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Predictive Validity of the SAVRY With Indigenous and Caucasian Female and Male Adolescents on Probation

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Abstract

Indigenous people and the courts have emphasized that it is important to examine whether violence risk assessment tools are valid and appropriate for Indigenous youth. However, studies are scarce. Therefore, we examined the predictive validity of youth probation officers' SAVRY ratings for 744 Canadian youth, including 299 Indigenous youth (219 male, 80 female), and 445 Caucasian youth (357 male, 88 female) in a prospective field study. The SAVRY summary risk ratings and risk total scores significantly predicted violent and any reoffending for Indigenous female and male youth with medium effect sizes. Relatively few significant differences in the predictive validity emerged for Indigenous and Caucasian youth. However, Historical, Protective, and Risk Total scores predicted any recidivism better for Caucasian males than Indigenous males. Also, Indigenous youth scored significantly higher on all risk domains than Caucasian youth. Opposite to predictions, the rates of false positives were higher for Caucasian youth than for Indigenous youth. Based on the results, the SAVRY appears to be a reasonable tool to use for assessing risk in youth who are Indigenous. However, assessors should take steps to ensure that they use the SAVRY in a culturally appropriate manner, such as considering cultural factors in case formulations and treatment planning as the SAVRY does not ground assessments in an understanding of factors such as colonialism. In addition, future research should examine culturally salient risk factors (e.g., discrimination) and examine potential causes of higher risk scores in Indigenous youth, particularly the role of both past and present-day colonialism.

Keywords: predictive validity, Indigenous youth, SAVRY, females, reserves

Public Significance Statement

This study found that SAVRY scores predict violent and any recidivism for Indigenous males and females and Caucasian females and males moderately well. Additionally, this study highlights the importance and need of Indigenous research protocols when doing research on Indigenous peoples.

Predictive Validity of the SAVRY with Indigenous Female and Male Adolescents on Probation

Violence risk assessment tools are used throughout the world, often with minority populations that are overrepresented in the justice system, including Indigenous peoples (Shepherd, Luebbers, Ferguson, Ogloff & Dolan, 2014). Indigenous peoples and Indigenous communities comprise of individuals who are “related to and/or who have historical continuity” with the First Peoples of North America (Canada and the United States), the Americas, Pacific Islands, New Zealand, Australia, Asia and Africa and who predate colonizing populations (Allan & Smylie, 2015, no page number). In Canada, the term “Indigenous” includes people who are First Nations, Métis and Inuit.

Indigenous youth make up around 8% of the Canadian population yet in 2017/2018, 48% of custody admissions and 39% of community admissions were Indigenous youth aged 12 to 17 (Department of Justice Canada, 2019). As such, their rate of incarceration is six times higher than their rate in the general youth population. Indigenous youth are overrepresented in other countries. In Australia, Indigenous youth were 26 times more likely to be incarcerated than non-Indigenous youth (Australian Institute of Health and Welfare, 2016), and in New Zealand, just over half of the prison population are Maori (New Zealand Department of Corrections, 2017).

As Indigenous scholars explain, this overrepresentation of Indigenous youth is closely tied to colonialism, including residential school experiences and the eradication of culture and traditional values (Monchalin, 2010). From 1864 to 1996, Indigenous children in Canada were forcibly separated from their families, communities, culture, and language, and placed in residential schools, where many experienced sexual, physical, emotional, cultural and spiritual abuse (Allan & Smylie, 2015). As Whitbeck and colleagues (2004) wrote, Indigenous people

...experienced one of the most systematic and successful programs of ethnic cleansing the world has seen. They were relocated to what amounted to penal colonies, starved, neglected and forbidden to practice their religious beliefs. Their children were taken from them and re-educated so that their language, culture and kinship patterns were lost to them (p. 121).

The negative experiences of residential school continue to impact the physical and mental health of survivors, their offspring and their communities (Allan & Smylie, 2015) and are linked to poor educational attainment, substance use difficulties, suicide, and criminal behavior (Truth and Reconciliation Commission of Canada, 2012). In this respect, colonialism can be considered a determinant of overrepresentation in the justice system, or in other words, the “causes of causes” for offending (Czyzewski, 2011, p. 1). Systemic discrimination, marginalization, and disparities stemming from colonialism continue today; compared to non-Indigenous youth, Indigenous children and youth in Canada are provided with fewer services, and less funding and resources, particularly those youth who reside on reserves (Fontaine, 2016).

Psychologists are ethically and, in some cases, legally, obligated to ensure that assessment approaches are valid and appropriate for cultural minority groups (American Psychological Association [APA], 2005). When youth commit crimes, they are often assessed with violence risk assessment tools which are used to guide decision-making about treatment, supervision levels and release decisions. So, although risk assessment tools have been found to

outperform unstructured clinical judgments of risk (Ægisdóttir et al., 2006), research on the predictive validity of these tool scores with Indigenous youth is limited. In Canada, a recent Supreme Court case held that Corrections Services Canada violated the Corrections and Conditional Release Act (1992) by using risk assessment tools on Indigenous offenders that had not been sufficiently validated for this population (*Ewert v. Canada*, 2018). As such, the purpose of this study was to examine the predictive validity of the Structured Assessment of Violence Risk in Youth (SAVRY; Borum, Bartel & Forth, 2006) scores with Indigenous, justice-involved youth. The SAVRY is one of the most widely used risk assessment tools for adolescents (Viljoen, McLachlan, & Vincent, 2010).

Predictive Validity of Risk Assessment Tool Scores with Indigenous Youth

In general, risk assessment tools are “informed by contemporary theories of risk assessment that argue that risk markers do not vary as a function of gender, ethnicity or geographical location” (Martel, Brassard & Jaccoud, 2011, p. 238). There is some research that suggests that well-established risk factors, such as criminal history, antisocial personality pattern and peer delinquency, predict reoffending in both Caucasian and Indigenous offenders (Gutierrez, Wilson, Rugge & Bonta, 2013). In addition, some studies have found that certain risk assessment tools can predict reoffending adequately in Indigenous populations. For instance, Olver and colleagues (2012) found that the Youth Level of Service/Case Management Inventory (YLS/CMI; Hoge & Andrews, 2006) had strong predictive validity for all types of recidivism among Indigenous youth (area under the curve scores [AUCs] = .70 to .78). In addition, a meta-analysis found that for Indigenous offenders, the YLS tool scores had a medium effect size for predictive validity for general recidivism (Olver, Stockdale & Wormith, 2014).

However, other studies have found that the predictive validity of tool scores is lower for Indigenous offenders than Caucasian offenders. In an Australian study on the YLS/CMI, AUCs for general and violent recidivism were not significant for Indigenous youth (AUC = .67 and .67 respectively) but were for Caucasian youth (AUC = .79 and .71 respectively; Shepherd, Singh & Fullam, 2015). In another study, the one-year predictive validity for YLS/CMI-Australian Adaptation scores were lower (but not significantly so) for Indigenous youth than for ethnic minority or White Australians (AUC = .60 versus .64; Thompson & McGrath, 2012).

Only two studies have examined the SAVRY in Indigenous youth. One study, conducted in Australia, found that the SAVRY Risk Total Score significantly predicted violent recidivism in Indigenous youth (AUC = .76; Shepherd et al., 2014). However, the SAVRY Total Score did not reach statistical significance in predicting general recidivism in Indigenous youth (AUC = .81), even though the AUC score fell in the large range (see Rice & Harris, 2005) although this is likely due to small sample size. The other study, conducted in Canada, found that SAVRY Risk Total scores significantly predicted violent recidivism in Indigenous youth (AUC = .64; Meyers & Schmidt, 2008). As well, AUC scores for violent recidivism were higher for Indigenous than Caucasian youth for a three-year follow-up period (AUC = .84 vs. .70).

Gaps in Research

In the two prior studies that examined the SAVRY’s predictive validity with Indigenous youth, the Indigenous sample sizes were very small ($n = 32$ in Shepherd et al., 2014; $n = 38$ in

Meyers & Schmidt, 2008), and although researchers generated AUC scores for Indigenous versus non-Indigenous groups, they did not test if these AUC scores differed significantly. In addition, these studies were file review studies, where the SAVRY was coded by research assistants from file information, rather than field studies.

As such, substantial gaps in knowledge remain regarding the appropriateness of using the SAVRY with Indigenous youth. First, studies have not yet looked at the nature and types of errors made in risk predictions for Indigenous youth. It is possible that error types differ for Indigenous and non-Indigenous youth, even if the SAVRY scores have adequate predictive validity for Indigenous youth overall. For instance, youth probation officers (YPOs) might incorrectly assume that all Indigenous youth are high risk due to incorrect stereotypes, thus leading to increased rates of false positives (i.e., offenders assessed as high risk who do not recidivate). However, research has not yet compared rates of false positives for these groups.

Second, there is a dearth of research on the predictive validity of SAVRY scores for females. Prior research is mixed; some studies indicate that SAVRY scores predict comparably well for both female and male youth (Penney, Lee & Moretti, 2010) while other studies have found that SAVRY scores are better at predicting for males compared to females (Schmidt, Campbell, & Houlding, 2011; Shepherd, et al., 2014) but all of these studies had relatively small sample sizes. Further, there is a dearth of research on Indigenous females who have even higher rates of overrepresentation in the justice system in Canada than do Indigenous males (Munch, 2012). For instance, Indigenous women represent 36.1% of all incarcerated women; the number of incarcerated Indigenous women increased by 57.9% in the last ten years, while the number of incarcerated Indigenous men increased by 38.1% (Public Safety Canada, 2017). Some researchers have questioned whether the SAVRY predicts reoffending for girls as well as it does for boys, as most risk assessment tools were developed and validated based on primarily male samples (Hannah-Moffat, 2009). If predictive validity is attenuated in girls, it might be even more attenuated in Indigenous girls. Indeed, intersectionality theory (Crenshaw, 1991) indicates that social categories such as race, sex, and class interact with and shape one another, such that a woman's experiences might differ depending on whether she is Indigenous or Caucasian, economically advantaged or -disadvantaged. Consequently, it is crucial that researchers conceptualize such categories simultaneously and consider how the historical and cultural contexts of their participants might influence their outcomes (Veenstra, 2011).

Third, researchers have typically measured cultural background in a crude manner and treated culture as a single dichotomous variable (i.e., Indigenous vs. non-Indigenous). However, there is enormous variability within Indigenous youth. In Canada, there are over 600 individual Nations (Statistics Canada, 2011). Further, the predictive validity for Indigenous youth might differ on depending on whether the youth lived in an urban setting or on reserve. Although it is preferred to refer to reserves as communities, the term reserves will be used in this paper for clarity. Approximately half of the Indigenous population in Canada live in urban areas with the other half living on a reserve (Statistics Canada, 2011). Due to historical and current colonial policies and actions, reserves have created communities with high rates of poverty which in turn, results in greater social problems, higher stress exposure, and fewer resources to help deal with these issues (Brockie, Dana-Sacco, Wallen, Wilcox & Campbell, 2015). Risk of offending appears higher on reserves than off (Statistics Canada, 2016).

Finally, few studies have tested whether Indigenous and non-Indigenous youth have different scores and profiles on the SAVRY (see Meyers & Schmidt, 2008; Shepherd et al., 2014). It is possible that Indigenous youth may receive higher ratings on SAVRY items due to colonialism. For instance, youth may have a distrust of education because their parents were forced to attend residential school, thus leading to elevated scores on Low School Commitment (see Shepherd et al., 2015). These group differences are important to test because if Indigenous youth do in fact score higher than Caucasian youth, these higher scores might lead to more restrictive sanctions (e.g., incarceration), thereby creating “*disparate impact*” or risk management decisions that may be morally unfair (Skeem & Lowenkamp, 2016, p. 685).

Consultation with Indigenous Peoples

In the present study, we sought to address the above gaps through a prospective field study with a provincial youth justice agency. In conducting this study, Indigenous peoples provided consultation and leadership. This emphasis on Indigenous community consultation is emphasized in numerous guidelines, such as the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP; United Nations General Assembly, 2007), the Royal Commission on Aboriginal People (RCAP; 1996), and the Truth and Reconciliation Commission of Canada (2015). In the past, non-Indigenous researchers, “have disempowered communities, imposed stereotypes that reinforced internalized racism, and conducted research that benefited the careers of individual researchers or even science at large but brought no tangible benefit to the communities” (Simonds & Christopher, 2013, p. 2185). As such, the UNDRIP stresses “nothing about us without us,” meaning that research about Indigenous peoples must include Indigenous communities (Aboubakrine, 2018). As Smith (2012), a Maori researcher, noted, including Indigenous communities “does not mean and has not meant a total rejection of all theory or research or Western knowledge. Rather, it is about centering [Indigenous] concerns and world views and then coming to know and understand theory and research from [Indigenous] perspectives and for [Indigenous] purposes” (p. 41).

As these guidelines emphasize, Indigenous people must be consulted and valued as co-producers of knowledge from the very beginning of a study (Maar et al., 2011). To date, few risk assessment studies have done this however. In one of the few studies to include consultation, Shepherd and Willis-Esqueda (2018) found that Indigenous professionals expressed concern that the SAVRY does *not* fully capture Indigenous experience and world views. For instance, although the SAVRY includes a risk factor entitled “Peer Rejection,” peer rejection might stem from different causes for Indigenous and non-Indigenous youth. Specifically, Indigenous youth might be more likely to experience peer rejection and racial abuse due to discrimination.

Drawing from the above principles, the current study was led by an Indigenous researcher (Métis), along with three non-Indigenous allies. An additional Indigenous researcher (Anishinaabe) provided consultation and mentorship. In addition, prior to initiating this study, our team conducted a province-wide consultation with 20 Indigenous professionals and 6 non-Indigenous youth justice professionals who had experience working with Indigenous youth (e.g., service providers at Indigenous organizations, probation officers, court workers, and lawyers; authors’ names redacted for blind review, 2012). During phone interviews, consultees were asked to indicate whether they agreed or disagreed with a set of statements about the SAVRY. They then expanded on and explained their responses.

Most consultees (85%) felt that the SAVRY had definite or potential usefulness with Indigenous adolescents (authors' names redacted for blind review, 2012). All consultees liked that the SAVRY included protective factors (100%). Nevertheless, they raised some concerns about the SAVRY's application to Indigenous youth. For instance, 73% of consultees felt that the SAVRY only evaluates the degree to which a risk factor is present, not *why* the factor is present or *how* contextual issues (e.g., colonialism) may contribute to offending. Consultees also noted that, beyond the factors included on the SAVRY, Indigenous youth may have additional culturally relevant protective factors (e.g., cultural connection, extended family and Elder involvement), and risk factors (e.g., residential school attendance by a family member, racism). Importantly, almost all of the consultees (96%) felt that the validity of the SAVRY with Indigenous youth should be directly examined via research.

Present Study

The aim of the present study was to compare the predictive validity of SAVRY scores for Indigenous and Caucasian youth on probation (i.e., examine psychometric bias). To improve upon previous research, we (1) tested predictive validity separately for females and males, (2) tested whether predictive validity for Indigenous youth varied depending on whether youth lived on or off reserve, (3) examined not only indices of discrimination (e.g., AUCs) but also the positive and negative predictive power, and (4) tested mean differences in SAVRY Total and domain scores for Indigenous and Caucasian youth. Furthermore, we used a prospective field study design, in which YPOs assessed youth with the SAVRY.

We hypothesized that SAVRY scores would show lower predictive validity and higher rates of false positives for Indigenous youth compared to Caucasian youth. We expected that the SAVRY would have lower predictive validity for females compared to males, and for Indigenous youth living on reserve compared to off reserve. We also predicted that Indigenous youth would score higher on risk factors and lower on protective factors than Caucasian youth.

Method

Participants

The sample consisted of 744 youth on probation in a Canadian province, including 299 Indigenous youth (80 female, 219 male) and 445 Caucasian youth (88 female, 357 male). The mean age of youth at assessment was 17.04 ($SD = 1.33$, range = 12 to 20). Nearly 60% of youth had prior charges ($n = 432$), and 233 (31.3%) had been previously incarcerated. Of the Indigenous youth ($n = 299$), 55 (18.4%) were currently living on reserve, 142 (47.5%) were currently living off reserve, and 30 (10.0%) had lived both on and off reserve at various points in their life. In the remaining cases ($n = 72$, 24.1%), it was unclear where youth lived. Most Indigenous youth were First Nations ($n = 198$, 66.2%), 49 were Métis (16.4%), and 3 were Inuit (in 43 cases it was not specified which Indigenous group youth belonged to). Also, 169 of the Indigenous youth had "status" (56.5%). Status is a legal term whereby the Canadian government decides who is deemed an "Indian" under the Indian Act (Hanson, n.d.). As shown in Table 1, some significant demographic differences arose between Indigenous and Caucasian youth. Compared to Caucasian females, Indigenous females were almost twice as likely to have a history of foster care. Compared to Caucasian males, Indigenous males were younger at age of

first conviction and more likely to have a history of foster care. There were no differences between groups for age, prior conviction, or follow-up timeframe.

Design

Based on Canadian definitions (Allan & Smylie, 2015), our sample of Indigenous youth included those who were First Nations, Inuit, and Métis. Our comparison group consisted of Caucasian youth rather than a group of “non-Indigenous youth.” This is because a non-Indigenous group would encompass broad cultural groups (i.e., Caucasian youth, non-Indigenous minority youth), and SAVRY scores’ predictive validity is not necessarily equivalent across these groups (Barnes et al., 2016). Caucasian youth were defined as youth whose parents were both White. Sample sizes of other ethnic minorities were very small (32 Asian, 48 East Indian, 19 African or Black, 16 Hispanic and 54 other ethnicities), making it difficult to meaningfully examine these groups. Also, minority youth can differ considerably in factors such as age at immigration, English proficiency, reasons for leaving their country of origin (e.g., due to war) and assimilation level. As such, these youth were not examined in the present study. However, examining predictive validity in minority groups is an important area for future research.

Procedure

Ethics approval was provided by the study site and the university, and data collection adhered to relevant ethical guidelines (APA, 2017, Canadian Institutes of Health Research [CIHR], Canadian Psychological Association [CPA], 2017, Natural Sciences and Engineering Research Council of Canada [NSERC], & Social Sciences and Humanities Research Council of Canada [SSHRC], 2014). In addition, we followed relevant reporting guidelines for risk assessment research (i.e., Singh, Yang, Mulvey, & the RAGEE Group, 2015). This study was conducted as part of a larger study that examined youths’ SAVRY case plans, in particular whether the inclusion of a case planning form increased the quality of case plans for youth on probation (authors’ names redacted for blind review, 2019). All analyses in this manuscript are original and have not been presented in previous publications.

Implementation of the SAVRY. In 2012, our community partners asked us to assist them in implementing a new risk assessment tool. They wanted to replace the tool they were using at that time, the Youth Community Risk/Needs Assessment (YCRNA; Ministry for Children and Families, n.d.), with a measure with more empirical support. In response, we followed the risk assessment implementation guidelines outlined in Vincent, Guy, and Grisso (2012). First, we provided the provincial youth justice agency with information about various risk assessment tools. Of the options provided, the agency expressed initial interest in the SAVRY. As such, we sought further feedback from YPOs, managers, and Indigenous advisors about the SAVRY (authors’ names redacted for blind review, 2012). Prior to full implementation of the SAVRY, we pilot tested the SAVRY with approximately 15 YPOs. Then, a SAVRY co-author, Dr. Patrick Bartel, provided six two-day SAVRY training sessions throughout the province; 98.4% of YPOs in the province attended a training ($n = 123$). As part of this training, YPOs coded a case vignette involving an adolescent offender so we could verify their interrater reliability. In most cases (i.e., 87.7%, $n = 107$), YPOs’ SAVRY Risk Total score fell within four points of the consensus rating that had been developed by the research team and SAVRY co-author. After completing training, YPOs were required to use the SAVRY to assess risk with

each youth on probation. Risk assessments were conducted after youth were adjudicated to guide service planning; they were not used to guide disposition decisions.

Sampling. To sample YPOs' SAVRY assessments, the youth justice agency generated a list of all youth throughout the province who were on community supervision following the SAVRY implementation (i.e., between November 2, 2012 and November 21, 2014). We then randomly sampled 292 cases that had a SAVRY assessment. However, 19 files were closed because the youth had turned 18 years old, so we randomly sampled 19 more cases. After we completed coding, the provincial agency generated a second list of all youth throughout the province who were on community supervision between April 30, 2015 and November 15, 2015. Again, we randomly sampled 629 cases that had a SAVRY assessment. However, 16 files were closed so we randomly sampled 16 more cases. We excluded cases that had already been included in the first set of cases we coded ($n = 7$) to ensure that each participant represented a unique case and we removed one case as it had more than 10% of SAVRY variables missing. Ethnic minority youth were removed from the sample ($n = 169$). Thus, our final sample of Indigenous and Caucasian youth was 744.

Data extraction and coding. Six trained research assistants (RAs; five undergraduate and one graduate student) accessed the provincial youth justice database and extracted YPOs' SAVRY assessment ratings and youths' demographic information. If youth had multiple SAVRY assessments, we examined the first SAVRY assessment that corresponded to our extraction dates and then found the corresponding index offense linked to that SAVRY. Prior to coding files, RAs received a half-day training delivered by a certified trainer, which included practice cases. In addition, to check that RAs recorded YPOs' SAVRY assessments reliably, a second RA coded a random sample of 78 files. The RAs' interrater reliability for the SAVRY Total Score fell in the excellent range (Cicchetti, 1994); the intraclass correlation coefficient (ICC; random, single raters, absolute agreement) was .99.

Recidivism. RAs also extracted youths' recidivism data (i.e., juvenile and adult records) using the provincial youth justice database. Violent recidivism included charges such as murder, assault, unlawful confinement, robbery, uttering threats, and sexual assaults (Douglas, Hart, Webster & Belfrage, 2013). Any recidivism included charges for both violent and non-violent recidivism (e.g., theft, assault, probation violations). Youth were followed for an average of 1.96 years ($SD = 0.52$, range = .78 to 3.39 years). None of the youth were incarcerated for the duration of the follow-up. For any recidivism, 332 (44.6%) participants from the whole sample recidivated. For violent recidivism, 153 (20.6%) of the sample reoffended. For any recidivism, there were significant differences (with small effect sizes) between Indigenous and Caucasian male and female groups for both any and violent recidivism. For any recidivism, 42 (52.5%) Indigenous females and 31 (35.2%) Caucasian females reoffended (see Table 1). For males, 122 (55.7%) of Indigenous males reoffended and 137 (38.4%) of Caucasian males reoffended. For violent recidivism, 20 (25.0%) Indigenous females reoffended and 11 (12.5%) of Caucasian females reoffended. More Indigenous males ($n = 63$, 28.8%) violently recidivated than Caucasian males ($n = 59$, 16.5%). Differences between the gender groups fell in the small effect size range for violent recidivism.

Measures

Demographic information. RAs coded the following continuous variables from the provincial youth justice database: current age (ICC = .99), age at first conviction (ICC = .99), and last school grade completed (ICC = .96). They coded the following dichotomous variables: gender (kappa = 1.00), prior incarceration (kappa = .94), history of foster care (kappa = .83), Indigenous ethnicity (kappa = .82), and whether youth lived on reserve (kappa = .49). To determine Indigenous ethnicity, RAs examined whether youth were identified as Indigenous on the intake forms or other youth justice records (e.g., presentencing reports), if youth lived on reserve or had status. If the file indicated any of these, the youth was rated as being Indigenous.

SAVRY (Borum, Bartley, & Forth, 2006). The SAVRY is a risk assessment tool designed to predict risk of violence in adolescents. It is based on a structured professional judgement (SPJ) approach and contains 24 risk factors rated as Low, Moderate or High in three domains. These include 10 *Historical* (e.g., Early Caregiver Disruption), six *Social/Contextual* (e.g., Stress and Poor Coping), and eight *Individual/Clinical* factors (e.g., Low Empathy/Remorse). The SAVRY also contains six protective factors (e.g., Prosocial Involvement), which are rated as Absent or Present. After rating all factors, evaluators make an overall Summary Risk Rating (SRR) for future violence. For research purposes, scores are added together to create total scores and domain scores. SAVRY scores have been found to have strong interrater reliability (Borum et al., 2006) and predictive validity (Olver, Stockdale & Wormith, 2009).

Data Analytic Plan

Statistical analyses were conducted using IBM SPSS Statistics version 24 (IBM Corporation, 2017). Significance levels were set at .05.

SAVRY ratings and recidivism rates. We tested group differences in SAVRY scores and recidivism using *t*-tests and chi-square analyses. One case was missing SAVRY items, and it was deleted as it was missing >10% of items. None of the cases were missing recidivism data.

Discrimination indices. To examine how well SAVRY scores were able to discriminate between participants who did and did not recidivate, we generated AUCs using receiver operating characteristics (ROCs) analyses. AUCs represent the probability that a randomly selected recidivist would have a higher SAVRY score than a randomly selected non-recidivist (Hanley & McNeil, 1982). AUCs range from 0.5 (i.e., no better than chance) to 1.0 (i.e., perfect discrimination; Cook, 2007) and were interpreted according to criteria laid out by Rice and Harris (2005): .556 indicates a small effect, .639 a medium effect, and .714 a large effect. To test for significant differences in AUC scores between groups, the Hanley and McNeil (1982) test was used (<http://vassarstats.net>). A Bonferroni correction was applied to AUCs.

It is also important to assess the tool's ability to identify high and low risk groups specifically (Singh, 2013; Singh, Desmarais, & Van Dorn, 2013). As such, as recommended (Singh et al., 2013), we calculated sensitivity (i.e., the proportion of recidivists who were rated High risk) and specificity (i.e., the proportion of nonrecidivists who were rated Low risk) estimates. For these analyses, we focused on the Violence SRR, as the primary goal of the SAVRY is to predict violent recidivism. We excluded youth who were rated Moderate risk because it was unclear what would constitute a false positive or false negative in these cases (see Viljoen et al., 2008).

Positive and negative predictive values. To assess the extent to which SAVRY predictions were realized, we calculated positive predictive values (PPVs; i.e., the proportion of High-risk youth who reoffended) and negative predictive values (NPVs; i.e., the proportion of Low risk youth who did not reoffend). Once again, we used the Violence SRR and excluded Moderate risk youth for these analyses. To provide more information about the direction and nature of errors, rates of false positives (i.e., High risk youth who did not reoffend) and false negatives (i.e., Low risk youth who did reoffend) were also calculated.

Survival analyses. Finally, we conducted Cox proportional hazards regression (i.e., survival analyses; Cox, 1972) to evaluate the time to first violent or any reoffense. If the youth did not reoffend, survival time was the length of the follow-up for that youth. This method helps account for differences in the follow-up length across youth. Furthermore, it allowed us to simultaneously test whether predictive validity was moderated by ethnicity and/or sex. To do so, we created interaction terms and added these to the models. We centered SAVRY Risk Total scores before entering them (Baron & Kenny, 1986). We also controlled for whether youth were from the first batch of cases (2012-2014) or the second (2015) by entering this as a covariate.

Results

Preliminary Analyses

Prior to our main analyses, we compared youth in first (2012-2014) and second (2015) batch of cases. The mean SAVRY Risk Total did not differ between Indigenous youth in batch 1 ($n = 82$) and 2 ($n = 217$), $t = .17$, $p = .867$, nor between Caucasian youth in batch 1 ($n = 151$) and 2 ($n = 294$), $t = .15$, $p = .882$. Violent recidivism rates did not differ across batches for Indigenous youth, $\chi^2(299) = .005$, $p = .945$ or Caucasian youth, $\chi^2(445) = 2.08$, $p = .149$. Indigenous youth in batch 2 were significantly more likely to have any charges than Indigenous youth in batch 1, $\chi^2(299) = 4.32$, $p = .038$, but any charges did not differ between batches for Caucasian youth, $\chi^2(445) = 1.06$, $p = .302$. Finally, the AUCs for the SAVRY Risk Total and any recidivism, and for the Violence SRR and violent recidivism, did not differ significantly across batches ($z = -0.89$, $p = .373$ and $z = -0.75$, $p = .453$, respectively). Given the similarities across cases, we collapsed batch 1 and 2 for our analyses. This provided greater power to analyze differences across sex and ethnicity.

SAVRY Ratings and Recidivism Rates

Indigenous females scored significantly higher than Caucasian females on the SAVRY Risk Total score and risk domains, but significantly lower on Protective Factors (see Table 1). For the SAVRY Risk Total score, effect size was in the large range while for risk domains, were in the small to medium ranges. Compared to Caucasian females, Indigenous females were also significantly more likely to be rated as High risk on the Violence SRR and were more likely to be charged with any and violent recidivism with all effect sizes being in the small range. A similar pattern of results was found with male youth. Indigenous males scored significantly higher than Caucasian males on the SAVRY Risk Total score and several risk domains (i.e., Historical, Social-Contextual) with effect sizes being in the small to medium range. During the follow-up period, Indigenous males were more likely to be charged with any and violent recidivism again, having small effect sizes.

Discrimination Indices

AUCs. In general, AUCs for SAVRY Risk Total and Violence SRRs significantly predicted any and violent recidivism with medium to large effects across groups (see Tables 2 and 3), except that the Violence SRR did not significantly predict violent recidivism in Caucasian females ($p = .109$). For violent recidivism, AUCs had similar ranges for both Indigenous females (range = .59 to .76) and Caucasian females (range = .53 to .73). In addition, AUCs appeared slightly higher for Caucasian males (range = .65 to .70) than Indigenous males (range = .63 to .68). However, none differed significantly.

For predictions of any recidivism (see Table 3), AUCs appeared slightly higher for Indigenous females (range = .59 to .77) than Caucasian females (range = .56 to .71). No significant differences emerged. Conversely, AUCs were higher for Caucasian males (range = .68 to .79) than Indigenous males (range = .61 to .70). Specifically, AUCs for the Historical domain ($z = -2.04$, $p = .041$), Protective factors ($z = -2.38$, $p = .017$), and Risk Total ($z = -2.07$, $p = .038$) were significantly higher for Caucasian males. However, after applying a Bonferroni correction ($p = .050$ divided by 24 comparisons = .002), none of these differences reached statistical significance.

Sensitivity and specificity. In predicting violent recidivism, more Indigenous females were correctly identified as high risk (88.9%) compared to Caucasian females (62.5%; see Table 5). However, fewer Indigenous females were correctly identified as low risk (46.4%) compared to Caucasian females (72.3%). Sensitivity and specificity patterns for males were similar, though not as exaggerated. Slightly more Indigenous males were correctly identified as high risk (73.8%) compared to Caucasian males (64.9%), while slightly fewer Indigenous males were correctly identified as low risk (67.7%) compared to Caucasian males (73.3%).

Likewise, in predicting any recidivism, more Indigenous females were correctly identified as high risk (82.8%) compared to Caucasian females (50.0%; see Table 6), and fewer were correctly identified as low risk (58.8%) compared to Caucasian females (78.8%). About the same proportion of Indigenous (58.4%) and Caucasian males (59.5%) were correctly identified as high risk, while slightly fewer Indigenous males were correctly identified as low risk (72.4%) compared to Caucasian males (81.7%).

Differences Between Ever On and Off Reserve Indigenous Youth

Indigenous youth who had ever lived on reserve (i.e., youth who currently lived on reserve and/or had in the past) did not differ significantly from those who had never lived on reserve in SAVRY Risk Total average (23.36 for ever on reserve vs. 23.98 for off reserve, $t = .47$, $p = .638$). Violent recidivism rates did not differ between off reserve Indigenous youth or Indigenous youth who had ever lived on reserve ($\chi^2(227) = 1.383$, $p = .240$) nor for any recidivism ($\chi^2(227) < .001$, $p = .988$). Means also did not differ between these groups for Historical ($t = .68$, $p = .498$), Social/Contextual ($t = .31$, $p = .754$), Individual ($t = .20$, $p = .844$), and Protective ($t = -1.13$, $p = .259$) domains.

AUCs did not significantly differ between on and off reserve youth regardless of whether we looked at the overall sample or males specifically (see Table 4). However, AUCs were

consistently larger for youth in the off-reserve group (ranging from .64 to .74) than the ever on reserve group (ranging from .58 to .69), with more AUCs reaching significance in the off-reserve group. As only nine female youth had ever lived on a reserve, we were unable to compare their AUCs with off reserve females.

PPVs and NPVs

For violent recidivism, PPVs were higher for Indigenous females (51.6%) and males (50.8%) than for Caucasian females (27.8%) and males (32.9%; see Table 5). In other words, more of the high-risk Indigenous youth went on to violently reoffend compared to the high-risk Caucasian youth. Conversely, NPVs were slightly lower for Indigenous females (86.7%) and males (85.1%) than for Caucasian females (91.9%) and males (91.2%). More of the low-risk Indigenous youth went on to violently reoffend than the low-risk Caucasian youth.

Patterns were similar for predictions of any recidivism (see Table 6). PPVs were slightly higher for Indigenous females (77.4%) and males (73.8%) than for Caucasian females (61.1%) and males (64.4%). Conversely, NPVs were slightly lower for Indigenous females (66.7%) and males (56.8%) than for Caucasian females (70.3%) and males (78.4%).

False positives and false negatives. Rates of false positives for violent recidivism were highest for Caucasian females (72.2%), followed by Caucasian males (67.1%), then Indigenous males (49.2%) and females (48.4%; see Table 5). For high risk youth, there was a significant association between ethnicity and violent recidivism, $\chi^2(1) = 6.96, p = .008$. High risk Indigenous youth were more than twice as likely to violently reoffend than Caucasian youth (OR = 2.22, 95% CI [1.17, 4.26]). Conversely, rates of false negatives were higher for Indigenous females (13.3%) and males (14.9%) than for Caucasian females (8.1%) and males (8.8%). For low risk youth, the association between ethnicity and violent recidivism was not significant.

Rates of false positives for any recidivism were also higher for Caucasian females (38.9%) and males (35.6%) than for Indigenous females (22.6%) and males (26.2%). However, the association between ethnicity and any recidivism was not significant for high risk youth. Once again, rates of false negatives were higher for Indigenous females (33.3%) and males (43.2%) than for Caucasian females (29.7%) and males (21.6%). For low risk youth, there was a significant association between ethnicity and any recidivism, $\chi^2(1) = 9.77, p = .002$, such that low risk Indigenous youth were more than twice as likely to reoffend at all compared to Caucasian youth (OR = 2.34, 95% CI [1.31, 4.18]).

Survival Analyses

A pair of Cox hierarchical regressions examined whether the SAVRY Violence SRR predicted time to first violent or any reoffense (see Table 6). Batch, sex, and Indigenous ethnicity were treated as covariates and were entered simultaneously with the two-way (High risk \times Sex and High risk \times Indigenous ethnicity and Sex \times Ethnicity) and three-way interaction terms (High risk \times Sex \times Indigenous ethnicity). The model predicting time to first violent reoffense was significant ($\chi^2(8) = 106.27, p < .001$), as was the model predicting time to first any reoffense ($\chi^2(8) = 92.01, p < .001$). For both models, the Violence SRR appeared to be driving the prediction

as it was the only significant predictor (violent $p < .001$; any $p < .001$). As the three-way interactions were not significant in either model, no moderation occurred.

Two models were also run using the SAVRY Risk Total to predict time to first violent or any reoffense (see Table 6). Once again, the violent recidivism model ($\chi^2(8) = 81.57, p < .001$) and any recidivism model ($\chi^2(8) = 185.12, p < .001$) were both significant. Higher Risk Total scores decreased time to violent or any recidivism. For the any recidivism model, males reoffended faster than females. The three-way interaction term (Indigenous x Sex x Risk total) for any recidivism was significant, such that ethnicity had a different effect for higher risk males than it did for higher risk females or lower risk youth.

Discussion

Although Indigenous youth are vastly overrepresented in the Canadian youth justice system (Department of Justice Canada, 2019), it is unclear if widely used risk assessment tools such as the SAVRY are appropriate to use with Indigenous youth. As such, in this prospective field study, we examined the predictive validity of SAVRY scores with 744 Caucasian and Indigenous youth.

Primary Findings

Indigenous adolescents were rated as having higher needs. As hypothesized by Indigenous consultees, Indigenous adolescents scored significantly higher on all SAVRY risk domains than Caucasian youth. In addition, consistent with other research (Office of the Correctional Investigator, 2015), Indigenous youth had higher rates of subsequent charges than their Caucasian counterparts, though this difference did not reach significance for females. The higher risk scores and rates of recidivism found may relate to colonialism, which scholars have theorized to be a distal determinant of Indigenous overrepresentation in the justice system (Czyzewski, 2011). It may also relate to ongoing marginalization and inequities. For instance, adequate healthcare is often lacking in Indigenous communities, which could lead to unaddressed needs (Greenwood et al., 2018). Discrimination could also contribute to heightened offending; prior research has found that Indigenous youth may engage in aggression in response to perceived discrimination (Hartshorn, Whitbeck & Hoyt, 2012). However, these possibilities were not directly tested in the present study and should be examined in future research.

SAVRY predicted reoffending in Indigenous and Caucasian youth. In general, the SAVRY significantly predicted violent and any recidivism among both Indigenous and Caucasian females and males. The SAVRY Summary Risk Rating for violence significantly predicted violent recidivism with AUCs ranging from .65 to .76. In addition, AUC scores for SAVRY Risk Total scores (which were calculated for research purposes but not used in professional practice) ranged from .63 to .73 for violent recidivism and .61 to .79 for any recidivism. These values fall in the medium to large range (Rice & Harris, 2005) and are comparable to the values found in other studies (Olver et al., 2009).

Contrary to hypotheses, relatively few significant differences emerged in the predictive validity of SAVRY scores between Indigenous and Caucasian youth. Of the 24 differences in AUCs that were tested, only three (i.e., 12.5%) were significantly lower in Indigenous youth than

Caucasian youth. Specifically, the Historical domain was a stronger predictor of any recidivism for Caucasian males than Indigenous males. This could be because the SAVRY does not capture historical risk factors related to colonialism (i.e., historical trauma). Alternatively, historical factors may not be as effective at differentiating Indigenous males who do and do not reoffend either because Indigenous males, in general, had high scores on this scale (e.g., less variability in scores) or because YPOs had difficulty accurately rating these factors for Indigenous males. Protective factors also predicted any reoffending significantly better for Caucasian than Indigenous males. Again, the Protective domain may not be capturing Indigenous specific protective factors such as extended family and Elder involvement, as noted by Indigenous consultees. Notably, once a Bonferroni correction was applied, these differences in predictive validity no longer reached significance.

Positive predictive power was higher in Indigenous than Caucasian youth. YPOs appeared to be more successful in identifying Indigenous youth who were high risk for reoffending than Caucasian youth who were high risk of reoffending. For instance, of the male and female youth YPOs rated as High risk for violence, 50-51% of Indigenous youth and 28-33% of Caucasian males were charged with subsequent violence. Contrary to expectations, rates of false positives were lower for Indigenous youth than Caucasian youth. Given that positive predictive values are base rate dependent (Singh, 2013), the higher positive predictive power for Indigenous versus Caucasian youth could stem from differences in the rates of recidivism across groups. It is also possible that the higher predictive accuracy for High risk Indigenous youth stems from biases in the detection and measurement of reoffending. For instance, since Indigenous youth are rated and perceived as higher risk by probation officers and law enforcement, they may be monitored more closely, resulting in more charges (i.e., racial/ethnic profiling). This self-fulfilling prophecy effect has been well-documented in research on arrest rates for people of color in the United States (Harcourt, 2007).

Predictive validity was comparable for Indigenous youth who lived on and off reserve. We found no significant differences in predictive validity across youth who had lived on versus off reserve, which may indicate that predictive validity is not substantially affected by place of residence or, potentially, levels of acculturation. In addition, whereas previous research indicated that crime rates on reserves were higher than for the rest of Canada (Statistics Canada, 2016), the current study did not find differences in recidivism or SAVRY Total scores for youth on versus off reserve. In other words, Indigenous youth tended to have higher needs regardless of whether they lived on a reserve. This could indicate that factors such as colonialism and ongoing marginalization and disparities affect all Indigenous youth regardless of where they live.

Limitations

Although this province-wide prospective field study is one of the first to examine the predictive validity of the SAVRY among Indigenous female and male youth, it has some limitations. First, we measured reoffending through official records (i.e., youth and adult justice records). Similar to other studies (see Viljoen, Mordell, & Beneteau, 2012), we used charges rather than convictions, as charges are thought to be a more sensitive measure. Nevertheless, many offenses are not detected by official records (Farrington, Jolliffe, Loeber & Homish, 2007). Furthermore, official records may reflect some ethnic and cultural biases. For instance, Indigenous people are more likely to be stopped and checked by the police (Huncar, 2017).

Second, although we compared predictive validity for Indigenous youth on and off reserve, the group of on reserve youth was small ($n = 85$). As such, these analyses may have had limited power, and the interrater reliability for determining whether a youth lived on or off reserve was modest ($\kappa = .49$), possibly because of the limited information provided. Also, we were unable to examine other aspects of indicators of cultural experiences and identity because such information was not included in youth justice files.

Third, although this study provided an opportunity to examine the predictive validity of SAVRY scores as they are used in real-world practice, similar to other field studies (e.g., Luong & Wormith, 2011), limited information was available pertaining to the interrater reliability of the SAVRY scores when used by YPOs. As part of their training, YPOs completed coding for a fictional case vignette and appeared to achieve acceptable interrater reliability for this case. However, it would have been preferable to have information on the SAVRY's interrater reliability in practice (i.e., field reliability). Finally, we were unable to examine the predictive validity of other minority groups in this study (e.g., Asian youth) due to small sample sizes and limited information. However, this is an important area for future research.

Implications for Practice

Based on the results of this study, the SAVRY appears to be a reasonable tool to use in assessing risk for Indigenous youth, especially as few other violence risk assessment tools have been validated with this population. Although we did not directly examine colonialism, it is still an important consideration for both practice and future research. Evaluators should take additional steps to ensure that they use the SAVRY in a culturally appropriate manner because Indigenous people have experienced a long history of colonialism, harmful policies, marginalization, and ongoing inequities, which continue to affect Indigenous peoples today. As a first step, evaluators should complete relevant training, such as Indigenous cultural competency training. When interviewing Indigenous youth and their families, evaluators should work to create a culturally safe environment (e.g., seeking information about youths' strengths in addition to vulnerabilities), and gather information about culturally relevant factors (e.g., youth's cultural connectedness). These culturally relevant factors can be added to SAVRY assessments as case-specific factors.

In making their risk judgements, evaluators should be careful not to assume that Indigenous youth pose a heightened risk for reoffending. Although, on average, Indigenous youth had somewhat higher risk ratings than Caucasian youth, there was enormous variability within Indigenous youth, and a sizable proportion were low risk. Evaluators should also be mindful that there are many cultural differences within Indigenous youth. For instance, there are over 600 Indigenous Nations in Canada (Statistics Canada, 2011). In addition, although we found some support for the SAVRY, evaluators should, in their reports and testimony, acknowledge that research on the use of the SAVRY with Indigenous youth is limited, particularly research that includes Indigenous consultation.

Evaluators can also aim to use a culturally informed approach in their case formulation. For instance, if an evaluator explains that the youth's previous violence occurred in response to ongoing discrimination and racist insults by peers, this can create a deeper understanding of the youth. This contextual understanding can help broaden the scope of interventions for the youth

and aid in focusing interventions on the root of the problem (e.g., experiences of discrimination), not just the symptoms (e.g., high risk for anger and aggression). Although models for cultural formulation of violence risk are lacking, one framework that may be helpful are the guidelines laid out in Gladue reports (*R. v. Gladue*, 1999; Shepherd & Anthony, 2018). In Gladue reports, evaluators consider how the effects of colonialism have brought the individual before the court (e.g., poverty and lack of services on their reserve or no high school or jobs on their reserve; see Shepherd & Anthony, 2018).

Finally, in developing treatment recommendations, evaluators should consider whether culturally specific interventions may be appropriate. A recent meta-analysis found that for Indigenous offenders, participating in a culturally based intervention (compared to a generic or standard intervention) was associated with lower rates of recidivism (Gutierrez, Chadwick & Wanamaker, 2018).

Implications for Future Research

Although SAVRY scores generally showed acceptable predictive validity with Indigenous youth, researchers might improve prediction and deepen our understanding of the multiple causes of offending among Indigenous youth by examining the role of culturally salient or culturally specific predictors (Shepherd & Willis-Esqueda, 2018). For instance, as consultees noted, factors such as historical trauma (e.g., having parents or grandparents who attended residential schools, having broken family lineages due to residential schools, foster care and adoption as well as historical and contemporary losses) and ongoing discrimination might exacerbate risk, whereas high cultural connectedness may mitigate it. Thus far, research indicates that these factors can contribute to a variety of adverse outcomes among Indigenous youth (e.g., mental and physical health; Burnette & Figley, 2016), emphasizing a need for further research, particularly on how such factors impact reoffending.

Future research should assess the utility of various risk assessment tools for conceptualizing and managing risk in Indigenous youth. Specifically, researchers should compare the predictive validity *and* the perceived utility of cultural etic approaches, such as the SAVRY, to culturally tailored risk assessment tools. If two risk tools are found to have comparable predictive validity, but one is more useful for conceptualizing and managing risk, the latter should be used. As of yet, culturally tailored tools have not been developed for Indigenous adolescents but one such tool was designed for adults (Boer, Couture, Geddes, & Ritchie, 2003).

Distinct types of biases in risk assessment tools should also be examined. Specifically, researchers have distinguished between psychometric bias, which can be attributed to the risk assessment tool, and evaluator bias, which can be attributed to the way the assessor uses or interprets the risk assessment tool (Shepherd & Lewis-Fernandez, 2016). For example, Shepherd and Lewis-Fernandez (2016) used the example of the clinical interview where Indigenous clients from Australia may interpret the Western method of questioning (direct and rapid) as uncomfortable (and therefore be less forthcoming with information) if strong rapport has not been built. Further, they noted that “rushing in and interrupting” are culturally disrespectful and, instead, one may have to “gently solicit feedback” from Indigenous youth (Shepherd & Willis-Esqueda, 2018, p. 617). Since risk tools often use information gleaned from interviews, their interpretations might be flawed if the information gathering process contains bias.

Finally, researchers should test whether the use of the SAVRY and other risk assessment tools may lead to disparate impact for Indigenous youth (Shepherd & Willis-Esqueda, 2018; Skeem & Lowenkamp, 2016). Given that Indigenous youth received higher mean SAVRY scores, it is possible that the adoption of the SAVRY might not only lead to more treatment referrals, but also lead to punitive sanctions for Indigenous youth (e.g., intensive supervision, incarceration). As an Indigenous participant from Shepherd and Willis-Esqueda's (2018) study noted, "I see most of these ([SAVRY] items) as symptoms of historical trauma, rather than violent offending. My reaction to here is that this questionnaire will criminalize Native people when the real issue is grief and historical trauma" (p. 608).

Summary

In sum, although we predicted that the SAVRY would show lower predictive validity in Indigenous youth than Caucasian youth, we found few differences between groups. However, even though the SAVRY predicts reoffending adequately for Indigenous youth overall, the Historical and Protective factor domains were less accurate in predicting reoffending for Indigenous males than Caucasian males. Evaluators should take additional steps to ensure that they use and interpret SAVRY assessments within a cultural lens (i.e., including contextual issues such as colonialism or racism). In addition, researchers should make efforts to improve our understanding and assessment of the factors that contribute to offending among Indigenous youth through community-based research and consultation with Indigenous people.

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Table 1

Indigenous and Caucasian Youth: Demographic Characteristics, SAVRY Scores, and Reoffense Rates

Variables	Females							Males						
	Indigenous (<i>n</i> = 80)		Caucasian (<i>n</i> = 88)		Difference			Indigenous (<i>n</i> = 219)		Caucasian (<i>n</i> = 357)		Difference		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>d</i>	CI	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>d</i>	CI
Age	16.45	1.44	16.86	1.27	1.93	.30	[-.61, .002]	17.13	1.26	17.15	1.33	0.18	.02	[-.15, .18]
Age First Conviction	15.20	1.55	15.67	1.35	2.08*	.32	[.02, .63]	15.61	1.54	15.94	1.38	2.69**	.23	[.06, .40]
Grade in School	9.00	1.20	9.19	1.35	0.68	.15	[-.16, .45]	9.37	1.28	9.75	1.35	2.51*	.29	[.12, .46]
SAVRY Risk Total	26.61	8.21	19.72	9.54	-4.98***	.77	[.46, 1.08]	22.42	9.34	18.34	9.40	-5.07***	.43	[.26, .61]
Historical	11.43	3.79	7.69	4.13	-6.09***	.94	[.62, 1.26]	9.59	4.21	7.10	4.09	-6.98***	.60	[.43, .77]
Social/Contextual	6.89	2.21	5.42	2.59	-3.91***	.61	[.30, .92]	5.42	2.46	4.55	2.54	-4.04***	.35	[.18, .52]
Individual	8.39	3.66	6.60	4.19	-2.93**	.46	[.15, .76]	7.35	3.94	6.68	4.01	-1.95	.17	[-.0003, .34]
Protective	2.50	1.58	3.38	1.91	3.22**	.50	[.20, .81]	3.30	1.82	3.49	1.80	1.23	.10	[-.06, .27]
	<i>n</i>	%	<i>n</i>	%	χ^2	<i>r</i>	CI	<i>n</i>	%	<i>n</i>	%	χ^2	<i>r</i>	CI
Prior Conviction	50	66.7	52	69.3	.12	.03	[-.12, .18]	118	61.8	212	67.1	1.48	.05	[-.03, .13]
Prior Incarceration	26	32.5	30	34.1	.05	.02	[-.13, .17]	84	38.4	93	26.1	9.66**	.13	[.05, .21]
Foster Care History	47	58.8	27	30.7	13.40***	.28	[.13, .45]	101	46.1	101	28.3	18.95***	.18	[.10, .27]
High Risk SAVRY	31	38.8	18	20.5	6.80**	.20	[.05, .36]	61	27.9	73	20.4	4.17*	.09	[.003, .17]
Any Recidivism	42	52.5	31	35.2	5.09*	.17	[.02, .33]	122	55.7	137	38.4	16.48***	.17	[.09, .25]
Violent Recidivism	20	25.0	11	12.5	4.35*	.16	[.009, .31]	63	28.8	59	16.5	12.18***	.15	[.06, .23]

Note. CI 95% lower and upper Cohen's *d* or *r*. $p = .05^*$ $p = .01^{**}$ $p = .001^{***}$. For Cohen's *d*, small effect size = 0.20, medium effect size = 0.50 and large effect size = 0.80 (Cohen, 1988).

Table 2

Violent Recidivism: AUC Scores for Indigenous and Caucasian Youth

SAVRY Scores	Indigenous				Caucasian				Difference	
	AUC	SE	95% CI _{AUC}	<i>p</i>	AUC	SE	95% CI _{AUC}	<i>p</i>	<i>z</i>	<i>p</i>
Females										
Historical	.69	.07	[.55, .82]	.012	.73	.09	[.56, .90]	.012	-0.34	.730
Social-Contextual	.62	.07	[.49, .75]	.112	.66	.08	[.50, .83]	.080	-0.33	.741
Individual Clinical	.66	.08	[.50, .81]	.038	.69	.09	[.51, .86]	.048	-0.25	.801
Protective	.59	.07	[.45, .73]	.237	.53	.10	[.35, .72]	.733	0.47	.638
Risk Total	.69	.07	[.56, .82]	.011	.73	.08	[.58, .89]	.012	-0.34	.730
Violence SRR	.76	.07	[.63, .89]	.001	.65	.10	[.46, .84]	.109	0.94	.345
Males										
Historical	.65	.04	[.57, .73]	.001	.67	.04	[.60, .74]	<.001	-0.34	.735
Social-Contextual	.63	.04	[.55, .71]	.003	.68	.03	[.61, .75]	<.001	-0.84	.399
Individual Clinical	.67	.04	[.59, .75]	<.001	.70	.03	[.63, .76]	<.001	-0.51	.607
Protective	.58	.04	[.49, .66]	.076	.65	.04	[.58, .72]	<.001	-1.28	.200
Risk Total	.67	.04	[.59, .74]	<.001	.70	.03	[.64, .77]	<.001	-0.51	.607
Violence SRR	.68	.04	[.60, .76]	<.001	.66	.04	[.59, .74]	<.001	0.34	.734

Note. CI_{AUC} = confidence interval of AUC. *n* for Indigenous females = 80, *n* for Caucasian females = 88, *n* for Indigenous males = 219, *n* for Caucasian males = 357. Protective Domain scores have been reverse-coded. Base rates for violence for Indigenous females *n* = 20 (25%); Caucasian females *n* = 11 (12.5%); Indigenous males *n* = 63 (28.8%); Caucasian males *n* = 59 (16.5%).

Table 3

Any Recidivism: AUC Scores for Indigenous and Caucasian Youth

SAVRY Scores	Indigenous				Caucasian				Difference	
	AUC	SE	95% CI _{AUC}	<i>p</i>	AUC	SE	95% CI _{AUC}	<i>p</i>	<i>z</i>	<i>p</i>
Females										
Historical	.73	.06	[.62, .84]	<.001	.71	.06	[.59, .82]	.001	0.24	.808
Social-Contextual	.65	.06	[.53, .77]	.022	.64	.06	[.52, .76]	.029	0.11	.910
Individual Clinical	.77	.05	[.66, .87]	<.001	.64	.07	[.51, .77]	.034	1.58	.114
Protective	.59	.07	[.46, .72]	.164	.56	.06	[.43, .68]	.373	0.36	.717
Risk Total	.76	.05	[.67, .87]	<.001	.69	.06	[.57, .81]	.003	0.86	.389
Violence SRR	.70	.06	[.59, .82]	.002	.61	.07	[.48, .74]	.097	1.04	.299
Males										
Historical	.69	.04	[.62, .76]	<.001	.78	.02	[.73, .83]	<.001	-2.04	.041
Social-Contextual	.64	.04	[.56, .71]	.001	.71	.03	[.66, .77]	<.001	-1.48	.136
Individual Clinical	.70	.04	[.63, .77]	<.001	.76	.03	[.71, .81]	<.001	-1.36	.174
Protective	.61	.04	[.53, .68]	.006	.72	.03	[.67, .77]	<.001	-2.38	.017
Risk Total	.70	.04	[.63, .77]	<.001	.79	.02	[.74, .84]	<.001	-2.07	.038
Violence SRR	.63	.04	[.56, .70]	.001	.68	.03	[.63, .74]	<.001	-1.05	.295

Note. CI_{AUC} = confidence interval of AUC. *n* for Indigenous females = 80, *n* for Caucasian females = 88, *n* for Indigenous males = 219, *n* for Caucasian males = 357. Protective Domain scores have been reverse coded. Base rates for any recidivism for Indigenous females *n* = 42 (52.5%); Caucasian females *n* = 31 (35.2%); Indigenous males *n* = 122 (55.7%); Caucasian males *n* = 137 (38.4%).

Table 4

AUC Scores for Indigenous Youth On and Off Reserve

	Ever On Reserve				Off Reserve				Difference	
	AUC	SE	95% CI _{AUC}	<i>p</i>	AUC	SE	95% CI _{AUC}	<i>p</i>	<i>z</i>	<i>p</i>
Total Sample										
Violent Recidivism										
Risk Total Scores	.64	.06	[.52, .77]	.030	.69	.05	[.59, .79]	.001	.60	.551
Violence Summary Rating	.65	.07	[.52, .78]	.026	.73	.05	[.64, .83]	< .001	.97	.332
Any Recidivism										
Risk Total Scores	.69	.06	[.58, .81]	.002	.71	.04	[.62, .79]	< .001	.28	.779
Violence Summary Rating	.62	.06	[.50, .74]	.053	.64	.05	[.55, .73]	.004	.26	.793
Males Only										
Violent Recidivism										
Risk Total Scores	.64	.07	[.50, .78]	.059	.69	.06	[.57, .80]	.004	.52	.601
Violence Summary Rating	.64	.07	[.49, .78]	.066	.73	.06	[.62, .84]	< .001	.96	.339
Any Recidivism										
Risk Total Scores	.66	.07	[.54, .79]	.019	.74	.05	[.63, .84]	< .001	.99	.323
Violence Summary Rating	.58	.07	[.45, .72]	.248	.65	.05	[.54, .76]	.011	.80	.423

Note. CI_{AUC} = confidence interval of AUC. Ever on-reserve youth *n* = 85, off-reserve youth *n* = 142. Ever on-reserve males *n* = 70, off-reserve males *n* = 101. Base rates for violence for on-reserve youth *n* = 29 (34.1%); off-reserve *n* = 38 (26.8%). Base rates for any recidivism for on-reserve youth *n* = 49 (57.6%); off-reserve *n* = 82 (57.7%). Violence rates off-reserve males *n* = 28 (27.7%); ever on-reserve males *n* = 23 (32.9 %). Any recidivism off-reserve males *n* = 60 (59.4%); ever-on reserve *n* = 38 (54.3 %).

Table 5

PPV, NPV, Sensitivity, and Specificity of the Violence Summary Risk Rating in Predicting Violent and Any Recidivism

Groups	<i>n</i>	False Positives % (95% CI)	False Negatives % (95% CI)	PPV % (95% CI)	NPV % (95% CI)	Sensitivity % (95% CI)	Specificity % (95% CI)
Violent Recidivism							
Indigenous Females	46	48.4 (30.2, 40.5)	13.3 (1.7, 40.5)	51.6 (33.1, 69.8)	86.7 (59.5, 98.3)	88.9 (65.3, 98.6)	46.4 (27.5, 66.1)
Caucasian Females	55	72.2 (46.5, 90.3)	8.1 (1.7, 21.9)	27.8 (9.7, 53.5)	91.9 (78.1, 98.3)	62.5 (24.5, 91.5)	72.3 (57.4, 84.4)
Indigenous Males	135	49.2 (36.1, 62.3)	14.9 (7.7, 25.0)	50.8 (37.7, 63.9)	85.1 (75.0, 92.3)	73.8 (58.0, 86.1)	67.7 (57.3, 77.1)
Caucasian Males	221	67.1 (55.1, 77.7)	8.8 (4.8, 14.6)	32.9 (22.3, 44.9)	91.2 (85.4, 95.2)	64.9 (47.5, 79.8)	73.3 (66.3, 79.6)
Any Recidivism							
Indigenous Females	46	22.6 (9.6, 41.1)	33.3 (11.8, 61.6)	77.4 (58.9, 90.4)	66.7 (38.4, 88.2)	82.8 (64.2, 94.2)	58.8 (32.9, 81.6)
Caucasian Females	55	38.9 (17.3, 64.3)	29.7 (15.9, 47.0)	61.1 (35.7, 82.7)	70.3 (53.0, 84.1)	50.0 (28.2, 71.8)	78.8 (61.1, 91.0)
Indigenous Males	135	26.2 (15.8, 39.1)	43.2 (31.8, 55.3)	73.8 (60.9, 84.2)	56.8 (44.7, 68.2)	58.4 (46.6, 69.6)	72.4 (59.1, 83.3)
Caucasian Males	221	35.6 (24.7, 47.7)	21.6 (15.3, 29.1)	64.4 (52.3, 75.3)	78.4 (52.3, 75.3)	59.5 (47.8, 70.4)	81.7 (74.3, 87.7)

Note. CI = confidence interval; PPV = positive predictive value; NPV = negative predictive value. The total number of participants in each group contain only youth assessed as either High or Low risk on the Violence Summary Risk Rating.

Table 6

Cox Proportional Hazards Model to Test Moderation by Ethnicity and Sex

	Violent				Any			
	<i>b</i> (SE)	HR [95% CI]	Wald	<i>p</i>	<i>b</i> (SE)	HR [95% CI]	Wald	<i>p</i>
Violence SRR								
Batch of cases	-0.12 (.18)	0.89 [0.62, 1.26]	0.45	.505	-0.11 (.12)	0.90 [0.71, 1.14]	0.77	.381
Sex	-0.06 (.31)	0.94 [0.51, 1.72]	0.04	.837	-0.19 (.25)	0.83 [0.51, 1.37]	0.54	.463
Indigenous	-0.80 (.51)	0.45 [0.17, 1.23]	2.41	.120	-0.40 (.36)	0.67 [0.33, 1.36]	1.23	.267
SRR	-2.23 (.56)	0.11 [0.04, 0.32]	15.80	< .001	-1.17 (.31)	0.31 [0.17, 0.58]	13.88	< .001
Indigenous x SRR	0.82 (.83)	2.27 [0.45, 11.43]	0.99	.320	0.09 (.49)	1.09 [0.42, 2.80]	0.03	.857
Sex x SRR	1.04 (.62)	2.84 [0.85, 9.49]	2.88	.090	0.53 (.37)	1.71 [0.83, 3.49]	2.13	.144
Indigenous x Sex	0.22 (.58)	1.24 [0.40, 3.89]	0.14	.708	0.17 (.42)	1.19 [0.52, 2.70]	0.17	.685
Indigenous x Sex x SRR	-0.82 (.90)	0.44 [0.08, 2.60]	0.82	.366	-0.42 (.55)	0.67 [0.22, 1.94]	0.58	.447
SAVRY Risk Total								
Batch of cases	-0.15 (.18)	0.86 [0.60, 1.23]	0.69	.406	-0.18 (.12)	0.84 [0.66, 1.07]	2.10	.147
Sex	0.50 (.39)	1.64 [0.76, 3.56]	1.58	.209	0.57 (.27)	1.76 [1.03, 3.01]	4.31	.038
Indigenous	-0.43 (.51)	0.65 [0.24, 1.76]	0.72	.397	0.07 (.32)	1.07 [0.57, 2.00]	0.04	.834
Risk Total	0.07 (.03)	1.08 [1.02, 1.14]	6.50	.011	0.10 (.02)	1.11 [1.06, 1.15]	22.19	< .001
Indigenous x Risk Total	0.01 (.04)	1.01 [0.93, 1.10]	0.04	.843	-0.04 (.03)	0.96 [0.91, 1.02]	1.73	.189
Sex x Risk Total	-0.01 (.03)	0.99 [0.93, 1.05]	0.14	.708	-0.04 (.02)	0.96 [0.92, 1.00]	3.17	.075
Indigenous x Sex	-0.03 (.55)	0.97 [0.33, 2.85]	0.00	.955	-0.44 (.35)	0.65 [0.33, 1.27]	1.60	.205
Indigenous x Sex x Risk	0.01 (.05)	1.01 [0.92, 1.10]	0.01	.910	0.07 (.03)	1.07 [1.01, 1.14]	4.89	.027

Note. HR = hazard ratio; CI = confidence interval; SRR = Summary Risk Rating