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Gender, race/ethnicity and prediction: Risk in behavioral assessment

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1. Introduction

Evaluations of risk and the probability of reoffending are critical to assessment research. Central to these studies, is the degree to which assessment instruments execute their main objectives, validity, and predictive accuracy (Auerhahn, 1999, 2006; Blackmore & Welsh, 1983; Chaiken, Chaiken, & Peterson, 1982; Cohen, 1983; Greenwood & Abrahamse, 1982; Von Hirsch & Gottfredson, 1984). More recently, examinations of gendered differences in predictive ability across racial/ethnic groups have emerged as an area of growing interest in risk assessment scholarship (Olver, Stockdale, & Wormith, 2009; Schwalbe, 2007; Smith, Cullen, & Latessa, 2009). Consistent across this growing body of research are concerns related to the accuracy of assessment instruments in terms of risk classification, prediction of correctional outcomes, and recidivism among female offenders.

Of the available research on gendered differences in predictive ability across racial/ethnic groups and the effect of assessment instruments on probation outcomes, there has been no clear consensus. Multiple studies report no difference in predictive ability across racial groups (Edens, Campbell, & Weir, 2007; Guy, Edens, Anthony, & Douglas, 2005; Olver et al., 2009; Schwalbe, 2007; Skeem, Edens, Camp, & Colwell, 2004), still others report decreased accuracy among minority probationers (Henderson, 2006; Henderson, Daniel, Adams, & Rembert, 2007; Whiteacre, 2006; Yacus, 1998). This contradictory pattern of findings is again observed in examinations of gender, behavioral predictions, and probation failure. Numerous studies report increased responsivity of gender-specific items in predicting probation failure (Funk, 1999; Lowenkamp, Holsinger, & Latessa, 2001; Oleson, van Benschoten, Robinson, & Lowenkamp, 2011; Olson, Alderden, & Luirgio, 2003; Viglione, Rudes, & Taxman, 2014), whereas others support the utility of gender neutral items to predict unsuccessful probation completion (Holtfreter, Reisig, & Morash, 2004; Reisig, Holtfreter, & Morash, 2006). In consideration of the lack of consensus on gender, race, risk assessment and probation outcomes, two positions emerge: (1) there is no apparent consensus on how well risk instruments perform among female minority offenders and (2) it is unclear whether that performance affects probation outcomes among female probationers of color.

2. The current study

Utilizing risk scores from the Wisconsin Risk Needs Assessment Instrument and other contextual variables (location and offense severity) the present analysis examines probation outcomes across a sample of female minority probationers. In short, we seek answers for the following research questions: (1) Does risk score, location, and offense severity predict probation outcomes among female minority probationers? (2) Do interactions between risk score, location, and offense severity predict probation outcomes among female minority probationers? In the context of location and offense severity, we evaluate whether a commonly utilized risk assessment instrument maintains its predictive validity across racial/ethnic groups of female probationers.

3. Prior research

Recently, the disparate criminal justice processing of minorities has received considerable attention (Demuth, 2003; Demuth & Steffensmeier, 2004b; Dixon, 1995; Free, 2001; Freiburger & Hilinski, 2013; Hebert, 1997; Helms & Jacobs, 2002; Huebner & Bynum, 2008; Jacobs & Carmichael, 2002; Johnston & Alozie, 2001; Kleck, 1981; Morgan & Smith, 2008; Peterson & Hagan, 1984; Vito, Higgins, & Tewksbury, 2012). Despite the many contributions of recent scholarship, research explicating the impact of an offender's race/ethnicity and gender on sentencing and criminal justice process outcomes is ambiguous at best. Even among prior research that examined the relationship between, sentencing decisions, and post prison recidivism, there has been little empirical investigation of the association between race, gender, and their combined influence on probation outcomes. This gap in probation studies is particularly troubling considering that

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probation, as a rehabilitative medium for female offenders, has become increasingly popular over the past two decades with the number of women and girls on probation nearly doubling from 13% in 1993 to 25% in 2014, (Herberman & Bonczar, 2014).

The subsequent review of literature presents research from juvenile and adult probation studies. Though this evaluation focuses on adult probationers, prior research examining the confluence of race, gender, and probation among juvenile populations demonstrates how demographic variables influence unequal outcomes and provide logical support for further exploration of these factors among adults. First, the association between race and probation is discussed, with a focus on studies evaluating race and probation outcomes, risk assessments, and behavioral predictions. We then transition into literature examining the interplay between gender and probation. The contextual factors, offense severity, risk score, and location are also considered. We conclude with a discussion regarding the interactional effect of the aforementioned factors on probation completion.

4. Race

4.1. Probation outcomes

New arrests and probation revocation has been a consistent methodological approach of past studies evaluating the influence of race on probation outcomes. However, many studies examining this topic report conflicting findings, resulting in a breadth of race and probation discourse that is nebulous, at best. In fact, Roundtree, Edwards, and Parker (1984) and Morgan (1994) reported no significant association between race and successful completion of a supervision term among adult probationers. While Irish (1976) and Clarke, Lin, and Wallace (1988) found evidence that affirmed the influence of race as a significant predictor of probation completion among adult probationers. On the other hand, Gray, Fields, and Maxwell (2001) found mixed results as technical violations appeared to be significantly related to race, but not probation success among a sample of adult probationers. Still, a considerable number of studies indicated adult minorities had the greatest chance of being arrested while on probation and receiving a technical violation (Johnson & Jones, 1998; Olson & Lurigio, 2000). Briefly stated, discourse assessing the relationship between race and probation outcomes is split. However, among studies that did support the association of these two factors, findings consistently that probationers who were both Black and male had the greatest likelihood of recidivating, in the form of rearrest and revocation (Gray et al., 2001; Johnson & Jones, 1998; Morgan, 1994; Olson & Lurigio, 2000; Roundtree et al., 1984).

4.2. Race and behavioral predictions

Risk assessment scores are an integral aspect of the current analysis. Risk-Needs assessment instruments have demonstrated utility in such areas as estimating an offender's risk of recidivating, identifying appropriate treatment levels, improving resource allocation, reducing implicit bias in supervision decision making, and increasing objectivity among officers. Contemporary research has supported the integration of risk-need assessment instruments among correctional agencies, with the breadth of empirical investigation centered on their ability to correctly predict an offender's likelihood of recidivating. The result has been an absence of scholarly insight into the ability of risk-needs assessment instruments to predict recidivism across racially diverse groups of adult offenders (Rembert, Henderson, & Pirtle, 2014; Whiteacre, 2006).

Similar to past studies examining the influence of race on probation outcomes, research evaluating the predictive equity of risk-needs assessment instruments across racial/ethnic groups is also conflicting. For instance, multiple studies have indicated that Black offenders were more likely to receive a higher risk designation than any other racial/ethnic group of adults (Eisenburg, Bryle, & Fabelo, 2009; Henderson, 2006; Henderson et al., 2007; Whiteacre, 2006; Yacus, 1998). Furthermore, prior research also identifies predictive bias manifested in the form of overclassification (or Type I error) for adult offenders of color (Rembert et al., 2014; Whiteacre, 2006). A noteworthy finding of past scholarship suggests a positive association between the amount of Whites in the sample and the instruments' predictive accuracy among adult and juvenile offenders (Edens et al., 2007; Gendreau, Goggin, & Little, 1996; Leistico, Salekin, DeCoster, & Rogers, 2008). By contrast, previous studies have also reported no difference in predictive accuracy across racial/ethnic groups of adult and juvenile offenders (Edens et al., 2007; Guy et al., 2005; Olver et al., 2009; Schwalbe, 2007; Skeem et al., 2004). Considered collectively, research suggests a lack of consensus regarding the predictive accuracy of risk needs assessment instruments across racial groups.

4.3. Gender and probation outcomes

This analysis focuses on probation outcomes among a sample of White and minority female probationers. Therefore, it is appropriate to offer a thorough review of gendered assessments of probation outcomes. Consistent throughout the literature are distinct differences in probation outcomes along gender lines, even after controlling for demographic (age and race) and contextual factors (offense type) (Koons-Witt, Sevigny, Burrow, & Hester, 2012). Overwhelmingly, research indicates that girls and women are more likely to receive probation as a rehabilitative modality and also have the greatest likelihood of successful probation completion (Clarke et al., 1988; Freiburger & Hilinski, 2013; Morgan, 1993). For example, in a 1993 meta-review of nearly 30 adult probation outcome studies, Morgan (1993) found that women were more likely than equally situated males to successfully complete their probation terms.

Contemporary research, on the other hand, has demonstrated gendered differences in probation outcomes (Gould, Pate, & Sarver, 2011; Schulenberg, 2007). For instance, researchers found no gendered differences in the rates of revocation (Kingsnorth, MacIntosh, & Sutherland, 2002; Olson & Lurigio, 2000), while other studies found that women were less likely to complete their supervision term successfully (Mayzer, Gray, & Maxwell, 2004; Morgan, 1994; Olson et al., 2003; Sims & Jones, 1997). Succinctly, scholarship evaluating disparate gendered probation outcomes remains unclear.

4.4. Gender and behavioral predictions

In addition to race, the present analysis also examines the relationship between gender and risk assessment instruments. Commonly used to standardize decision making in correctional settings, risk assessment instruments rely on a combination of well-documented static, dynamic, and protective factors to predict risk of reoffending across and juvenile populations (Lowenkamp et al., 2001; Oleson et al., 2011; Viglione et al., 2014). Despite the increased objectivity of risk assessment instruments based on actuarial principles, too few studies have examined the predictive validity of these instruments on the basis of gender. The extant literature examining the association between gender and risk assessment instruments report conflicting findings across adult and juvenile populations. Previous studies indicate that adult and juvenile risk assessment instruments tend to overclassify female offenders as high risk (Funk, 1999; Olson et al., 2003). The result is gratuitous surveillance and overtreatment (Steinmetz & Henderson, 2015), the effects of which can increase the likelihood of probation failure due to technical violations rather than commission of a new crime. Other research assessing gender and risk assessment instruments are more promising. Olson et al. (2003) reported increased responsivity for risk needs assessment instruments that included gender specific items among adult offenders. Moreover, Funk (1999) found support for using separate juvenile risk assessments for female offenders citing significantly increased classification of reoffending risk. Additionally,

Wright, Voorhis, Bauman, and Salisbury (2007) evaluation of gender-responsive adult assessment instruments found that six of the eight models under analysis achieved statistical significance when integrated with gender neutral instruments. This research supports the position that female risk of offending is compositionally different from that of their male counterparts. Given the substantial growth of females entering the criminal justice system, at minimum, existing research suggests continued inquiry in the area of gender and risk need assessments (Wright et al., 2007).

4.5. Gender, race, and probation outcomes

Much of the prior research examining the association between race, gender, and probation outcomes has evaluated each of these factors independently. Few studies have considered the interaction of these statuses on probation completion. In fact, much of the extant literature seeking to identify racialized gender discrepancies in probation outcomes suggests that minority female offenders experience sanctions just as severe as their male counterparts. For example, Steffensmeier and Demuth (2006) report that although female offenders were sentenced more leniently in their analysis, there was no such difference in sentence severity across racial groups of adult offenders. Other studies indicate that Black girls and women are more likely to receive severe sanctions despite committing similar crimes to their White counterparts (Bickle & Peterson, 1991; Koons-Witt, 2002; Koons-Witt et al., 2012; Spohn, Welch, & Gruhl, 1985). Succinctly, the interconnected identities of race and gender appear to converge in a matrix of disadvantage for female offenders of color.

5. Interaction effects

A common observation throughout the body of correctional research, is the limited assessment of the direct effect of race on correctional outcomes (Demuth, 2003; Demuth & Steffensmeier, 2004a; Dixon, 1995; Free, 2001; Freiburger & Hilinski, 2013; Hebert, 1997; Helms & Jacobs, 2002; Huebner & Bynum, 2008; Jacobs & Carmichael, 2002; Johnston & Alozie, 2001; Kleck, 1981; Morgan & Smith, 2008; Peterson & Hagan, 1984; Vito et al., 2012). Fewer still are the studies that consider the interactive effects of race and gender on correctional outcomes across offender populations (Tapia & Harris, 2006). The added insight of examining the complex interplay between gender and race in correctional outcomes not only acknowledges the additive properties of the combined statuses, but incorporates their combined effect into the analysis. Thus, statistical consideration of the variant dimensions of oppression provides the context necessary to understand the obstacles to probation success for minority and female probationers that may differ from those experienced by their White and male counterparts.

It is worth noting that prior research has narrowly considered the interactive effects of established predictors of correctional outcomes such as age and race (Demuth & Steffensmeier, 2004b; Leiber, Reitzel, & Mack, 2011); gender and race/ethnicity (Johnston & Alozie, 2001; Spohn & Holleran, 2000); race, gender, and age (Freiburger & Hilinski, 2013; Steffensmeier, Ulmer, & Kramer, 1998); and gender and employment (Spohn & Holleran, 2000). Common among these studies, is the finding of improved predictive power of models analyzing probation completion. Therefore, this improvement has both theoretical and practical implications for risk assessments of gendered and racially diverse groups under supervision.

5.1. Offense severity

Despite growing empirical attention given to the interactive effects between demographic predictors (i.e., race, gender, age) and correctional outcomes, there have been few studies that evaluate the interactive property of race, gender, and offense severity and its subsequent influence on probation outcomes. Steinmetz and Henderson (2015) were among the first to report a significant interaction between race and offense severity in probation failure for adult probationers. However, there remains a lack of investigation between the interaction of race, offense severity, and its influence on probation outcomes for female probationers. Prior research has demonstrated that offense severity informs sentencing and probation decision making regarding the seriousness of the offense committed and the likelihood of reoffending (Leiber et al., 2011). These findings are tempered by conflicting research indicating that the severity of the current offense has no, or even an indirect association with reoffending (Grattet, Lin, & Petersilia, 2011; Langan & Levin, 2002). The lack of investigation between gender, offense severity, race, and probation outcomes is particularly concerning as the majority of female probationers are under supervision for non-violent, less severe offenses than their male counterparts (Bloom, Owen, & Covington, 2003; Koons-Witt et al., 2012).

5.2. Location

The influence of jurisdictional differences on correctional outcomes is an area that has received insufficient academic consideration. Steinmetz and Henderson (2015) conducted one of the first examinations of jurisdictional differences as a function of location in their analysis of race, gender, offense severity interactions, and probation outcomes. Drawing on research from Spohn and Holleran (2000) that found differential sentencing in three separate jurisdictions for a sample of adults and juveniles, Steinmetz and Henderson (2015) maintained that considering location allowed them "…to identify macro-level jurisdictional and sociopolitical context differences (i.e., penal codes, sentencing policies, procedures, cultural contexts)" for their sample of adult probationers (p. 4). Moreover, Weidner, Frase, and Schultz (2005) report that among a sample of adult defendants, sentencing and correctional outcomes were influenced by the jurisdiction in which the sentence and correctional outcome was received. This sentiment is echoed by Dixon (1995) who reports that sentencing decisions may be influenced by such factors as the political, economic, and social contexts in which courts operate.

Apart from prior literature examining the relationship between jurisdictional differences and recidivism, extant research has also focused on the meso-level association between reoffending and neighborhood context. Kubrin and Stewart (2006) found significantly more recidivism for adult offenders who returned to disadvantaged communities relative to those who return to affluent communities, even after controlling for individual-level factors. Despite the demonstrated effect of the socioeconomic standing of the neighborhood, the analysis called on future research to examine more proximal attributes of neighborhoods, specifically the allocation of social services affecting neighborhood specific recidivism, a factor that varies widely based on economic prioritization and discretion from jurisdiction to jurisdiction.

Although, the breadth of prior research examines location effects on sentencing decisions, we maintain that those charged with overseeing probation outcomes operate in jurisdictions that are similarly affected by political, economic and social factors. As such, the present analysis seeks to evaluate whether the impact of location will be consistent with prior research and demonstrate an effect on probation outcomes among minority female probationers.

6. Methodology

6.1. Participants

Consistent with the racial/ethnic composition of the state's female probation population, proportionate numbers of Black, Hispanic, and White probationers (n = 34238) were randomly selected from a large southwestern state's central repository of probation data. Each probationer was released from probation between September 1, 2000 and

Table 1
Chi-Square analysis with column proportion comparisons.

Characteristics	N	Whites			Blacks			Hispanics			Total	
		%	χ^2	N	%	χ^2	N	%	χ^2	n	%	χ^2
Offense severity												
Felony	$2{,}417_b$	15.9		$3{,}226_b$	21.5		776_a	19.3		6419	18.7	
Misdemeanor	$12{,}799_a$	84.1	147.43	$11{,}784_a$	78.5	132.12	$3{,}236_a$	80.7	1.05	27,819	81.3	157.03
Age												
118-2512q123												
18–25	606_a	4.0		456_a	3.0		$153_{a,b}$	3.8		1215	3.5	
26–35		39.239.2									40.9	
26–35	5959_b	39.2		6324_b	42.1		1725_b	43.0		14,008	40.9	
36–45	4091_b	26.9		4581_b	30.5		1236_b	30.8		9908	28.9	
46–55	3064_a	20.1		2493_a	16.6		$630_{a,c}$	15.7		6187	18.1	
56 and over	1496_a	9.8	194.16	1156_a	7.7	105.46	268_c	6.7	43.5	2920	8.5	205.51
Supervision/risk level												
High	$3{,}586_a$	23.6		$3{,}840_a$	25.6		772_a	19.2		8198	23.9	
Medium	$7{,}124_a$	46.8		$7{,}493_a$	49.9		$1{,}908_b$	47.6		16,525	48.3	
Low	$4{,}506_b$	29.6	46.232	$3{,}677_b$	24.5	149.48	$1{,}332_c$	33.2	90.29	9515	27.8	189.34
Location												
City A	$9{,}369_b$	61.6		$8{,}297_b$	55.3		$1{,}863_b$	46.4		19,529	57	
City B	$5{,}847_a$	38.4	229.8	$6{,}713_a$	44.7	33.88	$2{,}149_a$	53.6	208.51	14,709	43	330.77
Probation completion												
Successful	$11{,}160_a$	73.3		$10{,}088_a$	67.2		$3{,}063_a$	76.3		24,311	71	
Unsuccessful	$4{,}056_b$	26.7	72.714	$4{,}922_b$	32.8	187.21	949_b	23.7	62.95	9927	29	201.10

August 31, 2010, from two of the state's largest counties. Each probation department is required to submit its offender data and probation closure type (i.e., successful or unsuccessful) to the state on a monthly basis. As noted in Table 1, a slight majority of the sample was Caucasian (44.4%), while the remaining participants were Black (43.8%) and Hispanic (11.7%). The majority of the sample was placed on probation for a misdemeanor offense (81.3%). The majority of probationers in this study are from County B (57 %). Demographic comparisons were examined to determine the existence of significant differences between the racial groups on gender, risk scores, age and offense severity (see Table 1).

The age of female probationers in the sample ranged from 23 to 93 years old (M = 39.3, SD = 10.46). Age was normally distributed, with skewness of .78 (SE = .013) and kurtosis of .103 (SE = 0.026). Post-hoc analyses were used to compare column proportions across groups using z-tests with Boneferonni adjustment. As indicated in Table 1, the proportion of Hispanic probationers between the ages 18 to 25, 46 to 55, and 56 and over differed significantly from their counterparts from other racial/ethnic groups in the sample. Additionally, the proportion of Hispanic probationers that were medium and low risk differed significantly from probationers from other racial/ethnic groups in the sample.

6.2. Dependent and independent measures

Predictors included in the logistic regression models include race/ethnicity, location, offense severity, and risk scores. Race/ethnicity is measured with one variable consisting of three categories (0 = White, 1 = Hispanic, 2 = Black). The White racial category served as the reference group. Location is the predictor we use to control for the county and department under which the probationer was supervised (0 = County A, 1 = County B). Offense severity measures the seriousness of the charge against the probationer (felony = 1, misdemeanor = 0).

6.2.1. Wisconsin risk needs assessment instrument

In determining the effect of the assessed risk scores, the Wisconsin Risk Needs Assessment Instrument risk scores are utilized. The risk score is a summed total of the static and dynamic items on the instrument and range from 0 to 43. Premised on the risk of failure, these total scores are used to determine the offender's level of supervision as minimum, medium, or maximum. According to the theory of risk, the higher an offender's risk, the more intensive their level of supervision. Validity estimates for the Wisconsin tool using correlation coefficients have ranged from .27 to .68 on measures of rearrests while on probation (Gendreau et al., 1996; Harris, 1994) and from .16 to .53 on measures of supervision success (Connelly, 2003; Harris, 1994; Schauer, 1990). Previous studies examining the Wisconsin instrument's relative improvement over chance (RIOC) rate have demonstrated no greater than 8% over chance predictions, with most indicating below chance accuracy (Connelly, 2003; Harris, 1994; Schauer, 1990). Finally, in predicting probation completion, prior research has demonstrated that the Wisconsin instrument's RIOC has ranged from 24% to 55%, indicating a maximum accuracy of only 5% above chance (Connelly, 2003; Harris, 1994).

6.2.2. Probation outcome

Remaining consistent with the practical use of probation closure types, we operationalize the probation outcome measure dichotomously (1 failure, 0 success). At the agency level, each probation case is closed successfully or unsuccessfully upon the request of the supervising probation officer. Any violation of the probationer's conditions of probation can serve as the basis for unsuccessful closure. This sample consisted of probation cases that were completed between the fiscal years of 2000–2010. As previously described, prior studies tend to rely on revocation as the outcome measure of choice, despite probation being a more robust estimate of probationer behavior. For example, there are cases where a probationer was unsuccessful in his or her probation, sentenced to treatment, yet his or her case was never revoked. In this way, standard approaches that only examine revocation fail to account for alternative ways to fail probation. Probation completion data were collected from the state database of probation closures, which is the central repository that all probation departments in the state submit their closure data, along with demographic data, assessments, prescribed treatment modalities, and probationer responses.

6.3. Statistical analysis

In this study, the dependent variable of concern is probation failure. Throughout the analysis, interaction effects are incorporated which follow suggestions made by prior research (Freiburger & Hilinski, 2013; Koons-Witt et al., 2012) with slight modifications made to account for

the data characteristics of our study. Previous research supports the idea that race and gender may be better predictors of probation outcomes than either variable alone (Bontrager, Bales, & Chiricos, 2005; Demuth & Steffensmeier, 2004b; Freiburger & Hilinski, 2013; Huebner & Bynum, 2008; Johnston & Alozie, 2001; Leiber et al., 2011; Spohn & Holleran, 2000; Steffensmeier et al., 1998). Therefore, we initially examine the interaction effects between race and gender. The interactions of race and offense severity are also considered. The current study also makes use of the Nagelkerke's R2 statistic rather than the McFadden (RL2). The RL2 statistic is based on the sum of squared errors rather than the − 2 log likelihood (Menard, 2010). As a result, the R2 is more appropriate to use in logistic regression analyses rather than explained variation statistics, which were made specifically for ordinary least squares regression analyses. In addition, the outcome variable used in this study—probation failure—is a truly dichotomous variable rather than one which represents an underlying continuous variable. In this case, R2 is an appropriate measure of explained variation in the likelihood the outcome occurs as concerns about underestimation of the strength of the relationship between predictors and the outcome measure are only salient when the outcome is a crude measure of an underlying continuous variable (Demaris, 1992; Menard, 2010).

7. Results

To address our research questions, we employ two by two contingency tables for each racial/ethnic group's predicted risk levels using a dichotomized high risk-low risk variable informed by the Wisconsin tool itself. This approach allowed for direct comparison of the Wisconsin Instrument's error rate of misclassified female probationers. Tables 2 and 3 present the contingency tables evaluating the predicted risk level for probationers who unsuccessfully and successfully completed the probation term. The Wisconsin Instrument predicted true positives for 83% of Black probationers, 84% of Hispanic probationers and 84% of White probationers. Additionally, the Wisconsin Instrument predicted true negatives for 43% of Black probationers, 57% of Hispanic probationers and 46% of White probationers. Overclassification errors (i.e., unnecessary limitations on freedom and unwarranted rehabilitative services) were similar among Black and White probationers, at 56.9% and 53.6% respectively. However, the overclassification error for Hispanic probationers was noticeably lower at 16%. Further, underclassification errors (i.e., missed treatment opportunity to probationers in need) for Black probationers were 17% and 15% for White probationers. Again, however, Hispanic probationers stood out with an underclassification rate nearly triple that of the other racial/ethnic groups at 43%.

7.1. Multivariate analysis

To determine the impact of race, location, offense severity, and risk assessment scores on female probation outcome, two models were conducted.[1] The initial model demonstrates the effect of the beforementioned variables on probation success (see Table 4). In the second model, the effect of the interactions of race, offense severity, and overall risk score on probation outcome are presented (see Table 5). Overall, both models were found to be significant ($p < 0.001$). The results of the initial model indicate that most of the variables included in the model were found to be significantly predictive ($p < 0.001$) of probation failure. In short, being Black (β 0.303), having served on probation in County A (β 0.348), being on probation for a felony offense (β 0.295), and having higher assessed risk scores (β 0.122) significantly increased the likelihood of unsuccessful probation completion. However, Hispanic status was not a significant predictor of probation failure in the model. Consistent with prior research, location, race (being Black), offense severity, and risk score were found to be significant predictors of probation failure. However, we encountered an unanticipated finding, as location (β 0.348) was found to be more predictive at the individual level than being on probation for a felony offense (0.295); race, specifically being Black (0.303); and risk score (β 0.122). This finding stands in stark contrast to the existing body of knowledge regarding risk prediction and probation outcomes.

The second model estimates the interaction effects of race with gender and offense severity on unsuccessful probation completion (see Table 5). Similar to the previous analysis of individual-level predictors, this model is also statistically significant ($p < 0.001$) and demonstrates an increase in explained variance (R2 = 0.133) compared to the first model (R2 = 0.125). The demands of simplicity in statistical modeling dictate that the interaction effect model may not contribute much beyond the first model in our understanding of probation failure. Because of the findings of previous research (Henderson, Tanana, Bourgeois, & Adams, 2015; Steinmetz & Henderson, 2015), considered in concert with leading intersectionality theories, this analysis will

Table 2
Predicted risk and probation outcome (unsuccessful).

	Predicted risk level			
	High risk		Low risk	
	True positive (positive hit)		False negative (under-classification error)	
	%	n	%	n
Unsuccessfully completed				
Black	83.0	2122	17.0	2800
Hispanic	84.0	438	43.0	511
White	84.0	1883	15.0	2173

Note. Wisconsin instrument.

Table 3
Predicted risk and probation outcome (successful).

	Predicted risk level			
	High risk		Low risk	
	True positive (over-classification error)		True negative (negative hit)	
	%	n	%	n
Successfully completed				
Black	56.9	1718	43.0	8370
Hispanic	16.0	334	57.0	2729
White	53.6	1703	46.0	9457

Note. Wisconsin instrument.

Table 4
Logistic regression on probation failure.

	B	S.E.	Wald	Exp(b)
Black	0.303*	0.027	124.023	1.354
Hispanic	− 0.02	0.045	0.201	0.98
City A	0.348*	0.027	165.342	1.417
Risk score	0.122*	0.002	3591.31	1.13
Offense severity	0.295*	0.033	77.988	1.343
− 2 Log likelihood	36,772.353			
R_L^2	0.125			
χ^2	4456.968*			

Note. N = 34,238.
* $p < 0.001$.

[1] Both models controlled for age at time of assessment. Previous studies indicate that younger probationers have a greater likelihood of probation failure.

Table 5
Logistic regression on probation failure including interaction effects.

	b	S.E.	Wald	Exp(b)
Black	0.056	0.07	0.627	1.057
Hispanic	− 0.321*	0.114	7.922	0.725
City A	0.139**	0.041	11.516	1.149
Offense severity	0.251**	0.054	21.68	1.286
Risk score	0.122**	0.033	0.002	1.129
Black	0.987**	0.212	89.54	1.718
Hispanic	0.089	0.109	0.52	1.087
Location interactions				
Black	0.345**	0.055	39.47	1.412
Hispanic	0.407**	0.089	20.791	1.503
Offense severity				
Black	0.055	0.07	0.602	1.506
Hispanic	0.092	0.114	0.602	1.096
− 2 Log likelihood	36,724.78			
R_L^2	0.133			
χ^2	4504.544**			

Note. N = 34,238.
* p < 0.01.
** p < 0.001.

proceed to examine the results of the second model as there are findings worth noting, even if the analysis must be approached cautiously (Table 6).

The interaction effects indicated that Hispanic women (β = 0.407; p < 0.001) were significantly more likely than White and Black women to fail probation in County A, suggesting that race/ethnicity seems to be predictive of failure in only one location. Recall that in the initial effect model, being Black was the second most powerful predictor. In the interaction effect model, the interaction effect between race and location was statistically significant compared to the established alpha level of p < 0.001. Specifically, both Black (β = 0.345, p < 0.001) and Hispanic (β = 0.407, p < 0.001) probationers in County A were more likely than White felony probationers to fail probation; indicating that race continues to be a significant predictor of probation failure. Interestingly, the interaction between race and risk score was only a significant predictor of unsuccessful probation completion for Black probationers (β = 0.987, p < 0.01). Overall, the results provide partial support for our hypothesis. The interaction between race, location, and risk score seemed to be an important predictor of probation failure, while the interaction of race and offense severity had no discernable effect on the likelihood of unsuccessful probation completion.

These conclusions, however, must be considered cautiously as differences in model fit between the initial and interaction effect models are marginal, at best. While evidence exists here supporting the interaction effects, simplicity points toward initial effects being more important for understanding probation in this sample. The implications for these findings are detailed below.

7.2. Receiver-operating characteristics

The use of AUC has become common practice in offender assessment, because it addresses the criticism of bivariate correlations and their assumption of an evenly distributed outcome measure in its determination of instrument predictability. The use of AUC also allows the comparison between multiple predictive validity studies. Ranging from .00 to 1.0, AUCs of .50 indicate the instrument is consistent with chance predictions, and the closer the AUC is to 1.0, the more accurate the instrument. Consequently, we use the receiver-operating characteristic's AUC analysis to examine the accuracy of the Wisconsin Instrument's predictability. As noted in the literature review, the average AUC value for juvenile risk assessment instruments was .64 (Schwalbe, 2007). Our findings indicated that the instrument was predictive of the total sample (AUC = 0.706, SE = 0.003, 95% CI = [0.70, 0.71], p < 0.001), indicating that the instrument predicted the correct classification roughly 20% better than chance.

Additionally, the predictive accuracy of the Wisconsin Instrument was significant for African American probationers (AUC = 0.68, SE = 0.004, 95% CI = [0.67, 0.69], p < 0.05).

Therefore, the Black AUC value is consistent with extant literature, while the AUC values for Hispanic (AUC = 0.75, SE = 0.009, 95% CI = [0.73, 0.77], p < 0.05) and White (AUC = 0.73, SE = 0.005, 95% CI = [0.71, 0.73], p < 0.05) probationers were significantly higher. Also, it bears mentioning that Black probationers' AUC confidence intervals did not overlap with the AUC confidence intervals of any other racial/ethnic groups' probationers, indicating that the tool was less predictive for Blacks compared to others in the sample.

8. Discussion

The implications of the gender and race intersectional bias in risk prediction instruments are appealing, and unfortunately research has, thus far, failed to adequately address this issue. Underlying this lack of investigation, is the contention that risk prediction instruments are free from inequitable predictions of criminal behavior and/or criminal justice supervision outcomes. Instruments that possess inherent bias are said to be few and unwarranting of adoption by correctional agencies. The existing body of research has supported the notion of gender-neutral prediction instrumentation, but has not paid sufficient attention to the predictive ability of risk assessment instruments for minority female offenders. The extant literature demonstrates the slant toward overlooking predictive inequities among minority female offenders. As such, the purpose of this analysis was to provide new evidence about the predictive accuracy of risk assessment instruments for minority female offenders.

Results demonstrate that simply examining the regression output overestimates the ability of a risk assessment instrument to equitably predict across the race and gender interaction, and therefore, the more consistent findings of existing literature are not supported. The data appear to suggest that location/jurisdiction, minority status and offense severity matter more than overall risk score, at the individual level. All the while, on the interactional level, minority status remains an issue warranting of further inquiry. The results from previous research that holds that there are no racial/ethnic and/or gender differences should be viewed with caution.

The findings reported here and elsewhere suggest it is important to more completely examine the intricate realities of minority female offenders when determining the predictive utility of risk assessment instruments (Henderson et al., 2015; Rembert et al., 2014). This may

Table 6
Area under the curve.

	African American		Hispanic		White		Sample	
Predictor	AUC (SE)	95% CI	AUC (SE)	95% CI	AUC (SE)	95% CI	AUC (SE)	95% CI
Total needs score	0.68 (0.004)*	[0.67, 0.69]	0.75 (0.009)*	[0.73, 0.77]	0.73 (0.005)*	[0.71,0.73]	0.706 (0.003)*	[0.70,0.71]

Note. AUC ¼ area under the curve; SE ¼ standard error, CI ¼ confidence interval.
* p < 0.001.

proceed by examining the instruments predictive ability by also paying attention to its predictive error, inclusive of both false positives and negatives. It may be the case that there are assumptions made by regression analysis such that the instrument itself is overestimating the individual effect of an offender's location and minority status that generate results that mimic an observed relationship – an issue most warranting of further inquiry (Singh & Fazel, 2010; Whiteacre, 2006). This approach addresses a common limitation in offender assessment and its reliance on bivariate correlations and their assumption of evenly distributed outcome measures in its determination of instrument predictability. By doing so, our findings identified location and minority status as obstacles to equitable predictions, both clearly issues worthy of future consideration.

Error analysis seems most applicable for assessing the predictive ability of risk assessment instruments, particularly when the questions revolve around issues of jurisdiction and an offender's minority status. For risk assessment, instrument validation should always be inclusive of error analysis subsequent to the standard of regression analysis. Another possibility would be to examine the ability of the assessment instrument to predict the intended outcomes respective of the various demographic groupings (i.e. race, gender, offense type, jurisdiction responsible for supervision, etc.). More recently studies have utilized the beforementioned, more holistic approach to risk assessment validation (Rembert, Henderson, Threadcraft-Walker, & Simmons-Horton, 2017; Henderson & Miller, 2013; Rembert et al., 2014; Whiteacre, 2006).

In addition to determining the predictive error of the instrument, future research can make advances by giving substantive attention to the potential effects of error on subsequent offender behavior. Given the unique importance of achieving predictive equity, examining error holds special appeal to those policy makers who have been charged with allocating millions towards these instruments. Whiteacre (2006) provides a challenge to the traditional risk assessment body of knowledge by being the first to propose examinations of predictive error, contending that regression analysis alone is insufficient and must be accompanied by an understanding of how inaccurate the instrument is across offender groups. In this case, equitable instruments may be more amenable to adoption and deserving of significant fiscal allocations. Meaningful research in the area of risk assessment must remain cognizant of the reality of instrumentation bias, an issue with inevitable and far reaching ramifications.

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