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RESEARCH REPORT

Identifying the Community High Risk Population for Allocation of the Program Integrity Funding

2019 N° R-424

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**Identifying the Community High Risk Population for Allocation of the Program Integrity
Funding**

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Executive Summary

Key words: *risk prediction; highest risk offenders; community supervision; RNR case supervision.*

The Correctional Service of Canada (CSC) has been receiving Treasury Board funding since 2007 to improve results with high-risk offenders in the community. Currently, the districts receive equal funding and have been allowed flexibility on how to use it. A standardized and empirically based method that defined the high-risk population for a more appropriate funding distribution was required. The goal was to allow for this funding to be incorporated into existing allocation mechanisms, promote successful reintegration, and ensure that interventions are targeted to high-risk populations in the community. Previous research (Thompson, Forrester, & Stewart, 2015) looked at factors related to community supervision outcomes to define the high-risk group for Indigenous and non-Indigenous men and women. Using this work as a foundation, the current project developed three models that empirically defined the highest-risk population for non-Indigenous men, Indigenous men, and federally sentenced women in order to support their safe transition to the community.

The final models were selected based on the strength of their association with reoffending, the feasibility of identifying the factors in the Offender Management System (OMS), and the parsimony of the model. We sought a procedure that would minimize false negatives so that fewer high-risk offenders would be misclassified as lower risk. A number of different procedures were examined, but the Decision Tree analysis was the easiest to understand and communicate and produced good predictability with only 3-4 factors in the models.

The models reliably predicted the highest-risk offenders. AUCs were in the moderate to high range and risk ratios demonstrated that the high-risk groups were 2 to 4 times more likely to reoffend than the average reoffending rate for the offender group. Of note, factors common to the three group of offenders included the risk rating on the CRI, substance misuse rating on the DFIA-R, and institutional misconducts. The high-risk group identified through this research are for the most part (over 80%) already being supervised at the highest levels of community supervision (Levels I, A residency, and A).

These findings highlight the importance of criminal history factors (CRI and institutional misconducts), but also of some key criminogenic needs, especially substance misuse, in contributing to reoffending for all offenders. Both the static factors and the dynamic factors included in the models reflect problems in self-control that can be mitigated with appropriate interventions. With respect to the Risk Needs and Responsivity (RNR) framework, identifying offenders at highest risk to reoffend is the first step in the application of the risk principle. The next step is to deliver an appropriate and higher intensity service to these high-risk offenders, which is the goal of the program integrity funding.

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Introduction

The overwhelming majority (over 95%) of offenders serving a federal sentence in Canada will spend at least part of their sentence under community supervision. In 2016-17, there were approximately 8,463 offenders (7,835 men and 628 women) living under supervised release in the community on day parole, full parole, or statutory release (Public Safety Canada, 2017). Community supervision, then, is the norm and the principle goal of community supervision is maximising public safety by preventing reoffending and facilitating offender reintegration.

In Canada, and in many other correctional constituencies internationally, correctional practice is guided by the framework defined by Andrews and Bonta (2010). This effective corrections model specifies that the social and personal costs of crime can be reduced by developing interventions that adhere to the risk, need and responsivity principles. The principles require that offenders assessed as high-risk be allocated to more intensive service (the risk principle), interventions target dynamic risk factors related to criminal behaviour (need principle), and, interventions be designed to maximize the effectiveness of the intervention by using cognitive and social learning principles and respecting individual differences related to culture, gender and cognitive style (responsivity principle).

Assessment of risk at the Correctional Service of Canada (CSC)

Risk factors associated with criminal recidivism are subsumed in the Central Eight described by Andrews and Bonta (2010), namely: antisocial history (criminal history variables), antisocial personality pattern, procriminal attitudes, procriminal associates, and needs in the employment/education, family/marital, leisure/recreation, and substance misuse domains. All the areas have been empirically linked to recidivism for both men and women although the strength of the relationship can vary by gender for some risk factors (Andrews & Bonta, 2010; Brown, 2017; Gendreau, Little, Goggin, 1996; Gutierrez, Wilson, Rugge, & Bonta, 2013; McCoy & Miller, 2013). In CSC, a recent validation study of the Dynamic Factors Identification and Analysis – Revised (DFIA-R) confirmed that the dynamic need domains represented within these Central Eight were significantly related to community outcomes for men, women and Indigenous federal offenders (Stewart, Wardrop, Wilton, Thompson, Derkzen, & Motiuk, & 2017). In addition, the Criminal Risk Index (CRI) tool, recently developed based on criminal history

factors assessed at intake, reliably predicts community outcome for men, women and Indigenous offenders in CSC (Motiuk & Vuong, 2018).

Previous research (Thompson, Forrester, & Stewart, 2015) looked at risk factors associated with revocation on federal offenders' first release. The factors were calculated separately for Indigenous and non-Indigenous men and women and for two outcomes: revocation for any reason (e.g., technical violations or new offences) and revocations with a new offence. While resource intensive, revoking offenders who have not reoffended but are perceived by parole officers as being at an increased risk of committing a new crime is among the risk management strategies used to suppress and reduce reoffending. Thompson and colleagues found that risk factors related to revocations for a new offence varied across the three groups examined, highlighting the need to consider possible population differences in the development of risk measures. Having an institutional charge, age (younger at release), a statutory release, having a previous suspension for failing to report, and criminogenic needs related to community functioning were identified as risk factors for Indigenous and non-Indigenous men. Whereas, having a drug-related release condition during supervision, low motivation to participate in correctional plan, low/moderate reintegration potential, and ever having a suspension related to breach of conditions and deteriorating or at risk behaviour were factors that were additionally predictive of revocations for non-Indigenous men. Low numbers of women offenders made it difficult to determine factors related to revocations with an offence specifically for women.

Communicating Risk: Defining a High-Risk Offender

Risk can be communicated using a number of different metrics. Most commonly, the percentage recidivism rate based on a defined time period is reported, risk ratios provide information on the relative risk compared to the base rate of the offender group, and, percentile ranks (e.g., offender A is in the top 5% in terms of risk for recidivism) is another method of conveying risk level (Hanson, Lloyd, Helmus, & Thornton, 2012). Categorical risk estimates tend to be most commonly cited; however, there is variability regarding what categorical risk estimates mean. With respect to recidivism rates, currently, no consistent probability of outcome (e.g., reoffending) over a prescribed period of follow-up is associated with each categorical risk level (Hilton, Carter, Harris, & Sharpe, 2008; Scurich, 2018). For example, the highest risk rating level (poor risk level) on the Statistical Information on Recidivism (SIR) scale predicts a reoffending rate of 67% within 3 years of release (Nafekh & Motiuk, 2002; Nuffield, 1982;)

,while on the Service Planning Instrument (SPin), the high risk category corresponds to an expected reoffending rate of 54% over a 1.5 year follow-up (Van Dieten & Robinson, 2007). As pointed out in a recent review of risk practices across Canada, even among tools from the same family like the variations on the Level of Service Inventory (LSI), the degree of risk associated with the designation of high risk can vary (Bourgon, Mugford, Hanson, & Coligado, 2018). For example, they note that the top 13% of offenders assessed using the LS/CMI would be categorized as “very high risk,” while only approximately the top 4% of offenders assessed using the LSI-OR would be categorized as such. The variable interpretation of risk categories illustrates the difficulty of using categorical risk designations to inform decisions in the criminal justice system.

Recognising the need for a common language to communicate risk levels, a working group sponsored by the Council of State Governments Justice Center including practitioners and academics in the criminal justice field has proposed a standardized five-level nominal system to identify offender risk and needs levels (Hanson, Bourgon, McGrath, Kroner, D’Amora, Thomas, & Tavaréz, 2017). They define risk levels ranging from offenders with low levels of risk and few (if any) criminogenic needs (Level I) to high risk offenders with many identifiable criminogenic needs across psychological, interpersonal, and lifestyle domains (Level V; Hanson et al., 2017). Offenders classified as Level V are characterized by having criminogenic needs across three domains (psychological, interpersonal, lifestyle) that are severe and chronic as well as many non-criminogenic needs (Hanson et al., 2017). Individuals at the highest risk have few strengths or resources that can aid them in desistance from crime and are among the top 5th percentile for recidivism rates. They require the most intensive service (monitoring, surveillance, change focused interventions), and will still have a significant likelihood of reoffending while under community supervision.

CSC allocates parole office resources to the community for the supervision of offenders according to the Community Parole Officer Resource Formula (CPORF). The formula is based on a detailed calculation of the proportion of the Full Time Equivalent (FTE) required to complete the mandated tasks required by community supervision. The formula is designed to be dynamic, with the identified FTEs changing with workload demands based on the number and type of offenders in the community and the work completed as a result. The formula calculation

includes estimates on the Frequency of Contact (FOC) or Level of Intervention set via Correctional Plan updates (updates to the Correctional Plan are event-based).¹

In addition to the funds distributed through CPORF, CSC has been receiving Treasury Board funding since 2007 to improve results with high-risk offenders in the community. Currently, the parole districts receive equal funding and have been allowed flexibility in deciding how to use it. Recently, it has been recognised by the Correctional Operations and Programs (COP) Sector that a standardized and empirically based method that defines the high-risk population which the funding should support is required. The goal is to allow this funding to be incorporated into existing allocation mechanisms to promote successful offender reintegration and ensure that interventions are targeted to the highest risk populations in the community.

Using the work of Thompson and her colleagues (2015) as a foundation, the current research developed three models that empirically defined the highest-risk population for non-Indigenous men, Indigenous men, and federally sentenced women. These individuals would generally be within the top 5th percentile for risk level, corresponding to the Level 4 or 5 in the White Paper published by the Council of State Governments Justice Center (Hanson et al., 2017). Another series of models were developed to identify the group of offenders within the Indigenous men, non-Indigenous men, Indigenous women and non-Indigenous women who are at highest risk to return to custody for any reason. Unlike the study by Thompson and her colleagues, the current project included all offenders who were released during a specified time period, not only those who were received a first release on a given term. Those in the highest risk group, then, were individuals who had the highest reoffending rates despite frequently having been involved with programming and intensive community supervision. The research answered the following questions:

1. What are the key variables that identify non-Indigenous and Indigenous offenders (men and women separately) most likely to return to custody with a new offence while under supervision?
2. a) What are reoffending rates for the defined high-risk groups?

¹ The levels of intervention (LOI) are defined in Commissioner's Directive 715-1 as: Level I (intensive cases seen at least eight times per month), level A (seen at least four times a month) and Level A – Residency Frequency of Contact is not specified because offenders are living in a structured environment, level B and B-Residency (seen at least twice a month), level C and C-Residency (once a month), level D (once every two months), and level E (once every 3 months).

- b) How does the average reoffending rates of this highest risk group compare to the average base rates of reoffending for the group (i.e., what is the risk ratio comparing the outcome of the identified high risk group compare to base rates for the whole group?)
 - c) What is the percentile rank of the high-risk group in each model?
3. Do the selected factors prove to be reliable in the validation sample?
 4. To what extent do the Level I and A-RES (residency) cases compare to the high-risk groups identified in this research?

A second series of calculations answered the same questions with respect to identifying the highest risk groups based on returns to custody for any reason.

Method

Participants

A cohort of federally sentenced offenders released on statutory release (SR), day, or full parole, or under long-term supervision orders (LTSOs) in 2013 through 2017 was identified and followed for at least 30 days or until the period of data collection ended (September 23, 2018). The median number of days follow-up was 341, although these times varied by gender and Indigenous background (see Table 1).² The cohort was randomly split to include a development sample (70% of the cohort) used to identify the variables that define the highest risk group and a validation sample (30%) to confirm these results. The most recent release within the 2013 to 2017 time period with at least 30 days of possible follow-up time was selected. This resulted in a total number of 15,782 offenders for the development sample and 6,772 offenders for the validation sample (see Table 2).

Table 1

Follow-up Times from Release to Revocation Admission Date, Warrant Expiry, Death, Deportation or September 23rd, 2018 (Entire Sample)

Group	<i>n</i>	Median	Mean	Standard Deviation
Non-Indigenous Men	16,344	367	454	334
Indigenous Men	4,728	245	328	286
Non-Indigenous Women	1,009	484	511	337
Indigenous Women	473	265	379	305
Total	22,554	341	429	329

Table 2

Ancestry Representation of the Development and Validation Samples

	Development sample		Validation sample	Total
	<i>n</i>		<i>n</i>	<i>n</i>
Non-Indigenous men	11,439		4,905	16,344
Indigenous men	3,308		1,420	4,728
Non-Indigenous women	705		304	1,009
Indigenous women	330		143	473
Total	15,782		6772	22,554

²Across the entire cohort, actual follow-up days from release to revocation, WED, LTSO expiry, death, deportation or Sept. 23, 2018 ranged from 1 to 1998 with a mean of 429, median of 341, standard deviation of 329. Since the distribution of follow-up time was skewed, we reported the median. The median was 367 for non-Indigenous men, 245 for Indigenous men, 484 for non-Indigenous women, and 265 for Indigenous women.

Measures

The most recent risk assessment (CRI; Motiuk & Vuong, 2018; Static Factor Assessment; CD-705-6), criminogenic need assessment (DFIA-R; Stewart et al., 2017), and other intake assessments completed prior to release were used to derive predictors. Predictors were selected based on previous research indicating their bidirectional relationship to offender outcomes. In addition to these assessments, age, release type, index offence type, index offence severities, number of offences on the sentence, instigating institutional incidents, and institutional charges/misconducts, were included in the modeling. Relevant Offender Management System (OMS) Flags and Alerts (e.g., detention criteria flags, dangerous offender flags, security threat group, Section 84 releases) were assessed for their contribution to outcome in the initial steps of the procedures. Outcomes were assessed based on OMS data on returns to federal custody with an offence. A second analysis on the models predicting returns to federal custody for any reason was also completed.

Procedure/Analytic Approach

Separate models were developed for each offender group and for the two outcomes: returns to custody with an offence and returns to custody for any reason. Choice of the final model was based on the risk ratio, the overall accuracy of the model (percent true positives and true negatives), the succinctness of the model, and in the reduction of false negatives, which meant a reduction in the Type I error (misclassification of a high-risk offender as a lower risk offender). It was decided that over-estimating risk and thereby allocating offenders to an unnecessary high-risk supervision strategy (that is, increasing false positives), was less of a concern with respect to case management outcomes than not identifying an individual at risk to reoffend. The area under the receiver operating characteristic statistics (ROC area or AUC) for each of the models were also reported. AUCs are the recommended statistic to characterise predictive or diagnostic accuracy in forensic psychology and psychiatry. Assuming a base rate of reoffending of 50%, Rice and Harris (2005) characterised AUCs of .56 as small, .64 as moderate, and .71 and above as high. With lower base rates, Rice and Harris note that the values for small, medium, and large effects would be smaller. For example, using their formula, for a 25% base

rate the AUC values for small, medium, and large would be slightly less at .55, .62, and .69 respectively.

The following procedural steps were employed to derive the models:

- Step 1. Bivariate analyses were conducted to assess the relationship between each outcome and the selected predictors using Chi-square and Student's *t*-tests.
- Step 2. A stratified sampling algorithm was used to develop the models for each offender group in order to enhance the predictive power and accuracy given the low base rates for returns to custody with an offence.
- Step 3. Multi-tree approaches (Random Forests and Gradient Boosting) were performed in order to produce more accurate predictions and assess the importance of each factor in predicting the outcomes. These tools have the benefit of dealing with small sample sizes and a large number of predictors.
- Step 4. As a parametric model logistic regression was performed, and assumptions were checked beforehand. Transformations were used when quantitative predictors had skewed distributions. In addition, since the logistic regression is sensitive to missing data, the missing values were imputed using the median for numeric predictors and tree surrogate method for categorical predictors.
- Step 5. Decision tree models were built in which decisions were made based on minimization of misclassification error. In order to adjust the level of statistical significance used to assess the identification of branches on the tree and counteract the problem of multiple comparisons, a Bonferroni adjustment was applied to the *p*-values.
- Step 6. To assess the accuracy of the selected model in the correspondent cohorts, a scoring approach was conducted to compare the each model's predictions to actual data in the cohort.
- Step 7. A statistically based model comparison technique was conducted with regard to the misclassification rate, the area under the curve values from the receiver operating characteristic analysis (ROC), the cumulative lift chart and the classification table summarizing false negatives, true negatives, false positives and true positives.

Results

The results are presented for each offender group. The models are derived from findings identifying the key factors (among 105 factors examined) that predicted returns to custody with an offence. After assessing four statistical models/approaches: Gradient Boosting Decision Trees (GB DTs), Random Forest (RF), Logistic Regression (LR) and Decision Tree Analysis (DTA), we identified that the best model in terms of interpretability, accuracy, reliability and parsimony was the DTA.³ Random Forest and Gradient Boosting procedures were used to identify the most important variables predicting revocations for the four groups. (An example of how the random forest approach was used to determine the importance of variables in the prediction of revocations for any reason for non-Indigenous men can be found in Appendix A). After identifying the most important variables through Random Forest and Gradient Boosting approaches we then applied the results to develop the Inductive Decision Tree model.

Model for Indigenous men

Table 3 presents the model that identifies the high-risk group for Indigenous men and the contribution of each factor to the overall risk prediction. To be included in the high-risk group all the following criteria had to be satisfied:

- ✓ A CRI score of greater than or equal to 17, AND
- ✓ Having at least 2 institutional charges from admission to release, AND
- ✓ Having a security threat group flag record, AND
- ✓ A rating on the DFIA-R Substance Use Domain of moderate or high.

The base rate of reoffending for the Indigenous men in the sample was 12%. The rate of reoffending for the group meeting all the risk criteria was 29%. The risk ratio therefore was 2.4. That is, offenders in the high-risk group were 2.4 times more likely to reoffend than the average reoffending rate for Indigenous men offenders. The identified high-risk group represents 6.9% of the entire Indigenous men cohort.

³ With regard to the sample size and the base rate of returns with an offence, a stratified sample with predefined prior-probabilities was used to balance data

Table 3

Percent of Returns to Custody with an Offence Using the Model's Criteria: Indigenous Men

		Training sample (N = 3,308)	Validation sample (N = 1,420)
Criteria	Risk Factors	Base rate 12%	12%
Offenders meeting Criterion 1	CRI > = 17	18%	18%
Offenders meeting Criteria 1 & 2	CRI score > = 17 AND Having at least 2 institutional charges from admission to release	21%	22%
Offenders meeting Criteria 1, 2 & 3	CRI score > = 17 AND Having at least 2 institutional charges from admission to release AND Having at least 1 security threat group record	27%	27%
Offenders meeting Criteria 1, 2, 3 & 4	CRI score > = 17 AND Having at least 2 institutional charges from admission to release AND Having at least 1 security threat group record AND Substance abuse domain moderate or high need	30%	28%

Accuracy of the high risk model for Indigenous men

Table 4 presents statistics on the overall accuracy of the model for both the development and validation samples including rates of false positives, false negatives, true negatives and true positive as well as the AUCs. The rate of false negatives was 7% indicating few offenders who reoffended were not identified in the model. However, the rate of false positives was higher at 20%, meaning that 20% of offenders who did not reoffend during the time period were misclassified as high risk. The AUC of .65 (.67 for the validation sample) represents a moderate significant effect.

Table 4

Accuracy of the Model for the Training and Validation Samples: Indigenous Men (N=4728)

		Training Sample		
False Negative	True Negative	False Positive	True Positive	AUC
7%	69%	19%	5%	.65
		Validation Sample		
False Negative	True Negative	False Positive	True Positive	AUC
7%	68%	20%	6%	.67

Overlap with high intensity community levels of supervision (LOI): Indigenous men

Indigenous men who meet all the criteria for the high-risk group overlap with the highest risk groups designated by the community's level of intervention. For example, 47% of the high-risk group were being supervised at Level I or Level A-Residency. This rises to 84% including the top three LOIs (I, A-Residency and A).

Model for non-Indigenous men

Table 5 presents the model for non-Indigenous men. To be included in the high-risk group all the following criteria need to be satisfied:

- ✓ A CRI score of greater than or equal to 13, AND
- ✓ Aggregate sentence length (generally from sentence commencement to warrant expiry date) \geq 4 Years, AND
- ✓ Substance abuse domain rating on the DFIA-R moderate or high need, AND
- ✓ Having at least three institutional charges from admission to release.

The base rate of reoffending for the non-Indigenous men in the sample was 6%. The rate of reoffending for the group meeting all the risk criteria was 24% resulting in a risk ratio of 4. That is, offenders in the high-risk group were 4 times more likely to reoffend than the average reoffending rate for non-Indigenous men offenders. The identified high-risk group represents 4.8% of the entire non-Indigenous men cohort.

Table 5

Percent of Returns to Custody with an Offence Using the Model's Criteria: Non-Indigenous Men

		Training sample (<i>N</i> = 11,440)	Validation sample (<i>N</i> = 4,904)
		Base rate	6%
Criteria	Risk Factors		6%
Offenders meeting Criterion 1	CRI score \geq 13	10%	10%
Offenders meeting Criteria 1 & 2	CRI score \geq 13 AND Aggregate sentence length (generally from sentence commencement to warrant expiry date) \geq 4 years	17%	17%
Offenders meeting Criteria 1, 2 & 3	CRI score \geq 13 AND Aggregate sentence length \geq 4 Years AND Substance abuse domain moderate or high need	20%	20%
Offenders meeting Criteria 1, 2, 3 & 4	CRI score \geq 13 AND Aggregate sentence length \geq 4 Years AND Substance abuse domain moderate or high need AND At least 3 institutional charges from admission to release	25%	21%

Accuracy of the high risk model for non-Indigenous men

Table 6 presents statistics on the overall accuracy of the model for both the development and validation samples including rates of false positives, false negatives, true negatives and true positive as well as the AUCs. The rate of false negative was 12.9 % and the rate of false positives was 21.4%. The AUC of .70 for the development and .72 for the validation sample represents a large significant effect.

Table 6

*Accuracy of the Model for the Training and Validation Samples: Non-Indigenous Men (*N* = 16344)*

		Training Sample		
False Negative	True Negative	False Positive	True Positive	AUC
13.2%	28.6%	21.5%	36.9%	.70
		Validation Sample		
False Negative	True Negative	False Positive	True Positive	AUC
12.4%	28.8%	21.2%	37.6%	.72

Overlap with high intensity community levels of supervision (LOI): Non-Indigenous men

Non-Indigenous men who meet all the criteria for the high-risk group overlapped with the highest risk groups designated by the community level of intervention. For example, 44% of the high-risk group were being supervised in Level I or Level A residency and 81% of the high-risk group of non-Indigenous men were in either Level I, Level A residency or Level A without residency.

Model for Indigenous women

Table 7 presents the model that identifies the high-risk group for Indigenous women and demonstrates the contribution of the addition of each factor to the final model. To be included in the high-risk group all the following criteria need to be satisfied:

- ✓ At least 1 minor institutional charge from admission to release, AND
- ✓ A CRI score of greater than or equal to 20, AND
- ✓ A rating on the DFIA-R Substance Use Domain of moderate or high.

The base rate of reoffending for the Indigenous women in the sample was 14%. The rate of reoffending for the group meeting all the risk criteria was 31%. The risk ratio therefore was 2.2. That is, offenders in the high-risk group were 2.2 times more likely to reoffend than the average reoffending rate for Indigenous women offenders. The identified high-risk group represents 14.6% of the entire Indigenous women cohort.

Table 7

Percent of Returns to Custody with an Offence Using the Model's Criteria: Indigenous Women

		Training sample (N = 330)	Validation sample (N = 143)
		Base rate	13.9%
Criteria	Risk Factors		14%
Offenders meeting Criterion 1	At least 1 minor institutional charge from admission to release	20.4%	16.3%
Offenders meeting Criteria 1 & 2	At least 1 minor institutional charge from admission to release AND CRI >= 20	32.9%	27.8%
Offenders meeting Criteria 1, 2 & 3	At least 1 minor institutional charge from admission to release AND CRI >= 20 AND Substance abuse domain moderate or high need	33.8%	31.3%

Accuracy of the high risk model for Indigenous women

Table 8 presents statistics on the overall accuracy of the model. The AUC for the development sample was .73, a highly significant effect, but the AUC declined on the validation sample to .64, probably reflecting the reduced sample size.

Table 8

Accuracy of the Model for the Training and Validation Samples: Indigenous Women (N = 473)

		Training Sample		
False Negative	True Negative	False Positive	True Positive	AUC
7.0%	72.0%	14.0%	7.0%	.73
		Validation Sample		
False Negative	True Negative	False Positive	True Positive	AUC
7.0%	71.0%	15.0%	7.0%	.64

Overlap with the LOI: Indigenous women

Indigenous women who met all the criteria for the high-risk group overlapped with the highest risk groups designated by the community's level of intervention. For example, 30% of the high-risk group were being supervised at Level I or Level A-Residency. This rises to 83% when including the top three LOIs (I, A-Residency and A).

Model for non-Indigenous women

The base rate of reoffending for non-Indigenous women was 3%, a rate too low to allow modeling to predict reoffending. This low base rate for non-Indigenous women suggests that the current supervision strategies are sufficient to manage the risk for these women.

Models predicting returns to custody for any reason

Although for this project the high-risk group was defined as those who were high risk to return to custody because of a new offence, we also developed models that predicted returning to custody for any reason. Table 9 summarizes the models for Indigenous men, non-Indigenous men, Indigenous women, and non-Indigenous women since their base rate of return to custody for any reason was sufficiently high that a model could be calculated.

A visual presentation of the results of these analyses can be found in Appendix B.

Table 9

Models Predicting Returns to Custody for Any Reason: Percent Returns to Custody and Accuracy Statistics

	Training Sample (N=3,308)	Validation Sample (N=1,420)	Risk Ratio
Indigenous men (Base rate = 54%)			
• Having at least 2 institutional charges between admission and release AND	73%	71%	
• The mean of number of DFIA-R indicators endorsed ≥ 0.37 AND	78%	76%	
• At least 1 Security threat group record exists	89%	89%	
AUC	0.71	0.70	1.6
Non-Indigenous men (Base rate = 33%)			
• CRI_score ≥ 15 AND	51%	52%	
• Having at least 2 institutional charges from admission to release AND	65%	66%	
• The mean of number of DFIA-R indicators endorsed ≥ 0.43 AND	69%	70%	
• Having at least 3 institutional incidents between admission and release	74%	76%	
AUC	0.70	0.71	2.3
Indigenous women (Base rate = 50%)			
• Total number of institutional charges between admission and release ≥ 3 AND	68%	65%	
• The mean of number of employment/education indicators endorsed ≥ 0.62 AND	85%	69%	
• Having at least 1 institutional incident between admission and release	88%	67%	
AUC	0.74	0.74	1.6
Non-Indigenous women (Base rate = 23%)			
• Substance abuse domain moderate or high need AND	35%	34%	
• CRI ≥ 12 AND	45%	41%	
• Total number of institutional charges between admission and release ≥ 11	86%	80%	
AUC	0.74	0.70	3.6

Discussion

This study empirically identified criteria that defined the highest risk offenders in the community who would meet the criteria for the Program Integrity Funding. We used administrative data to identify factors that predict returns to custody with an offence. Models were developed separately for Indigenous men, non-Indigenous men, and Indigenous women. Given low base rates of reoffending (3%), however, we were not able to establish a model predicting reoffending for non-Indigenous women. We recommend that the Program Integrity Funding allocated for women be reserved for Indigenous women only since the low base rate for non-Indigenous women suggests that the current supervision strategies are sufficient to manage the risk for non-Indigenous women.

The final models were selected based on the strength of their association with reoffending, the feasibility of identifying the factors in OMS, and the succinctness of the model. We sought a procedure that would minimize false negatives reducing the likelihood that high-risk offenders would be misclassified as lower risk. A number of different procedures were examined, but we found that the Decision Tree analysis was the easiest to understand and communicate and produced good predictability with only 3-4 factors in the models.

The models reliably predicted the highest risk offenders. AUCs were in the moderate to high range and risk ratios demonstrated that the high-risk groups were 2 to 4 times more likely to reoffend than the average reoffending rate for the offender group. Consistent with recommendations in the White Paper on risk communication (Hanson et al., 2017), the high risk group represented about the top 5 percent in terms of risk to reoffend. Factors that predicted reoffending that were common to the three groups of offenders included the risk rating on the CRI, substance misuse rating on the DFIA-R and institutional misconducts. Offenders in the high-risk groups identified through this research are for the most part (over 80%) already being supervised through the higher levels of community supervision (I, A - residency, and A). Although not a requirement of the project, we also looked at models predicting returns to custody for any reason. Here we found again that the CRI, substance misuse rating on the DFIA-R and institutional misconducts were components of the models. In addition, for women, employment needs, and for Indigenous men, association with a gang (security threat group) predicted returns. The rates of returns for the highest risk groups for Aboriginal men and women and non-

Indigenous women were at least 86%; the rate for the highest risk non-Indigenous men was 74%. Again, the models were highly predictive with AUCs of .70 or greater.

These findings highlight the importance of criminal history factors (CRI and institutional misconducts), but also of some key criminogenic needs, especially substance misuse, in contributing to reoffending for all groups of offenders. Both the static factors and the dynamic factors reflect problems in self-control that can be mitigated with appropriate interventions. With respect to the RNR framework, identifying offenders at highest risk to reoffend is the first step in the application of the risk principle. The next step is to deliver appropriate and higher intensity services to these high-risk offenders, which is the goal of the program integrity funding.

The nature of community supervision and the types of interventions that can be effective in reducing risk are variable. Among those that have established research support are efforts to help offenders to access stable employment and housing, structured leisure, and participation in correctional programs that target criminogenic need related to problems in self-regulation, antisocial associates, and substance misuse (see Stewart et al., 2017 and Brown & Motiuk, 2005 for reviews). Interventions that currently have less empirical support apply suppression techniques such as heavy monitoring or inflexible sanctions. Whether these suppression approaches are not effective because they are not appropriate and simply do not work, or whether the close monitoring facilitates detection of violations or antisocial behaviour, is not clear.

Finally, although the models developed through this study provide a statistically solid description of the highest risk cases it should be noted that the reoffending rate, even for the highest risk groups, for these federal offenders was relatively low (consistent with a Level 2 group according to the parameters of the White Paper; Hanson et al., 2017). This may reflect the shorter follow-up time in our study where the median was around one year, instead of two years described in the White Paper. This would suggest that the guidelines for level of service for the highest risk group developed in the White paper may not apply to the highest risk federal offenders; however, the revocation rate for any reason for the federally sentenced high-risk group was very high (74%-88%). It may be that the low reoffending rate reflects the high level of monitoring and supervision and low tolerance for rule violations provided by parole offices in the community.

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Appendix A

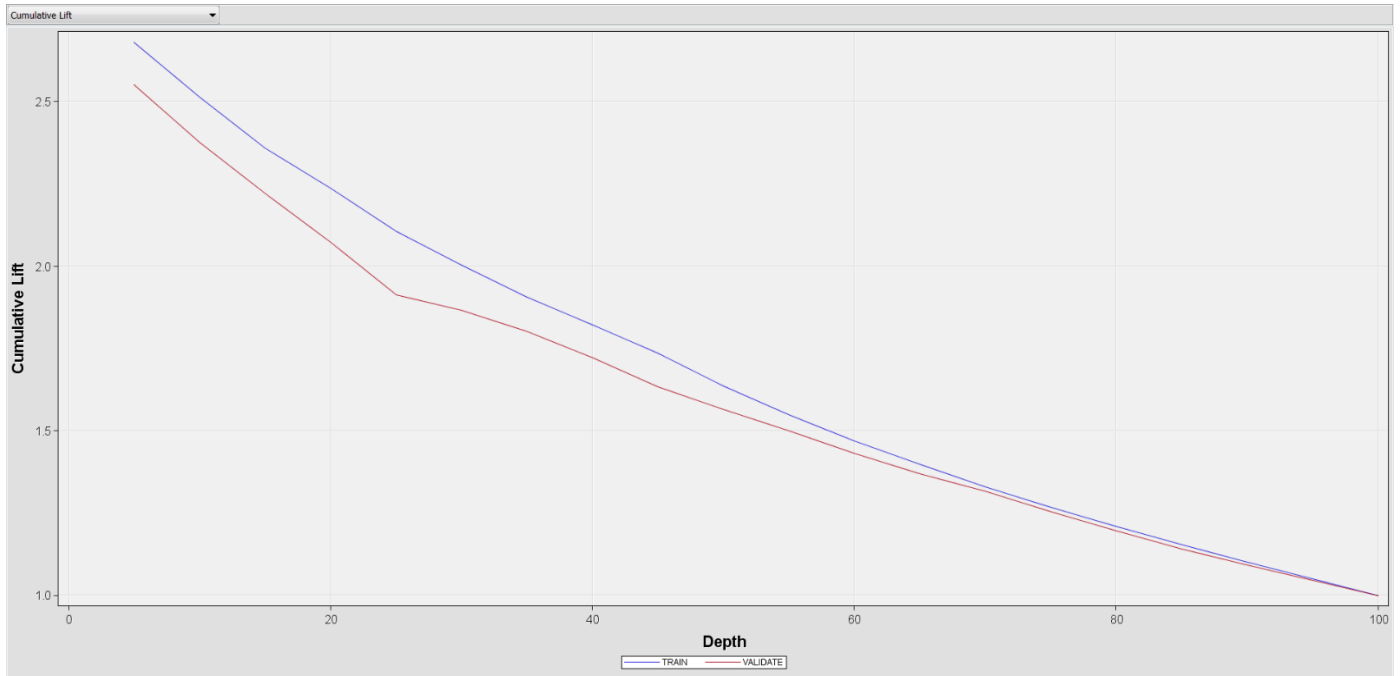
Table A-1

Loss Reduction Variable Importance from the Random Forest Approach (Revocations for Any Reason: Non-Indigenous Men)

Variable	Number of rules	Gini	OOB Gini	Valid Gini	Margin	OOB Margin	Valid Margin
CRI_score	304	0.0117	0.0092	0.0108	0.0235	0.0208	0.0233
DFIA-R mean count of indicators endorsed	153	0.0070	0.0054	0.0056	0.0141	0.0124	0.0128
Incident count (institutional)	257	0.0067	0.0052	0.0061	0.0134	0.0119	0.0125
Total charges (institutional)	163	0.0056	0.0052	0.0053	0.0113	0.0109	0.0108
LOI	218	0.0067	0.0052	0.0059	0.0133	0.0121	0.0129
Number of needs on the DFIA-R that received moderate or high ratings	139	0.0043	0.0036	0.0035	0.0086	0.0080	0.0082
Offender security level at release	170	0.0036	0.0031	0.0032	0.0071	0.0067	0.0064
Has gone on drug taking bouts or binges (indicator on the Substance Abuse domain of the DFIA-R)	142	0.0034	0.0027	0.0026	0.0067	0.0061	0.0060
Substance Abuse domain rating	166	0.0034	0.0026	0.0025	0.0068	0.0060	0.0060
Associate domain - proportion of indicators endorsed	154	0.0034	0.0022	0.0018	0.0069	0.0058	0.0052
Substance use domain rating of moderate or high	80	0.0016	0.0013	0.0013	0.0031	0.0029	0.0029
Attitude domain- proportion of indicators endorsed	69	0.0016	0.0010	0.0009	0.0032	0.0026	0.0027
Most recent admission prior to targeted release	134	0.0016	0.0009	0.0007	0.0032	0.0026	0.0022
Substance Abuse domain – proportion of indicators endorsed	105	0.0017	0.0009	0.0011	0.0035	0.0026	0.0030
Disrespects personal belongings (indicator on the Attitude domain)	104	0.0014	0.0008	0.0007	0.0027	0.0022	0.0022
Associates with substance abusers (indicator on the Substance Abuse domain)	58	0.0010	0.0008	0.0008	0.0021	0.0019	0.0020
Community Function domain - proportion of indicators endorsed.	88	0.0014	0.0007	0.0008	0.0027	0.0021	0.0022

Figure A-1

Cumulative lift chart from the random forest approach (revocations for any reason for non-Indigenous men)



Appendix B

CRITERIA FOR HIGH RISK GROUPS / REVOCATIONS WITH AN OFFENCE

NON-INDIGENOUS MEN

- ❑ The rate of returns with an offence in the entire cohort (N=16344) is 6%.
- ❑ In the identified high-risk group (N=784), this rate is 24%.

INDIGENOUS MEN

- ❑ The rate of returns with an offence in the entire cohort (N=4728) is 12%.
- ❑ In the identified high-risk group (N=326), this rate is 29%.



NON-INDIGENOUS WOMEN

- ❑ The rate of returns with an offence in the entire cohort (N=1009) is 3%.
- ❑ This group was **considered** as **low-risk** with regard to its low base rate.

INDIGENOUS WOMEN

- ❑ The rate of returns with an offence in the entire cohort (N=473) is 14%.
- ❑ In the identified high-risk group (N=69), this rate is 30%.

NON-INDIGENOUS MEN

- ❖ CRI equal or greater than 13.
- ❖ Aggregate sentence length equal or greater than 4 years.
- ❖ Substance abuse domain moderate or high need.
- ❖ Having at least 3 institutional charges from admission to release.

INDIGENOUS MEN

- ❖ CRI equal or greater than 17.
- ❖ Having at least 2 institutional charges from admission to release.
- ❖ Having at least 1 security threat group record.
- ❖ Substance abuse domain moderate or high need.

NON-INDIGENOUS WOMEN

- ❖ This group was considered as low-risk with regard to its low base rate.

INDIGENOUS WOMEN

- ❖ Having at least 1 minor institutional charge from admission to release.
- ❖ CRI equal or greater than 20.
- ❖ Substance abuse domain moderate or high need.

CRITERIA FOR HIGH RISK GROUPS / REVOCATIONS FOR ANY REASON

NON-INDIGENOUS MEN

- ❑ The rate of returns to custody for any reason in the entire cohort (N=16344) is 33%.
- ❑ In the identified high-risk group (N=1092), this rate is 75%.

INDIGENOUS MEN

- ❑ The rate of returns to custody for any reason in the entire cohort (N=4728) is 54%.
- ❑ In the identified high-risk group (N=440), this rate is 89%.



NON-INDIGENOUS WOMEN

- ❑ The rate of returns to custody for any reason in the entire cohort (N=1009) is 23%.
- ❑ In the identified high-risk group (N=24), this rate is 83%.

INDIGENOUS WOMEN

- ❑ The rate of returns to custody for any reason in the entire cohort (N=473) is 50%.
- ❑ In the identified high-risk group (N=83), this rate is 81%.

NON-INDIGENOUS MEN

- ❖ CRI equal or greater than 15.
- ❖ Having at least 2 institutional charges between admission and release.
- ❖ Mean of number of DFIA-R indicators endorsed equal or greater than 0.43.
- ❖ Having at least 3 institutional incidents between admission and release.

INDIGENOUS MEN

- ❖ Having at least 2 institutional charges between admission and release.
- ❖ Mean of number of DFIA-R indicators endorsed equal or greater than 0.37.
- ❖ Having at least 1 security threat group record.

NON-INDIGENOUS WOMEN

- ❖ Substance abuse domain moderate or high need.
- ❖ CRI equal or greater than 12.
- ❖ Total number of institutional charges between admission and release equal or greater than 11.

INDIGENOUS WOMEN

- ❖ Having at least 3 institutional charges between admission and release.
- ❖ Mean of number of employment/education indicators endorsed equal or greater than 0.62.
- ❖ Having at least 1 institutional incident between admission and release.