN

Variable(s) Entered on Step Number 12..
LASOFF11 LAST 5 YR TYPE 11 OFF->MOTOR VEHICLE

Multiple R              .30266
R Square                .09160                R Square Change      .00229
Adjusted R Square       .08527                F Change             3.61385
Standard Error          .37557                Signif F Change      .0575

Analysis of Variance
                    DF      Sum of Squares      Mean Square
Regression          10      20.39706            2.03971
Residual            1434     202.26730           .14105

F =          14.46075      Signif F = .0000

```

The level of "fit" using these statistics (i.e., an adjusted  $r^2$  of .085 or a Standard Error of .376) does not compare at all favourably with the levels considered reasonable in areas such as economic or demographic model building or forecasting. The level of fit is also considerably below that found in other parts of this project for regression systems to predict *General Release Risk* for Non-Aboriginals (i.e., an adjusted  $r^2$  of .243 or a Standard Error of .435).

14. The statistics shown are from step 12 in the Stepwise Regression procedure. Since one of the previous steps resulted in a variable being *removed* from the equation, only 10 variables are in the equation at step 12.

It is well recognized that it is far more difficult to build models that statistically explain past variations in release risk than it is to build models that statistically explain past variations in economic production and employment and demographic change — and it seems it is more difficult to predict *Broad Violent* Release Risk than *General* Release Risk. However, despite these mitigating circumstances, these levels of statistical accuracy do raise concerns about the value of this particular prediction system.

However, before making a final evaluation, one should consider what have been argued in other project reports as being more policy and operationally relevant measures of the accuracy of risk prediction instruments. It is to these that the discussion will now turn.

### 3.3.2 Release Risk vs Risk Scores

Figure 3.3 begins that part of the discussion by showing the Broad Violent Release Success Rates that were experienced by offenders who had different Broad Violent Regression Risk Scores — those scores being calculated using the Regression Broad Violent Risk Scoring System<sup>15</sup>.

As noted earlier, the sample of offenders in the Risk Prediction File were split into two roughly equal samples. Data from the first, the *Construction*, sample were used to estimate the parameters of the Broad Violent Regression Risk Scoring System. Data from the second, the *Validation*, sample were then used to test whether the system was "robust" enough to retain its ability to predict release risk across different groups of offenders — and especially groups other than the ones in the *Construction* sample.

For the 76% of the sample of releases in the *Construction* Sample with Broad Violence Risk Scores of 38 through 50, Figure 3.3 shows a clear relationship between Regression Risk Scores and Broad Violence Release Success Rates<sup>16</sup> — with Broad Violent Release Success Rates falling fairly regularly (from 100% to 72%) as risk scores rise. However, the relationship between Regression Risk Scores and Broad Violence Release Success Rates becomes rather erratic for releases with risk scores in the higher range of between 51 and 63.

An examination of the data in Figure 3.3 also suggests the 5 category Risk Rate Score grouping shown in Figure 3.4. Although the *Lowest Risk* subgroup contains only 4% of the releases, the other four subgroups are reasonably large.

At one extreme (for the *Construction* sample), the Regression Risk Scores isolate one group of *Lowest Risk* offenders who represent 4% of all offenders and who have an average Broad Violent

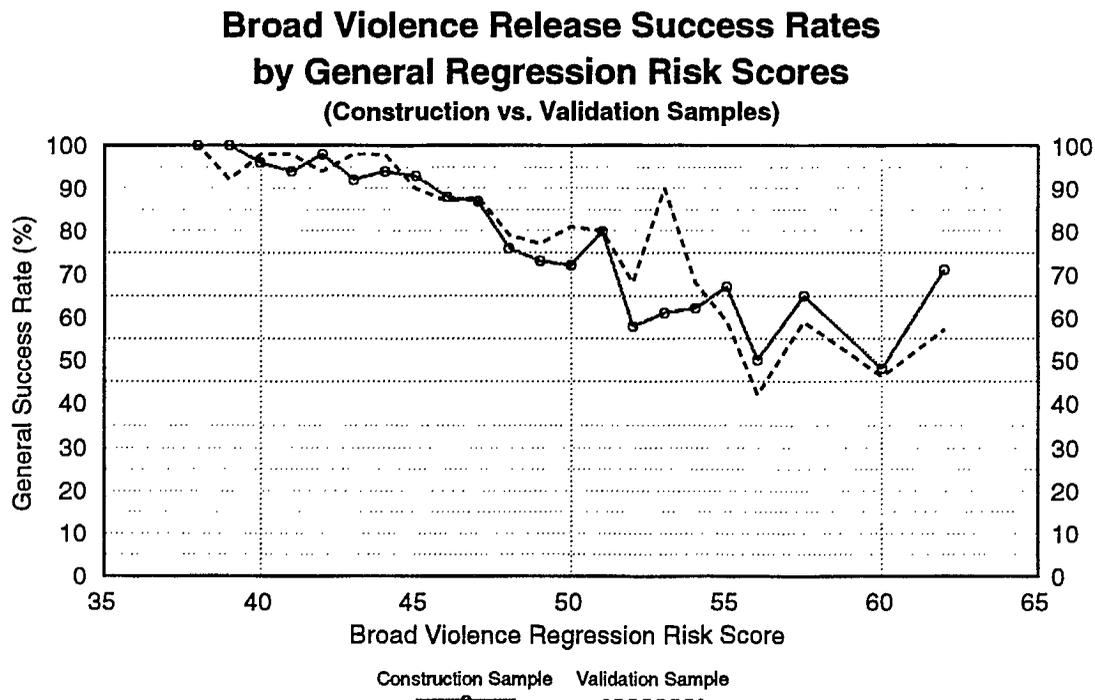
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15. The statistics required to produce all figures in this section can be found in Figure A3.3a, A3.3b and A3.3c in the Statistical Appendix.

It should also be noted that, to facilitate the presentation of results, all "raw" Regression Risk Scores have been multiplied by "40" and converted to the nearest whole number. In addition, all resulting scores less than "38" have been converted to "38", and all scores above "62" have been converted to "62".

16. Note that the following graphs in this section show Success (rather than Failure) rates.

Figure 3.3



Construction and Validation Samples of  
Male Warrant of Committal Admissions  
Released in 1983/84

Success Rate of 100%. At the opposite extreme, the Regression Risk Scores identify a different group of the *Highest Risk* offenders who represent 19% of all offenders and who have an overall success rate of only 60%.

Although this difference between the Lowest and Highest risk groups is not inconsequential, it is considerably smaller than the difference that was produced by the regression scoring system that was developed for General Release Risk. For the latter type of risk, the scoring system identified 24% of the offenders as *Lowest Risk* and 17% of the offenders as *Highest Risk*. The success rates of the two groups differed by (88% - 15% =) 73 percentage points — as opposed to a comparable difference of only (100% - 60% =) 40 percentage points for the Broad Violent Risk system.

A more important shortcoming of the Broad Violent scoring system is that it fails to identify any group — let alone a sizeable group — of inmates that can be identified as *very likely* to commit a violent offence. In fact, none of the Broad Violent Risk Scores are associated with a group of offenders with chances of success of less than 50%<sup>17</sup>. This poses obvious difficulties for

17. ...with the exception of the 48% success rate associated with the Broad Violent Risk Score of "60".

decision-makers who might have understandable difficulties in denying parole to, for instance, the *Highest Risk* group when over half of that group would be expected to succeed using this Broad Violent risk criterion<sup>18</sup>.

Since identifying offenders with a high propensity for committing violent offences after release would be one of the main objectives in developing a Violent Risk prediction system, this shortcoming is particularly important.

Figure 3.4

Broad Violent Release Success Rates for Different Groupings of Cases (Groupings based on Regression Risk Scores)						
General Regression Risk Score	Construction Sample		Validation Sample		Total Sample	
	Range (average)	% of cases	Range (average)	% of cases	Range (average)	% of cases
Lowest Risk up to 39	100 — 100% (100%)	4%	100 - 92% (97%)	4%	100 - 95% (98%)	4%
Moderate Risk 40 - 45	96 - 92% (94%)	27%	98 - 90% (95%)	28%	97 - 92% (95%)	28%
Mid- Risk 46 - 47	88 - 87% (87%)	22%	88 - 87% (88%)	21%	88 - 87% (88%)	21%
High Risk 48 - 51	80 - 72% (73%)	28%	81 - 77% (79%)	28%	80 - 75% (77%)	28%
Highest Risk 52 & Up	71 - 48% (60%)	19%	90 - 42% (65%)	19%	76 - 45% (62%)	19%

Next, one of the additional problems usually encountered by risk prediction exercises is that the prediction scoring systems that are developed using one sample of offenders usually do not work as well when used to predict the risks associated with a different sample of offenders.

Examination of Figure 3.3 and Figure 3.4 indicates that this problem was also encountered by this study. The risk scoring system that was developed using the Construction sample was used to assign risk scores to each case in the Validation sample. The Broad Violent Release Success Rates for cases having the same individual risk scores were then calculated and the results were used to plot the validation curve in Figure 3.3. Grouping Validation sample cases according to the 5 different ranges of risk scores allowed the creation of the middle columns of Figure 3.4.

The risk scores divide up the Validation sample (according to the 5 groups of scores) in very similar proportions to the manner in which the Construction sample was divided. In addition, the relationship between the resulting scores and Broad Violent Release Risk for the Validation sample

18. On the other hand, given the nature of the violent risk criterion, other decision makers might feel that a threshold of acceptable risk of higher than 50% would be more than appropriate.

was very similar to that for the Construction sample. However — although the results are still more than acceptable for use in assisting parole decision-making — the Regression Scores did not fare as well in the Validation sample in terms of isolating the highest and lowest release risks.

For instance, the *Lowest Risk* and *Moderate Risk* groups for the Construction sample had average Broad Violent Release Success Rates of 100% and 94%, respectively. However, in the Validation sample there was little difference (i.e. 2 percentage points) between the average success rates for those two groups. At the other extreme, the success rates for the *High* and *Highest Risk* group in the Validation sample (79% and 65%) were 6 and 5 percentage points above the average risk for the analogous groups from the Construction sample (73% and 60%)<sup>19</sup>.

However, on the whole there does not seem to be any cause for major concern regarding any loss in predictive accuracy between the construction and validation sample.

### 3.3.3 Dynamic tests of Predictive Usefulness

Next, Figure 3.5 compares the accuracy of the Regression Scoring System for the construction and validation samples using as criteria the *Dynamic Parole Success Rate* and the *Dynamic Total Error Rate*<sup>20</sup>. As shown in the companion project reports these *dynamic* indicators provide an important perspective for evaluating prediction systems — a practical perspective of particular importance to policy and operational planners and decision makers.

The validation sample had a slightly higher overall average Broad Violent Release Success Rate, 83% compared to 81% for the construction sample. Nonetheless, when Regression Risk Scores are used to select inmates for parole, the Dynamic Parole Success Rates for the best risk inmates released from the validation sample are very similar to those for the construction sample — although they are slightly higher at overall parole rates above 65%.

Similar conclusions apply when one examines the total number of decision errors (i.e. released failures plus denied successes) at different overall parole rates— as measured by the Dynamic Total error Rate in Figure 3.5.

It is also worth noting that the Dynamic Total Error Rate curves in Figure 3.5 decrease steadily from very low to very high rates of parole. This pattern is in contrast to the "U" shape exhibited

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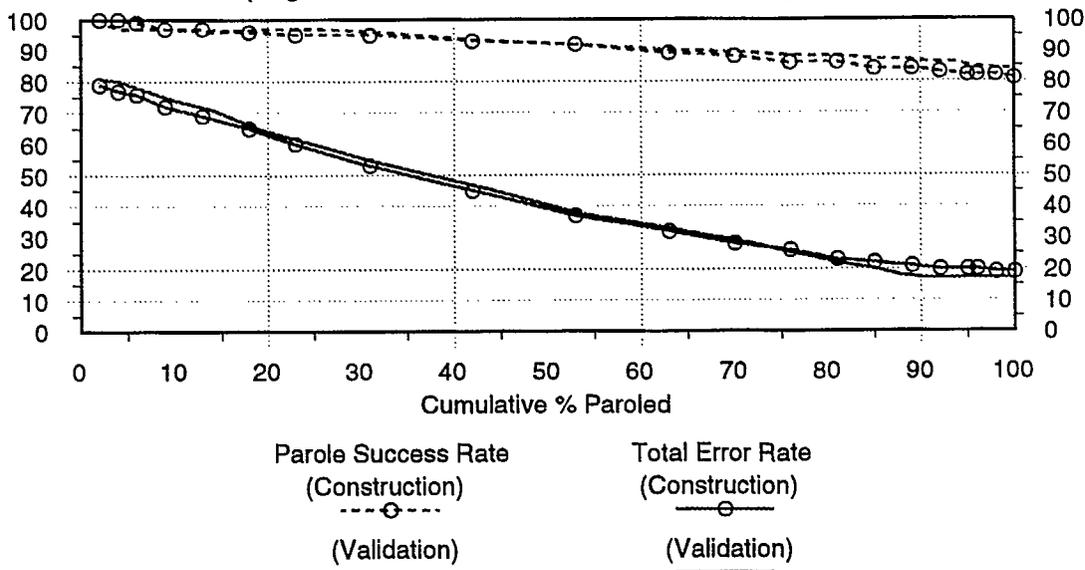
19. The range shown for the Highest Risk Group for the validation sample is "90 - 42%". If the "90%" figure were found for a significant group of offenders, a major problem would exist for the scoring system. In fact, the "90%" score was very atypical of that group and was exhibited by only 3% of the sample with a regression risk score of "53".

This atypical value for those with a risk score of "53" also accounts for much of the above noted increase in the average risk score for the *Highest Risk* group between the Construction and Validation samples.

20. Descriptions of the *Dynamic Total Error Rate*, the *Dynamic Parole Success Rate*, and the *Dynamic Relative Improvement Over Chance* can be found in the companion project report that focuses on General Release risk for Non-Aboriginals.

Figure 3.5

**Broad Violent Dynamic Total Error Rate and  
Dynamic Parole Success Rates  
(Regression: Construction vs Validation Samples)**



Construction and Validation Samples of  
Male Warrant of Committal Admissions  
Released in 1983/84

by the analogous *General Release Risk* Dynamic Total Error Rate shown in the companion project report. In the case of *General Release Risk*, as one increased the overall parole rate from very low levels to levels in the 35% range, the Dynamic Total Error Rate fell — i.e., at each increase in the parole release rate, the decrease in the number of inmates denied parole who would have been successful on release (denial/successes) was greater than the increase in the number of inmates who were paroled and who failed after release (release/failures). However, after a certain point the Dynamic Total Error Rate began to increase — i.e., further increases in the parole release rate each resulted in an increase in release/failures that was greater than the decrease in denial/successes. The main policy implication of this "U" shape of the Dynamic Total Error curve was that one could identify an "optimum"<sup>21</sup> parole rate between 0% and 100% at which the total number of decision errors would be minimized.

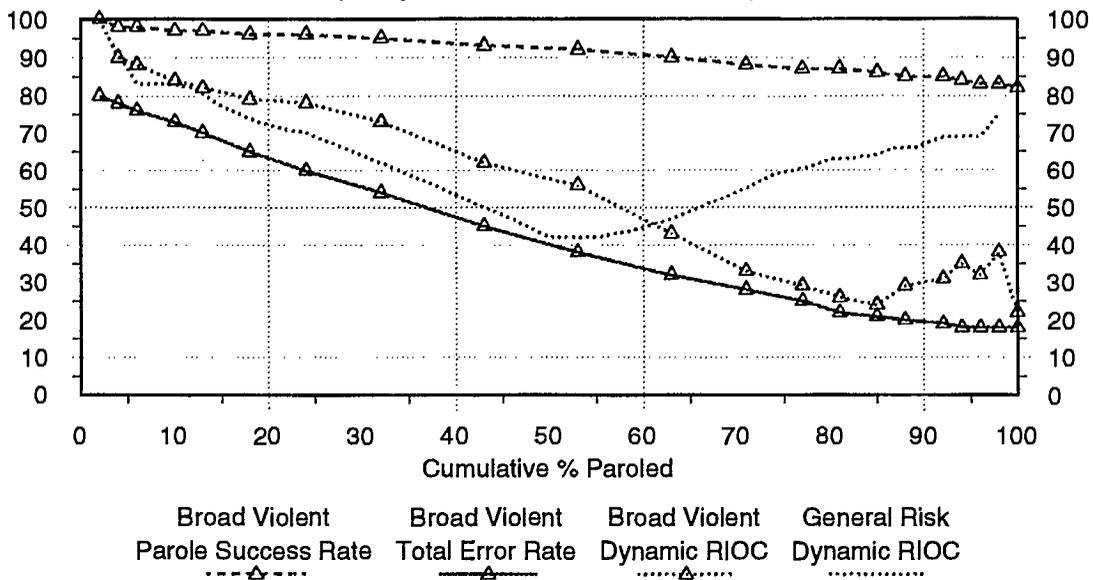
In contrast here, the only policy implication one could draw from the monotonically decreasing shape of the Dynamic Total Error Rate for Broad Violent Release Risk would be to release *all* such inmates (to minimize the total number of denial/success and release/failure errors).

21. ....optimum in terms of this one criterion.

Finally, again as noted in other project reports, there is an argument to be made for comparing different risk prediction systems using a statistic that takes into account, not only the overall likelihood of release success or failure (the base rate), but also the rate at which offenders are released to parole (the selection rate). The statistic commonly used for this purpose, the Relative Improvement Over Chance (RIOC), is usually measured at the "optimum" parole rate. The improved version of this statistic that was developed for the current project, the *Dynamic* Relative Improvement Over Chance (DRIOC), is measured at *all* parole rates. The latter measure is presented<sup>22</sup> in Figure 3.6.

Figure 3.6

**Broad Violence Dynamic RIOC, Total Error Rate  
and Parole Success Rates  
(Compared to General Risk DRIOC)**



Construction and Validation Samples of  
Male Warrant of Committal Admissions  
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As can be seen, the values taken by the DRIOC vary substantially from one parole rate to another. However, for Broad Violent Release Risk these values fall fairly regularly - from 100% at a parole rate of 2%, to 24% at a parole rate of 85%. For the sample of offenders that was used in this study, roughly 50% were released to parole. At that parole rate the DRIOC took a value of approximately 60%.

22. The data in that Figure, and for the next two Figures is based on the combined (construction plus validation) sample of all offenders in the data base.

For purposes of comparison, Figure 3.6 also shows the values taken by the Dynamic Relative Improvement over Chance (DRIOC) that were calculated for the General Release Risk regression prediction system that was presented in the companion project report. The General Release risk DRIOC took a value of just over 40% at a parole rate of 50%. However, since the two DRIOC's refer to two considerably different types of release risk, any detailed comparisons should be done with caution<sup>23</sup>.

### 3.3.4 Risk and Actual Parole Decisions

In evaluating scoring systems developed to predict other types of release risks, other project reports contain detailed examinations of the extent to which actual parole release decisions were consistent with the predicted risk for different offenders.

Such a detailed examination for Broad Violent Release Risk is beyond the scope of the current report<sup>24</sup>. Instead, the discussion will be limited to a few simple observations.

First of all, in other project reports, it was found that the Parole Board granted parole to relatively high proportions of inmates having low *General Release Risk Prediction Scores* — and to relatively low proportions of inmates having high *General Release Risk scores*.

For this report, for each inmate a *Broad Violent Release Risk* score was calculated using the regression scoring System described earlier in this report. For inmates with different risk scores (i.e., predicted risk level), Figure 3.7 then shows the percent of those inmates who were actually paroled, and the percent of those inmates (with the same risk score) who actually succeeded after release (i.e., were not convicted of a Broad Violent offence).

Figure 3.7 shows that there is clearly a relationship between actual parole decisions and predicted *Broad Violent Release Risk* (as predicted by the regression risk prediction system described earlier in this report).

The dashed line shows that, as the Broad Violent Regression (predicted) Release Risk Scores increase, the (actual) probability of inmates' succeeding after release falls — from close to 100% for inmates with the lowest regression Scores, to below 60% for scores of "56" and higher.

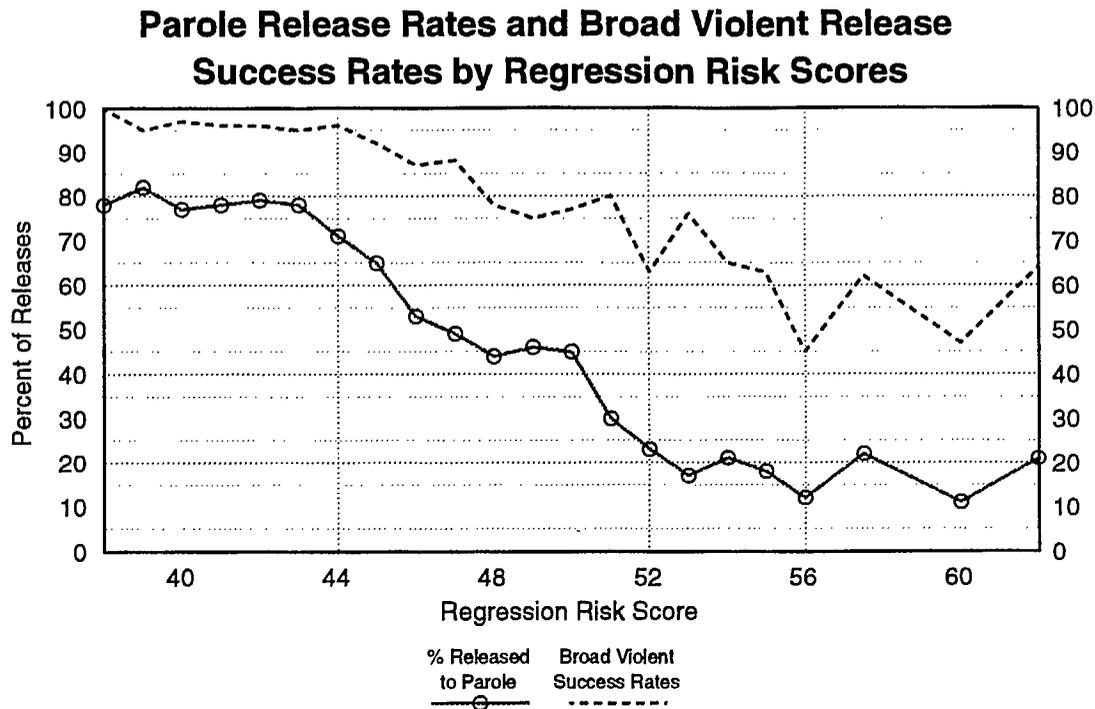
However, of more interest to the current discussion, the solid line in Figure 3.7 shows that, as the risk scores increase (i.e., predicted release risk increases) from "39" to "53", the percent of inmates

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23. As shown here, if one were to use the DRIOC as the standard for comparison, the *Broad Violent Regression Release Risk* prediction system outperformed the *General Regression Release Risk* prediction system within the range of parole release rates that are most relevant to current and recent parole release activities (i.e. between 12% and 60% parole release rates). However, this result highlights one of the limitations of the DRIOC as an indicator of the *policy and operational usefulness* of prediction instruments. As is evident from the previous analysis, the Broad Violent Regression Risk prediction system scores higher on the DRIOC measure — not because it produces more accurate predictions — but because of the much higher overall "base rate", and therefore the increased difficulty of producing predictions that improve on chance.

24. However, the interested reader will find the data necessary for such an analysis in the Appendix to this report.

Figure 3.7



Construction and Validation Samples of Male Non-Aboriginal Warrant of Committal Admissions Released in 1983/84

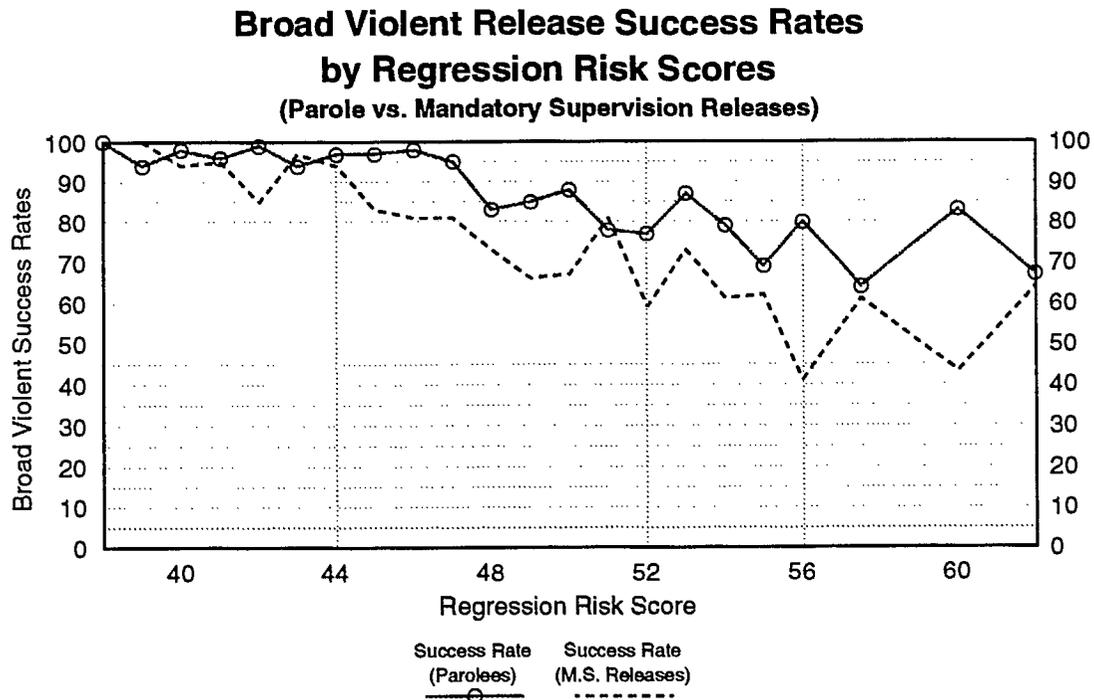
released to parole falls steadily. 82% of the inmates with Broad Violent Release Risk Scores of "39" were actually paroled. However, only 17% of the inmates with Broad Violent Release Risk Scores of "53" were paroled.

Thus, actual Board decisions for inmates in our sample are consistent with the hypothesis that different Broad Violent Release risks associated with different individual inmates already play a significant role in the process of deciding whether or not to release different groups of inmates to parole<sup>25</sup>. Therefore, use of a risk prediction system such as those considered in this report would not represent a major change in the *general direction or principles* of parole decision-making.

Figure 3.8 addresses an additional observation that was made in other project reports. The Figure again shows the actual Broad Violent Release Success Rates of offenders who had different Broad Violent regression Risk Scores — but separately for offenders released to parole and for offenders denied parole and released later on Mandatory Supervision.

25. Although it should be noted that for scores higher than "53" the relationship between predicted release risk and actual percent paroled virtually disappears.

Figure 3.8



Construction and Validation Samples of  
Male Non-Aboriginal Warrant of Committal  
Admissions Released in 1983/84

As was found in the investigations of other types of release risk in other project reports, the most obvious conclusion is that, when faced with a group of offenders with the same *statistically* predicted Broad Violent risk (i.e., with the same Broad Violent regression Risk Score), the Parole Board was able to divide that group into two subgroups: one subgroup (i.e., the subgroup who were paroled) with better chances of success than the other subgroup (i.e., the subgroup who were not paroled). In other words, in most cases for **any specific level of predicted risk**, those inmates who were paroled had better actual success rates than those inmates who were not paroled.

Given any specific level of *predicted* Broad Violent risk, the actual Parole Board decisions improved on the statistical risk predictions<sup>26</sup>.

26. As noted in other project reports, it is, of course, possible that the differences in success rates are due to other factors not considered here. For instance, if parolees received better remedial treatment than M.S. releases, or if parolees were less closely monitored by the authorities than were parolees, then one would expect parolees to exhibit higher (reported) success rates than would M.S. releases — even if they represented similar levels of risk at time of release. However, determining which of the possible alternative hypotheses best explains the data requires analysis that must be left to later projects.

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For reasons discussed at length in other project reports, this capability does **not** necessarily mean that the Parole Board **overall** made better risk predictions than would a Board which relied solely on the statistical risk scoring system. However, the finding does strongly imply that the *best* system for predicting risk *might* in at least some circumstances combine the contributions of **both** the information provided by a statistical risk scoring system **and** the additional expertise and experience of parole Board members.

### 3.4 Concluding Comments

The analysis in this Chapter leads towards a number of conclusions.

First of all, certain variables make a significant contribution to the prediction of both *General* Release Risk and *Broad Violent* Release Risk. However, predictions of *Broad Violent* release risk are improved by information on variables that are not helpful in predicting *General* Release Risk, and vice versa.

Second, although the regression risk prediction system developed for this project does add to our understanding of Broad Violent risk prediction, and does improve our ability to predict this type of risk, there is certainly room for subsequent projects to improve our ability to predict Broad Violent risk.

Third, actual Parole Board release decisions do seem to be related to the predicted risk of Broad Violent recidivism.

Finally, there is an indication that the best method of predicting Broad Violent release risk would eventually involve using statistical risk scoring systems in combination with the expertise, experience and current decision making processes currently associated with Parole Board members.

## Chapter 4

### Narrow Release Risk

#### 4.1 Introduction

The previous Chapter addressed the problem of predicting *Broad* Violent Release Risk. This Chapter focuses on *Narrow* Violent Release Risk. The analysis will be of particular interest to those concerned with developing an ability to predict the chances of released offenders' committing the especially violent offences noted with an asterisk in Figure 2.1 earlier.

#### 4.2 Significant Predictors of Violent Risk

As for the Broad Violence regressions, the Narrow Violence Regression equation estimated for this report was based on data from the Risk Prediction File.

Again similarly to the case for Broad Violent Risk, the Narrow Violent regression analysis resulted in only 10 variables (of the 170 variables in the Risk Prediction File) being included in the regression equation. The inclusion of other variables did not significantly improve the ability of the equation to statistically explain Narrow Violent release risk.

The included variables, the order in which those variables entered the equation<sup>27</sup>, and the values of the corresponding regression coefficients are shown in Figure 3.1 presented earlier in Chapter 3. For purposes of comparison, Figure 3.1 also shows the variables that were found to make a statistically significant contribution (in analogous regression equations) to predictions of *General Release Risk*<sup>28</sup>, and those variables that are used by the Nuffield system to predict General Release Risk (denoted by an "(N)").

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27. The (Step-wise Ordinary Least Squares Linear Regression) procedures used to calculate the Narrow Violent regression equations were identical to those described earlier for the Broad Violent regressions and to those described in the companion project report for General Release Risk for Non-Aboriginals.

28. Figure 3.1 also shows the variables that were found to make a statistically significant contribution (in analogous regression equations) to predictions of *Broad Release Risk*. These latter results were discussed in the previous Chapter.

The variable that statistically explained the largest part of the variation in Narrow Violent Release Risk was:

*1st the total number of all previous convictions for Escapes/Failures,*  
That variable also played a significant role in **all three** of the other prediction systems referenced in Figure 3.1 — the Nuffield and Regression systems for predicting General Release Risk and the Regression system for predicting Broad Violent Risk. The total number of all previous convictions for Escapes/Failures was the third variable to enter the Broad Violent Release Risk regression equation and the 5th variable to enter the General Release Risk equation.

The next variable that explained the most variation in Narrow Violent Release Risk — after the effects of Number of previous Escapes/Failures were accounted for — was

*2nd the Security Classification of the Releasing Institution.*  
This variable also played a significant role in **all three** of the other prediction systems referenced in Figure 3.1. In fact, Previous Escapes/Failures was the first variable to enter the Broad Violent Release Risk regression equation and the third variable to enter the General Release Risk equation.

The third and seventh variables to enter the Narrow Violent Risk regression —

*3rd the total number of all previous convictions for Against the Person Offences,* and  
*7th the total number of convictions during the last 5 years for Motor Vehicle Offences* — did not play a statistically significant role in **either** the Nuffield or Regression based systems for predicting General Release Risk. However, both variables were among the variables that played a significant role in the regression to predict Broad Violent Release Risk.

Next, as was the case for Number of previous Escapes/Failures and Security Classification, the fourth additional variable that entered the Narrow Violent Release Risk regression —

*4th the Age of the inmate at Prime Term Admission*  
also played a significant role in **both** the Nuffield and Regression systems for predicting General Release Risk and the regression system for predicting Broad Violent Release Risk.

However, although the fifth variable to enter the Narrow Violent regression —

*5th the total number of all previous convictions for Weapons* — also played a significant role in the Regression system for predicting General Release Risk and the regression system for predicting Broad Violent Release Risk, it did **not** play a role in the Nuffield system for predicting General Release Risk.

Finally, the four remaining variables that were significant contributors in the regression to predict Violent Release Risk most set the Narrow Violent risk prediction system apart from the other regression prediction systems developed for this project —

- 6th the total number of prime term convictions for Against the Person Offences,*
- 8th the total number of all previous convictions for Violent Sexual Offences,*
- 9th the total number of all previous convictions during the last 5 years for Violent Sexual Offences,* and
- 10th the total number of all previous convictions during the most recent set of convictions for Violent Sexual Offences.*

Although the last 3 variables played an important role in the Nuffield System for predicting General Release Risk, none of the four variables played a significant role in the General Risk or Broad Violent regressions.

It should also be noted that these last four variables underline the role of the offenders' having a previous history of Against the person and Violent Sexual Convictions in predicting Narrow Violent Risk.

In summary, certain variables that were useful in the Nuffield and regression efforts to predict *General Release Risk* and *Broad Violent Release Risk* were also helpful in predicting *Narrow Violent Release Risk*. On the other hand, predicting *Narrow Violent Release Risk* also requires information on additional variables that were not found useful in those other prediction exercises.

Conversely, information that was of predictive value for the Nuffield and Regression General Release Risk systems was not found to be of value for predicting Narrow (or Broad) Violent risk. The two most obvious examples include the two variables that statistically were the first and second most important in explaining the variation in General Release Risk:

- *Time at Large before Prime Term Admission*, and
- *Total number of Previous convictions for Property Offences*.

Finally, it is also of interest that whenever a variable was significant in more than one of the Nuffield, or Narrow Violent, Broad Violent, or General Violent Risk Regressions, that variable had the same directional impact in all the prediction systems.

### 4.3 Assessing Predictive Accuracy and Usefulness

The next task is to assess the practical usefulness of the Narrow Violence Regression prediction system — especially in situations that are policy or operationally *relevant*.

#### 4.3.1 Regression Statistical Measures of Fit

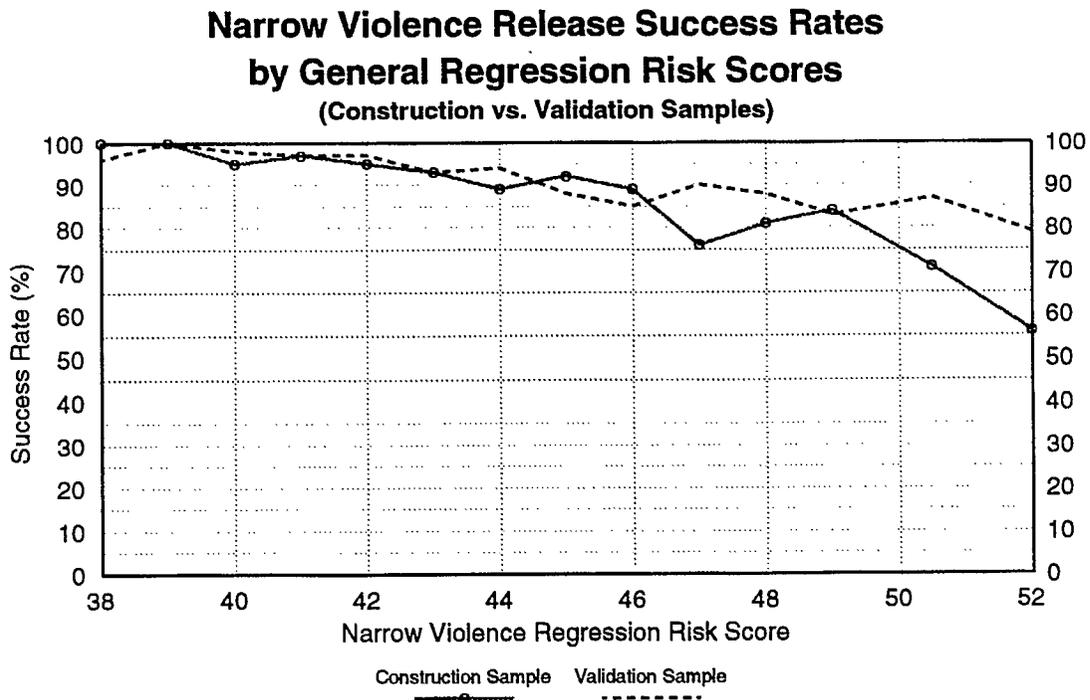
Figure A4.1 in the Statistical Appendix contains some of the more traditional statistics that measure the purely statistical accuracy with which the Regression Risk Prediction Scoring System "fits" the data used to statistically explain past variations in Narrow Violence Release Risk. Certain of those statistics are presented in Figure 4.1.

The level of "fit" using these statistics (i.e. an adjusted  $r^2$  of .060 or a Standard Error of .285) is even worse than that obtained for the Broad Violence regression in the previous Chapter — and it has already been noted that the Broad Violence regression did not compare favourably with the levels considered reasonable in areas such as economic or demographic model building or forecasting — or for that matter, with the level of fit achieved in this project by *General Release Risk* regressions. These results are therefore a source of considerable concern regarding the statistical acceptability of this regression on purely statistical grounds.

However, before making a final determination, one should evaluate the regression scoring system in terms of more policy and operationally relevant measures.



Figure 4.2



Construction and Validation Samples of  
Male Warrant of Committal Admissions  
Released in 1983/84

one would be hard pressed to think of any circumstances in there would be any differences in the policy or operational decisions that would be appropriate for a group of potential releases whose predicted chances of Narrow Violent Release Success were 100% — as compared to decisions appropriate for a group of potential releases with chances of Narrow Violent Release Success of 89%.

Secondly, only 14% of the offenders fell within the range of Narrow Violent regression scores of "47" to "52". Further, although the average Narrow Violent Release Risk (64%) of offenders within that group is below the average for other groups in Figure 4.3, the pattern of Narrow Violent Risk from low to high regression scores within that range (see Figure 4.2) is at best random.

Third, although an examination of the data in Figure 4.2 suggests the 4 category Risk Rate Score grouping shown in Figure 4.3, offenders are certainly not evenly distributed among the categories. In fact, 80% of the offenders fall within the *Moderate Risk* category. Finally, the most important shortcoming of the Narrow Violent scoring system is that it fails (even worse than did the Broad Violent system) to identify any — let alone a sizeable — group of

Figure 4.3

Narrow Violent Release Success Rates for Different Groupings of Cases (Groupings based on Regression Risk Scores)						
General Regression Risk Score	Construction Sample		Validation Sample		Total Sample	
	Range (average)	% of cases	Range (average)	% of cases	Range (average)	% of cases
Lowest Risk up to 39	100 — 100% (100%)	5%	100 - 96% (99%)	5%	100 - 98% (99%)	5%
Moderate Risk 40 - 46	97 - 89% (93%)	80%	98 - 86% (93%)	80%	97 - 87% (93%)	80%
Mid- Risk 47 - 49	84 - 73% (79%)	10%	90 - 83% (88%)	11%	84 - 83% (84%)	10%
High Risk 50 & Up	71 - 56% (64%)	5%	87 - 79% (83%)	5%	79 - 67% (74%)	5%

inmates that can be identified as very likely to commit a Narrow Violent offence. Even for the *High Risk* category of offenders — i.e. those with the lowest chances of success — nearly two in every 3 releases would **not** be expected to commit a Narrow Violent offence. Obviously, this would raise difficulties for decision makers who would be concerned about, for instance, denying parole to the *Risk* group when a strong majority of that group would be expected to succeed using this Narrow Violent risk criterion<sup>31</sup>.

Similar to the conclusion reached regarding Broad Violent Risk in Chapter 3 earlier, since identifying offenders with a high propensity for committing violent offences after release would be one of the main objectives in developing a Violent Risk prediction system, this shortcoming is particularly important.

Next, the project also investigated the extent to which a "shrinkage" in predictive accuracy occurs between a Construction sample and a separate, Validation, sample. The risk scoring system that was developed using the Construction sample was used to assign risk scores to each case in the Validation sample. The results are shown in Figure 4.2 and, for 4 different groupings of risk scores, the middle columns of Figure 4.3.

The information shown in both Figures indicates that the Narrow Violent regression equation exhibits this type of shrinkage problem often encountered in prediction studies.

31. On the other hand, as was noted in the discussion of the Broad Violence results, given the nature of the risk criterion, other decision makers might feel that a threshold of acceptable risk of higher than 50% would be more than appropriate.

The risk scores divide up the Validation sample (according to the 4 groups of scores) in very similar proportions (and in a similarly unbalanced manner) as was done for the Construction sample. In addition, the relationship between the resulting scores and Narrow Violent Release Risk for the Validation sample was very similar to that for the Construction sample. However, although the Regression Scores fare nearly as well in the Validation sample as far as picking out *Lowest Risks* is concerned, they did not do as well in picking out the (relatively) higher risks. More specifically, the *Mid-Risk* releases in the Validation sample had an average Narrow Violent Release Success Rate (88% - 79% = ) 9 percentage points above the average success rate of the *Mid-Risk* releases in the Construction Sample. Similarly, the *High-Risk* releases in the Validation sample had an average Narrow Violent Release Success Rate fully (83% - 64% = ) 19 percentage points above the average success rate of the *High-Risk* releases in the Construction Sample.

In summary, there does seem to be a sizeable drop off in predictive efficiency between the Construction and Validation samples.

### 4.3.3 Dynamic tests of Predictive Usefulness

Next, Figure 4.4 compares the accuracy of the Regression Scoring System for the Construction and Validation samples using as criteria the *Dynamic Parole Success Rate* and the *Dynamic Total Error Rate*<sup>32</sup>. As indicated earlier, these *dynamic* indicators provide an important perspective for evaluating prediction systems — a perspective of particular practical importance to policy and operational planners and decision makers.

The Validation sample had a slightly higher overall average Narrow Violent Release Success Rate — i.e., 93% compared to 90% for the Construction sample. Nonetheless, when Regression Risk Scores are used to select inmates for parole, the Dynamic Parole Success Rates for the best risk inmates released from the Validation sample are very similar to those for the Construction sample .

Similar conclusions apply when one examines the total number of decision errors (i.e., released failures plus denied successes) at different overall parole rates— as measured by the Dynamic Total error Rate in Figure 4.4.

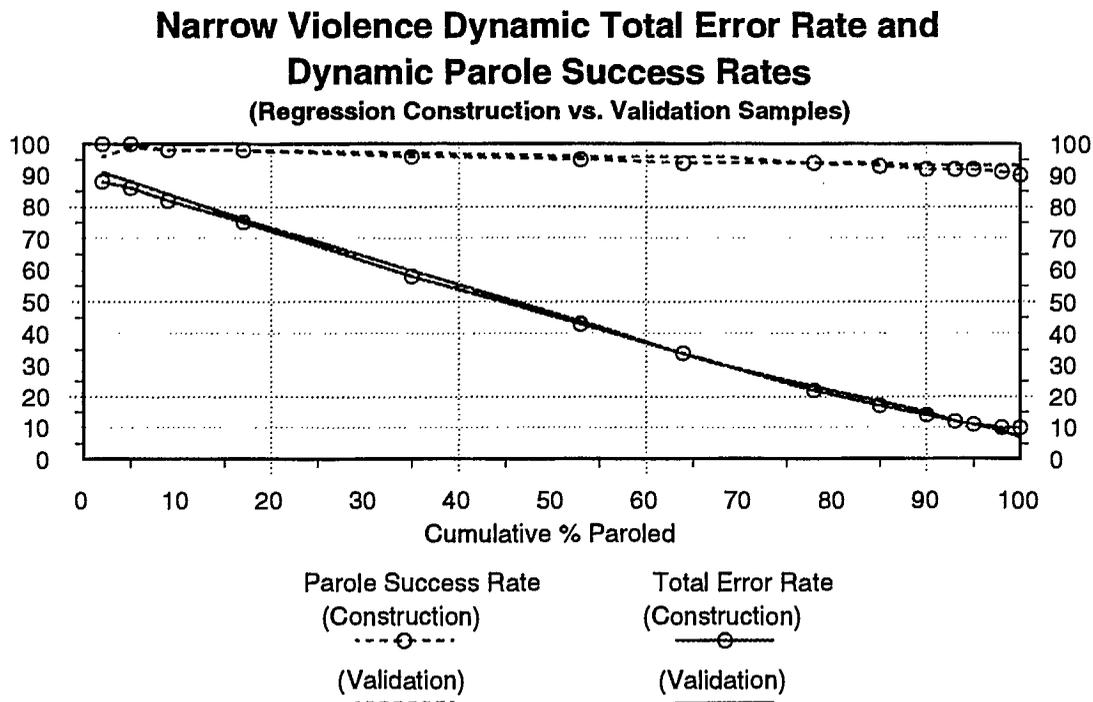
As was found in the Broad Violent risk analysis in the previous Chapter — the Dynamic Total Error Rate curves in Figure 4.4 decrease steadily from very low to very high rates of parole. This pattern is in contrast to the "U" shape exhibited by the analogous *General Release Risk* Dynamic Total Error Rate shown in the companion project. Given the monotonically decreasing shape of the Dynamic Total Error Rate for Narrow Violent Release Risk, to minimize the total number of denial/success and release/failure errors, one would have to release *all* the inmates.

Finally, as noted earlier, the Relative Improvement Over Chance (RIOCI) indicator takes into account, not only the overall likelihood of release success or failure (the base rate), but also the rate at which offenders are released to parole (the selection rate). The improved version of this

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32. Descriptions of the *Dynamic Total Error Rate*, the *Dynamic Parole Success Rate*, and the *Dynamic Relative Improvement Over Chance* can be found in the companion project report that focuses on General Release risk for Non-Aboriginals.

Figure 4.4



Construction and Validation Samples of  
Male Warrant of Committal Admissions  
Released in 1983/84

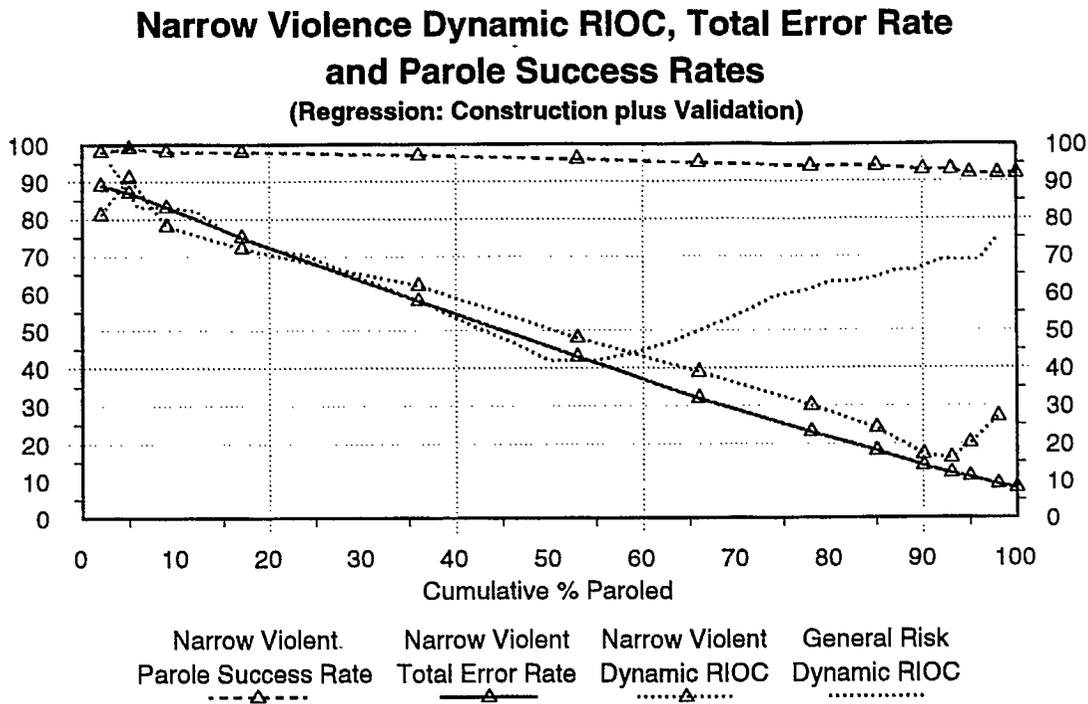
statistic, the *Dynamic Relative Improvement Over Chance (DRIOC)*, that was developed for this project is measured at *all* parole rates and is presented<sup>33</sup> in Figure 4.5.

As can be seen<sup>34</sup>, the DRIOC takes different values at different rates of parole, but falls fairly regularly - from 81% at a parole rate of 5%, down to 16% at a parole rate of 93% and then back up to 27% at a parole rate of 100%. For the sample of offenders that was used in this study, roughly 50% were released to parole. At that parole rate the DRIOC took a value of approximately 50%.

33. The data in that Figure, and for the next two Figures is based on the combined (construction plus validation) sample of all offenders in the data base.

34. Although it was calculated with reference to an effort to predict a different measure of release risk, for purposes of comparison Figure 4.5 also shows the values taken by the Dynamic Relative Improvement over Chance (DRIOC) that were calculated for the General Release Risk regression prediction system and were presented in a companion project report.

Figure 4.5



Construction and Validation Samples of  
Male Warrant of Committal Admissions  
Released in 1983/84

**4.3.4 Risk and Actual Parole Decisions**

A detailed examination of the extent to which actual parole release decisions were consistent with predicted Narrow Violent Release Risk is beyond the scope of the current report<sup>35</sup>. Instead, the discussion will be limited to a few simple observations.

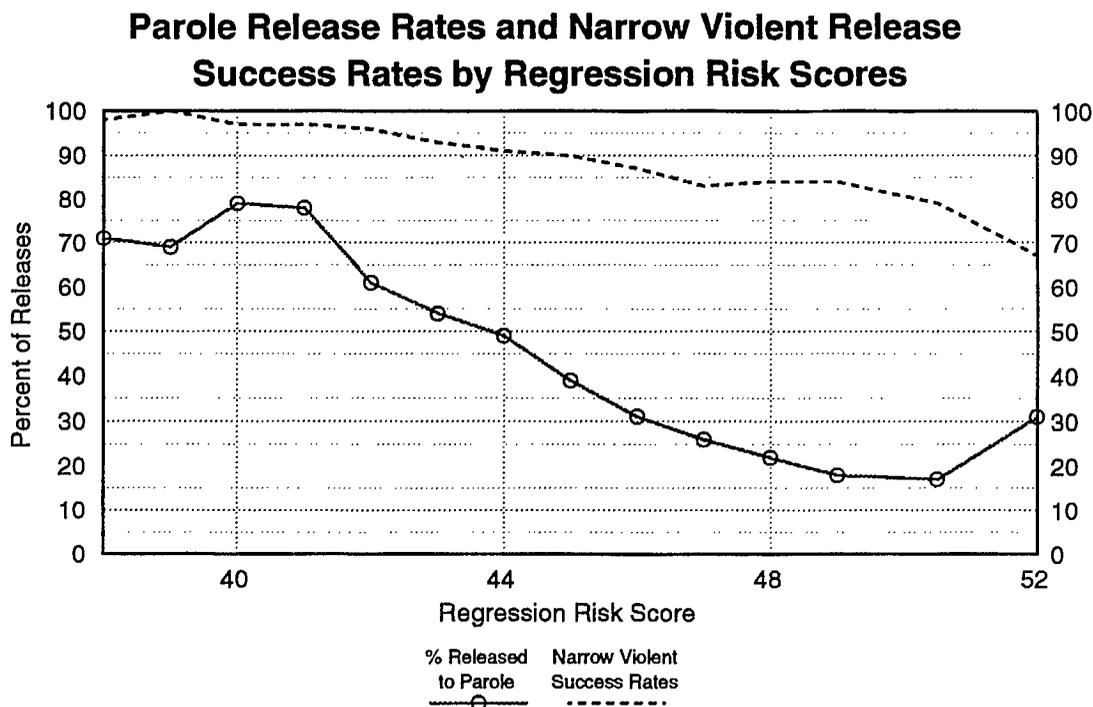
For each inmate a *Narrow Violent* Release Risk score was calculated using the regression scoring System described earlier in this Chapter. For inmates with different risk scores (i.e., predicted risk level), Figure 4.6 then shows the percent of those inmates who were actually paroled, and the percent of those inmates (with the same risk score) who actually succeeded after release (i.e., were not convicted of a *Narrow Violent* offence).

The dashed line in Figure 4.6 shows that, as the *Narrow Violent* Regression (predicted) Release Risk Scores increase, the (actual) probability of inmates' succeeding after release falls — from

35. However, the interested reader will find the data necessary for such an analysis in the Appendix to this report.

close to 100% for inmates with the lowest regression Scores, to below 70% for scores of 52 and higher.

Figure 4.6



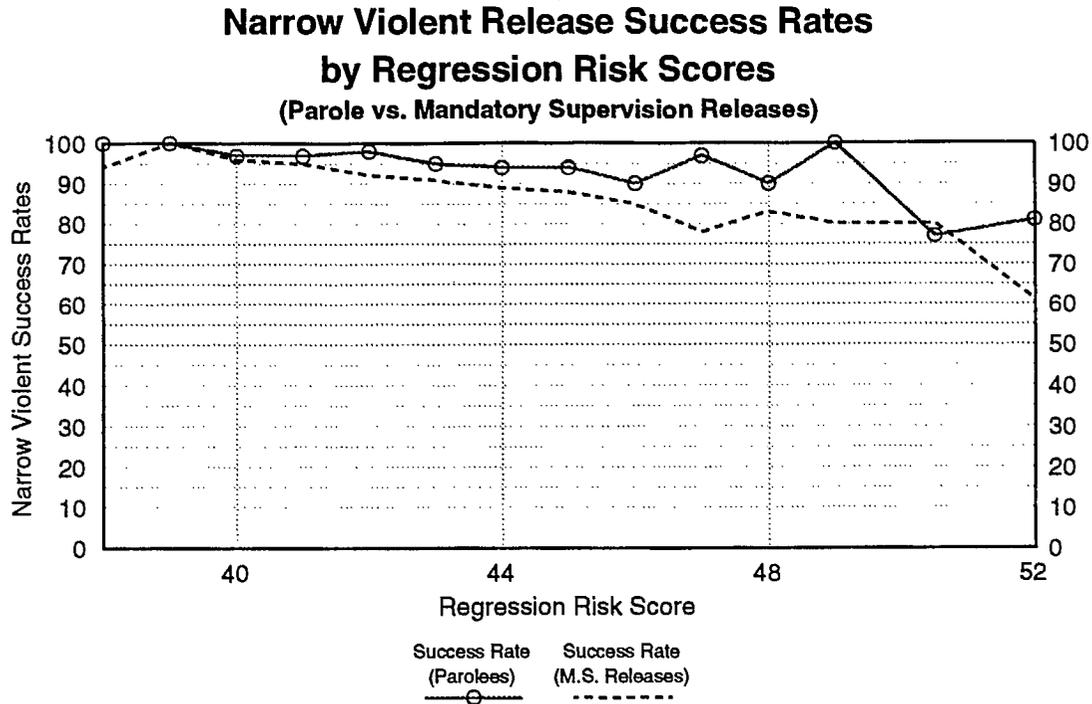
Construction and Validation Samples of Male Non-Aboriginal Warrant of Committal Admissions Released in 1983/84

However, of more interest to the current discussion, Figure 4.6 shows that there is clearly a relationship between actual parole decisions and predicted *Narrow Violent* Release Risk (as predicted by the *Narrow Violent* regression risk prediction scoring system). The solid line in Figure 4.6 shows that as the risk scores increase (i.e., predicted release risk increases) from "40" to "51" the percent of inmates released to parole falls steadily. Nearly 80% of the inmates with *Narrow Violent* Release Risk Scores of "40" were actually paroled. However, less than 20% of the inmates with *Narrow Violent* Release Risk Scores of "51" were paroled.

Thus actual Board decisions for inmates in our sample are certainly consistent with the hypothesis that different *Narrow Violent* Release risks associated with different individual inmates already (at least implicitly) play a significant role in the process of deciding whether or not to release different groups of inmates to parole. These results represent, therefore, further evidence that use of a risk prediction system such as those considered in this report would not represent a major change in the *general direction or principles* of parole decision-making.

Figure 4.7 addresses an additional observation that was made in other project reports. The Figure again shows the actual Narrow Violent Release Success Rates of offenders who had different Narrow Violent regression Risk Scores — but separately for offenders released to parole and for offenders denied parole and released later on Mandatory Supervision.

Figure 4.7



Construction and Validation Samples of  
Male Non-Aboriginal Warrant of Committal  
Admissions Released in 1983/84

Analogous to what was found in the investigations of other types of release risk in other project reports, the most obvious conclusion is that, when faced with a group of offenders with the same *statistically* predicted Narrow Violent risk (i.e., with the same Narrow Violent regression Risk Score), the Parole Board was able to divide that group into two subgroups: one subgroup (i.e., the subgroup who were paroled) with better chances of success than the other subgroup (i.e., the subgroup who were not paroled). In other words, in most cases for **any specific** level of *predicted* risk, those inmates who were paroled had better actual success rates than those inmates who were

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not paroled. Given any specific level of *predicted* Narrow Violent risk, the actual Parole Board decisions improved on the statistical risk predictions<sup>36</sup>.

For reasons discussed at length in other project reports, this capability does **not** necessarily mean that the Parole Board overall made better risk predictions than would a Board which relied solely on the statistical risk scoring system. However, the finding does strongly imply that the *best* system for predicting risk *might* in at least some circumstances combine the contributions of both the information provided by a statistical risk scoring system **and** the additional expertise and experience of parole Board members.

#### 4.4 Concluding Comments

This analysis of Narrow Violent risk completes the report. That analysis tends to support a number of conclusions.

First of all, certain variables make a significant contribution to the prediction of *General* Release Risk and both *Broad* and *Narrow Violent* Release Risk. However, predictions of *Narrow Violent* release risk are improved by information on variables that are not helpful in predicting the other types of Release Risk, and vice versa.

Second, the regression risk prediction system developed for this project does add to our understanding of Narrow Violent risk prediction. It also represents a modest improvement in our ability to predict this type of risk. However, on many criteria the regression system that was developed would require considerable improvement before it could be seen as making a significant contribution to conditional release operational and policy decision making.

On the other hand, the evidence is rather clear that actual Parole Board release decisions do seem to be already related (at least implicitly) to the predicted risk of Narrow Violent recidivism.

Finally, as with systems to predict other types of release risk, there is an indication that the best method of predicting Narrow Violent release risk would eventually involve statistical risk scoring systems in combination with the expertise, experience and current decision making processes of Parole Board members.

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36. However, the degree of improvement does not seem to be as large as for other types of release risk.

As noted for Broad Violent Risk earlier, it is of course also possible here that the "treatment" effect (of community supervision) could be overriding the "selection" (i.e. granting parole) effect.



